

MEMBRANE FILTRATION MARKET

GLOBAL FORECAST TO 2028

BY APPLICATION (DAIRY PRODUCTS, DRINKS & CONCENTRATES, WINE & BEER),
MODULE DESIGN (SPIRAL WOUND, TUBULAR SYSTEMS,
PLATE & FRAME AND HOLLOW FIBER), MEMBRANE MATERIAL, TYPE, AND REGION

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TABLE OF CONTENTS

1	INTRODUCTION	38
1.1	STUDY OBJECTIVES.....	38
1.2	MARKET DEFINITION.....	38
1.3	STUDY SCOPE	39
1.3.1	MARKET SEGMENTATION.....	39
1.3.2	REGIONS COVERED.....	40
1.3.3	INCLUSIONS & EXCLUSIONS	40
1.4	YEARS CONSIDERED	41
1.5	CURRENCY CONSIDERED	42
1.6	STAKEHOLDERS	42
1.7	SUMMARY OF CHANGES.....	43
1.8	RECESSION IMPACT	43
2	RESEARCH METHODOLOGY	44
2.1	RESEARCH DATA	44
2.1.1	SECONDARY DATA.....	45
2.1.1.1	Key data from secondary sources	45
2.1.2	PRIMARY DATA.....	45
2.1.2.1	Key data from primary sources	46
2.1.2.2	Breakdown of primary interviews.....	46
2.1.2.3	Key primary insights	47
2.2	MARKET SIZE ESTIMATION	47
2.2.1	MARKET SIZE ESTIMATION METHODOLOGY: BOTTOM-UP APPROACH.....	49
2.2.2	MARKET SIZE ESTIMATION METHODOLOGY: TOP-DOWN APPROACH	50
2.3	MARKET BREAKDOWN AND DATA TRIANGULATION	51
2.4	RESEARCH ASSUMPTIONS	52
2.5	LIMITATIONS AND RISK ASSESSMENT	53
2.6	RECESSION IMPACT	53
3	EXECUTIVE SUMMARY	54
4	PREMIUM INSIGHTS	59
4.1	OPPORTUNITIES FOR PLAYERS IN MEMBRANE FILTRATION MARKET	59
4.2	ASIA PACIFIC: MEMBRANE FILTRATION MARKET, BY MEMBRANE MATERIAL AND KEY REGION.....	60
4.3	MEMBRANE FILTRATION MARKET, BY TYPE AND REGION	61
4.4	MEMBRANE FILTRATION MARKET, BY KEY REGION	62

5	MARKET OVERVIEW.....	63
5.1	INTRODUCTION	63
5.2	MACROECONOMIC INDICATORS.....	63
5.2.1	GROWTH IN INDUSTRIAL AND URBAN INFRASTRUCTURE.....	63
5.2.2	HEALTH & ENVIRONMENTAL AWARENESS.....	64
5.3	MARKET DYNAMICS.....	65
5.3.1	DRIVERS.....	65
5.3.1.1	Rapid growth of dairy industry.....	65
5.3.1.2	Rise in demand for premium food and beverage products.....	68
5.3.1.3	Consumers' inclination toward high-quality products.....	69
5.3.1.4	Emerging technologies in membrane filtration field.....	70
5.3.1.5	Optimization of product efficiency in food processing due to innovations in ceramic membranes.....	71
5.3.1.6	Efficiencies offered by membrane filtration technologies.....	72
5.3.1.6.1	Product efficiency.....	72
5.3.1.6.2	Energy efficiency.....	72
5.3.2	RESTRAINTS.....	73
5.3.2.1	High setup cost.....	73
5.3.2.2	Maintenance and cleaning involved in membrane filtration.....	73
5.3.3	OPPORTUNITIES.....	74
5.3.3.1	Growth of markets for plant-based and dairy alternatives.....	74
5.3.3.2	Rise in demand for extended shelf life.....	75
5.3.4	CHALLENGES.....	75
5.3.4.1	Lack of awareness about advantages of membrane filtration.....	75
5.3.4.2	Membrane integrity and lifespan.....	76
6	INDUSTRY TRENDS	77
6.1	INTRODUCTION	77
6.2	VALUE CHAIN ANALYSIS	77
6.2.1	RESEARCH AND PRODUCT DEVELOPMENT.....	78
6.2.2	SOURCING.....	78
6.2.3	MANUFACTURING.....	79
6.2.4	MEMBRANE MODULE ASSEMBLY.....	79
6.2.5	DISTRIBUTION AND MARKETING.....	79
6.2.6	END USERS.....	80
6.2.7	AFTER-SALES SERVICE.....	80
6.3	TRADE ANALYSIS.....	81
6.3.1	AMINO-RESINS, PHENOLIC RESINS, AND POLYURETHANES IN PRIMARY FORMS.....	82
6.4	SUPPLY CHAIN ANALYSIS	82
6.5	TECHNOLOGY ANALYSIS	83
6.5.1	GRAPHENE.....	83

6.5.2	BIOMIMETIC	84
6.5.3	MILK FRACTIONATION	84
6.6	PRICING ANALYSIS	85
6.6.1	AVERAGE SELLING PRICE TREND, BY REGION	85
6.6.2	INDICATIVE PRICING ANALYSIS, BY MEMBRANE MATERIAL	85
6.7	PATENT ANALYSIS	86
6.8	ECOSYSTEM ANALYSIS	90
6.9	KEY CONFERENCES & EVENTS	92
6.10	REGULATORY LANDSCAPE	93
6.10.1	INTRODUCTION	93
6.10.1.1	US	93
6.10.1.1.1	Food and Drug Administration (FDA)	93
6.10.1.2	India	94
6.10.1.2.1	Bureau of Indian Standards (BIS)	94
6.10.2	REGULATORY BODIES, GOVERNMENT AGENCIES, AND OTHER ORGANIZATIONS	94
6.11	TRENDS/DISRUPTIONS IMPACTING CUSTOMERS' BUSINESSES	97
6.12	PORTER'S FIVE FORCES ANALYSIS	98
6.12.1	THREAT OF NEW ENTRANTS	98
6.12.2	THREAT OF SUBSTITUTES.....	99
6.12.3	BARGAINING POWER OF BUYERS	99
6.12.4	BARGAINING POWER OF SUPPLIERS	100
6.12.5	INTENSITY OF COMPETITIVE RIVALRY	100
6.13	CASE STUDY ANALYSIS	101
6.13.1	SNYDER'S NFS MEMBRANES USED FOR WHEY CONCENTRATION & DE-ASHING.....	101
6.13.2	LAGUNITAS BREWING COMPANY'S HIGH-STRENGTH BREWERY WASTEWATER TREATED TO HIGH MBR AND RO STANDARDS FOR REUSE	102
6.14	KEY STAKEHOLDERS AND BUYING CRITERIA.....	102
6.14.1	KEY STAKEHOLDERS IN BUYING PROCESS	102
6.14.2	BUYING CRITERIA.....	103
7	MEMBRANE FILTRATION MARKET, BY APPLICATION	105
7.1	INTRODUCTION	106
7.2	DAIRY PRODUCTS.....	107
7.2.1	LIQUID MILK	110
7.2.1.1	Growing consumer interest in broad spectrum of liquid milk offerings to fuel market expansion	110
7.2.1.2	Milk protein fractionation	112
7.2.1.2.1	Surging consumer demand for protein-packed products to boost growth.....	112
7.2.1.3	Milk concentration	113
7.2.1.3.1	Need for preserving vital elements in milk to spur market expansion	113

7.2.1.4	Milk pre-concentration	114
7.2.1.4.1	Growing need to extend shelf-life of milk powder to propel adoption of membrane filtration technologies for milk pre-concentration	114
7.2.1.5	Water recovery.....	116
7.2.1.5.1	Stringent environmental regulations to drive demand for membrane filtration for water recovery.....	116
7.2.2	OTHER DAIRY PRODUCTS	117
7.2.2.1	Whey.....	118
7.2.2.1.1	Rising global demand for whey protein to boost adoption of membrane filtration technologies	118
7.2.2.2	Milk and whey-based ingredients.....	119
7.2.2.2.1	Rising demand for nutritious food products to drive market	119
7.2.2.3	Cheese.....	120
7.2.2.3.1	Surge in consumption of cheese to boost market growth	120
7.3	DRINKS & CONCENTRATES.....	121
7.3.1	RISING DEMAND FOR CONVENIENCE FOOD ITEMS, DRINKS, AND JUICES TO DRIVE USE OF MEMBRANE FILTRATION.....	121
7.4	WINE & BEER	123
7.4.1	CHANGING LIFESTYLES AND INCREASED CONSUMPTION OF BEVERAGES TO DRIVE MARKET.....	123
7.5	OTHER FOOD & BEVERAGE APPLICATIONS	125
8	MEMBRANE FILTRATION MARKET, BY MEMBRANE MATERIAL	127
8.1	INTRODUCTION	128
8.2	POLYMERIC.....	129
8.2.1	INCREASING UTILIZATION OF POLYSULFONE MEMBRANES IN FOOD & BEVERAGE SECTOR TO FUEL MARKET GROWTH.....	129
8.3	CERAMIC	130
8.3.1	DEMAND FOR MEMBRANES WITH DURABILITY, EXCEPTIONAL TEMPERATURE RESISTANCE, AND EASE OF MAINTENANCE TO DRIVE POPULARITY OF CERAMIC MEMBRANES.....	130
9	MEMBRANE FILTRATION MARKET, BY MODULE DESIGN.....	132
9.1	INTRODUCTION	133
9.2	SPIRAL WOUND.....	134
9.2.1	EXTENSIVE UTILIZATION OF SPIRAL WOUND MEMBRANES IN FOOD & BEVERAGE INDUSTRY TO DRIVE MARKET	134
9.3	TUBULAR SYSTEMS	135
9.3.1	GROWING IMPORTANCE OF TUBULAR SYSTEMS IN DAIRY AND WINE INDUSTRIES TO ENCOURAGE MARKET GROWTH.....	135
9.4	PLATE & FRAME AND HOLLOW FIBER	136
9.4.1	EXTENSIVE USE OF HOLLOW FIBERS FOR ULTRAFILTRATION AND MICROFILTRATION OF MEMBRANE SYSTEMS IN BEVERAGE INDUSTRY TO BOOST GROWTH.....	136

10	MEMBRANE FILTRATION MARKET, BY TYPE	138
10.1	INTRODUCTION	139
10.2	REVERSE OSMOSIS (RO)	140
10.2.1	GROWING POPULARITY OF PROCESSED FOOD PRODUCTS TO DRIVE USE OF RO TECHNOLOGY FOR WATER FILTRATION	140
10.3	ULTRAFILTRATION (UF).....	141
10.3.1	GROWING USE OF ULTRAFILTRATION IN TREATING DAIRY PRODUCTS TO DRIVE MARKET.....	141
10.4	MICROFILTRATION (MF).....	143
10.4.1	RISING ADOPTION OF MICROFILTRATION IN TREATING BEVERAGES TO PROPEL GROWTH.....	143
10.5	NANOFILTRATION (NF)	144
10.5.1	ABILITY OF NANOFILTRATION TECHNOLOGY TO REMOVE LOW-MOLECULAR COMPONENTS FROM LIQUID TO DRIVE ITS USE.....	144
11	MEMBRANE FILTRATION MARKET, BY REGION	146
11.1	INTRODUCTION	147
11.2	RECESSION INDICATORS.....	148
11.3	NORTH AMERICA	152
11.3.1	NORTH AMERICA: RECESSION IMPACT ANALYSIS	153
11.3.2	US	162
11.3.2.1	Growing popularity of dairy products to propel demand for membrane filtration solutions	162
11.3.3	CANADA.....	166
11.3.3.1	Growing demand for functional food products and wine to drive market	166
11.3.4	MEXICO	171
11.3.4.1	Rapid growth in dairy industry to drive growth	171
11.4	EUROPE.....	175
11.4.1	EUROPE: RECESSION IMPACT ANALYSIS.....	175
11.4.2	SPAIN.....	184
11.4.2.1	Growing wine industry to drive membrane filtration market	184
11.4.3	ITALY.....	189
11.4.3.1	Stringent food safety regulations to encourage use of membrane filtration technologies.....	189
11.4.4	GERMANY	193
11.4.4.1	Growing consumption of food products and beverages to drive growth	193
11.4.5	UK	198
11.4.5.1	Rising consumption of drinks and concentrates to boost demand for membrane filtration technologies	198
11.4.6	FRANCE.....	202
11.4.6.1	Rising demand to adopt membrane filtration technologies in cheese industry.....	202

	11.4.7	NETHERLANDS	206
	11.4.7.1	Extensive use of membrane filtration by dairy, beverage, and functional food manufacturers to drive market	206
	11.4.8	DENMARK.....	211
	11.4.8.1	Increased consumption of cheese to propel market.....	211
	11.4.9	REST OF EUROPE	215
11.5		ASIA PACIFIC.....	219
	11.5.1	ASIA PACIFIC: RECESSION IMPACT ANALYSIS	220
	11.5.2	CHINA.....	229
	11.5.2.1	Rising demand for milk products in high-end restaurants to drive growth.....	229
	11.5.3	SOUTHEAST ASIA	233
	11.5.3.1	Growing demand for functional foods and nutraceutical products to encourage market expansion	233
	11.5.4	INDIA.....	238
	11.5.4.1	Growing use of UF and MF technologies in dairy industry to drive market	238
	11.5.5	JAPAN.....	242
	11.5.5.1	Increasing need for membrane filtration in functional food industry to boost growth	242
	11.5.6	AUSTRALIA.....	247
	11.5.6.1	Rising health concerns and demand for nutritious food products to drive growth	247
	11.5.7	NEW ZEALAND.....	251
	11.5.8	REST OF ASIA PACIFIC.....	256
11.6		SOUTH AMERICA	260
	11.6.1	SOUTH AMERICA: RECESSION IMPACT ANALYSIS	261
	11.6.2	BRAZIL.....	269
	11.6.2.1	Focus of manufacturers on adding value to products and ensuring sustainable production processes to propel growth	269
	11.6.3	CHILE.....	273
	11.6.3.1	Rising income of people and inclination to healthy living to drive market	273
	11.6.4	ARGENTINA.....	277
	11.6.4.1	Increased demand for drinks and concentrates to drive adoption of membrane filtration technology	277
	11.6.5	REST OF SOUTH AMERICA	282
11.7		REST OF THE WORLD (ROW)	286
	11.7.1	ROW: RECESSION IMPACT ANALYSIS.....	286
	11.7.2	MIDDLE EAST.....	294
	11.7.2.1	Rising demand for functional food products and beverages to boost market.....	294
	11.7.3	AFRICA	298
	11.7.3.1	Increasing water scarcity and environmental concerns to drive popularity of membrane filtration technologies	298

12	COMPETITIVE LANDSCAPE	303
12.1	OVERVIEW	303
12.2	MARKET SHARE ANALYSIS	303
12.3	HISTORICAL REVENUE ANALYSIS FOR KEY PLAYERS	304
12.4	ANNUAL REVENUE VS. REVENUE GROWTH FOR KEY PLAYERS	305
12.5	EBITDA OF KEY PLAYERS, 2022 (USD BILLION).....	306
12.6	STRATEGIES ADOPTED BY KEY PLAYERS	306
12.7	GLOBAL SNAPSHOT OF KEY PARTICIPANTS	309
12.8	COMPANY EVALUATION MATRIX FOR KEY PLAYERS.....	309
12.8.1	STARS.....	309
12.8.2	EMERGING LEADERS.....	309
12.8.3	PERVASIVE PLAYERS.....	310
12.8.4	PARTICIPANTS	310
12.8.5	PRODUCT FOOTPRINT.....	311
12.9	COMPANY EVALUATION MATRIX FOR STARTUPS/SMES	314
12.9.1	PROGRESSIVE COMPANIES.....	314
12.9.2	STARTING BLOCKS	314
12.9.3	RESPONSIVE COMPANIES.....	314
12.9.4	DYNAMIC COMPANIES	314
12.9.5	COMPETITIVE BENCHMARKING	316
12.10	COMPETITIVE SCENARIO	318
12.10.1	PRODUCT LAUNCHES	318
12.10.2	DEALS.....	319
12.10.3	OTHERS	322
13	COMPANY PROFILES.....	323
13.1	KEY PLAYERS.....	323
13.1.1	ALFA LAVAL.....	323
13.1.1.1	Business overview	323
13.1.1.2	Products offered.....	324
13.1.1.3	Recent developments	326
13.1.1.4	MnM view.....	326
13.1.1.4.1	Right to win.....	326
13.1.1.4.2	Strategic choices made.....	327
13.1.1.4.3	Weaknesses and competitive threats.....	327
13.1.2	GEA GROUP AKTIENGESELLSCHAFT	328
13.1.2.1	Business overview	328
13.1.2.2	Products offered.....	329
13.1.2.3	Recent developments	330
13.1.2.4	MnM view.....	331
13.1.2.4.1	Right to win.....	331
13.1.2.4.2	Strategic choices made.....	331

	13.1.2.4.3	Weaknesses and competitive threats	331
13.1.3		DUPONT	332
	13.1.3.1	Business overview	332
	13.1.3.2	Products offered	333
	13.1.3.3	MnM view	335
	13.1.3.3.1	Right to win	335
	13.1.3.3.2	Strategic choices made	335
	13.1.3.3.3	Weaknesses and competitive threats	335
13.1.4		PALL CORPORATION	336
	13.1.4.1	Business overview	336
	13.1.4.2	Products offered	337
	13.1.4.3	Recent developments	341
	13.1.4.4	MnM view	342
	13.1.4.4.1	Right to win	342
	13.1.4.4.2	Strategic choices made	342
	13.1.4.4.3	Weaknesses and competitive threats	342
13.1.5		VEOLIA	343
	13.1.5.1	Business overview	343
	13.1.5.2	Products offered	344
	13.1.5.3	MnM view	345
	13.1.5.3.1	Right to win	345
	13.1.5.3.2	Strategic choices made	345
	13.1.5.3.3	Weaknesses and competitive threats	345
13.1.6		3M	346
	13.1.6.1	Business overview	346
	13.1.6.2	Products offered	347
	13.1.6.3	MnM view	349
13.1.7		PENTAIR	350
	13.1.7.1	Business overview	350
	13.1.7.2	Products offered	351
	13.1.7.3	Recent developments	352
	13.1.7.4	MnM view	352
13.1.8		DONALDSON COMPANY, INC.	353
	13.1.8.1	Business overview	353
	13.1.8.2	Products offered	354
	13.1.8.3	MnM view	354
13.1.9		PORVAIR FILTRATION GROUP	355
	13.1.9.1	Business overview	355
	13.1.9.2	Products offered	356
	13.1.9.3	Recent developments	358
	13.1.9.4	MnM view	358

13.1.10	TORAY INDUSTRIES, INC.....	359
13.1.10.1	Business overview	359
13.1.10.2	Products offered.....	360
13.1.10.3	Recent developments	361
13.1.10.4	MnM view.....	362
13.1.11	HYDRANAUTICS - A NITTO GROUP COMPANY.....	363
13.1.11.1	Business overview	363
13.1.11.2	Products offered.....	364
13.1.11.3	MnM view.....	364
13.1.12	SPXFLOW.....	365
13.1.12.1	Business overview	365
13.1.12.2	Products offered.....	366
13.1.12.3	Recent developments	367
13.1.12.4	MnM view.....	367
13.1.13	MMS MEMBRANE SYSTEMS.....	368
13.1.13.1	Business overview	368
13.1.13.2	Products offered.....	368
13.1.13.3	Recent developments	369
13.1.13.4	MnM view.....	369
13.1.14	KOCH SEPARATION SOLUTIONS.....	370
13.1.14.1	Business overview	370
13.1.14.2	Products offered.....	370
13.1.14.3	Recent developments	371
13.1.14.4	MnM view.....	371
13.1.15	SYNDER FILTRATION, INC.	372
13.1.15.1	Business overview	372
13.1.15.2	Products offered.....	372
13.1.15.3	Recent developments	373
13.1.15.4	MnM view.....	373
13.1.16	PROMINENT.....	374
13.1.16.1	Business overview	374
13.1.16.2	Products offered.....	374
13.1.16.3	Recent developments	375
13.1.16.4	MnM view.....	375
13.2	STARTUPS/SMES.....	376
13.2.1	MANN+HUMMEL.....	376
13.2.1.1	Business overview	376
13.2.1.2	Products offered.....	376
13.2.1.3	Recent developments	377
13.2.1.4	MnM view.....	377

13.2.2	GRAVER TECHNOLOGIES	378
13.2.2.1	Business overview	378
13.2.2.2	Products offered.....	378
13.2.2.3	MnM view.....	379
13.2.3	CRITICAL PROCESS FILTRATION, INC.	380
13.2.3.1	Business overview	380
13.2.3.2	Products offered.....	380
13.2.3.3	MnM view.....	380
13.2.4	NOVASEP.....	381
13.2.4.1	Business overview	381
13.2.4.2	Products offered.....	381
13.2.4.3	MnM view.....	381
13.2.5	NILSAN NISHOTECH SYSTEMS PVT. LTD.	382
13.2.5.1	Business overview	382
13.2.5.2	Products offered.....	382
13.2.5.3	MnM view.....	382
13.2.6	APPLIED MEMBRANES, INC.....	383
13.2.7	ZWITTERCO	383
13.2.8	MEMBRANE SOLUTIONS (NANTONG)	384
13.2.9	MEMBRANE SYSTEM SPECIALISTS, INC.....	385
13.2.10	IMEMFLO	386
14	ADJACENT & RELATED MARKETS.....	387
14.1	INTRODUCTION	387
14.2	LIMITATIONS	387
14.3	MICROFILTRATION MEMBRANE MARKET.....	387
14.3.1	MARKET DEFINITION	387
14.3.2	MARKET OVERVIEW	388
14.3.3	MICROFILTRATION MEMBRANE MARKET, BY TYPE.....	388
14.3.4	MICROFILTRATION MEMBRANE MARKET, BY REGION.....	389
14.4	MEMBRANE SEPARATION TECHNOLOGY MARKET.....	390
14.4.1	MARKET DEFINITION	390
14.4.2	MARKET OVERVIEW	390
14.4.3	MEMBRANE SEPARATION TECHNOLOGY MARKET, BY TECHNOLOGY	390
14.4.4	MEMBRANE SEPARATION TECHNOLOGY MARKET, BY REGION.....	391

15 APPENDIX.....	392
15.1 DISCUSSION GUIDE	392
15.2 KNOWLEDGESTORE: MARKETSANDMARKETS' SUBSCRIPTION PORTAL	398
15.3 CUSTOMIZATION OPTIONS.....	400
15.4 RELATED REPORTS.....	400
15.5 AUTHOR DETAILS.....	401

LIST OF TABLES

TABLE 1	USD EXCHANGE RATES, 2018–2021	42
TABLE 2	RESEARCH ASSUMPTIONS	52
TABLE 3	MEMBRANE FILTRATION MARKET SNAPSHOT, 2023 VS. 2028	55
TABLE 4	TOP 10 IMPORTERS AND EXPORTERS OF ALMONDS, 2022 (USD THOUSANDS)	81
TABLE 5	TOP 10 IMPORTERS AND EXPORTERS OF AMINO-RESINS, PHENOLIC RESINS, AND POLYURETHANES IN PRIMARY FORMS, 2022 (USD THOUSANDS)	82
TABLE 6	INDICATIVE PRICING ANALYSIS, BY MEMBRANE MATERIAL (USD/SQUARE METER)	85
TABLE 7	KEY PATENTS PERTAINING TO MEMBRANE FILTRATION MARKET, 2013–2022	86
TABLE 8	ROLE OF PLAYERS IN MARKET ECOSYSTEM	91
TABLE 9	MEMBRANE FILTRATION MARKET: DETAILED LIST OF CONFERENCES & EVENTS, 2022–2023	92
TABLE 10	NORTH AMERICA: LIST OF REGULATORY BODIES, GOVERNMENT AGENCIES, AND OTHER ORGANIZATIONS	94
TABLE 11	EUROPE: LIST OF REGULATORY BODIES, GOVERNMENT AGENCIES, AND OTHER ORGANIZATIONS	95
TABLE 12	ASIA PACIFIC: LIST OF REGULATORY BODIES, GOVERNMENT AGENCIES, AND OTHER ORGANIZATIONS	96
TABLE 13	MEMBRANE FILTRATION MARKET: PORTER'S FIVE FORCES ANALYSIS	98
TABLE 14	INFLUENCE OF STAKEHOLDERS ON BUYING PROCESS FOR MEMBRANE FILTRATION, BY TYPE	103
TABLE 15	KEY CRITERIA FOR SELECTING SUPPLIER/VENDOR, BY TYPE	104
TABLE 16	MEMBRANE FILTRATION MARKET, BY APPLICATION, 2018–2022 (USD MILLION)	106
TABLE 17	MEMBRANE FILTRATION MARKET, BY APPLICATION, 2023–2028 (USD MILLION)	107
TABLE 18	DAIRY PRODUCTS: MEMBRANE FILTRATION MARKET, BY SUBAPPLICATION, 2018–2022 (USD MILLION)	108
TABLE 19	DAIRY PRODUCTS: MEMBRANE FILTRATION MARKET, BY SUBAPPLICATION, 2023–2028 (USD MILLION)	108
TABLE 20	DAIRY PRODUCTS: MEMBRANE FILTRATION MARKET, BY REGION, 2018–2022 (USD MILLION)	108
TABLE 21	DAIRY PRODUCTS: MEMBRANE FILTRATION MARKET, BY REGION, 2023–2028 (USD MILLION)	109
TABLE 22	DAIRY PRODUCTS: MEMBRANE FILTRATION MARKET, BY TYPE, 2018–2022 (USD MILLION)	109
TABLE 23	DAIRY PRODUCTS: MEMBRANE FILTRATION MARKET, BY TYPE, 2023–2028 (USD MILLION)	109
TABLE 24	LIQUID MILK: MEMBRANE FILTRATION MARKET, BY SUBAPPLICATION, 2018–2022 (USD MILLION)	110
TABLE 25	LIQUID MILK: MEMBRANE FILTRATION MARKET, BY SUBAPPLICATION, 2023–2028 (USD MILLION)	111
TABLE 26	LIQUID MILK: MEMBRANE FILTRATION MARKET, BY REGION, 2018–2022 (USD MILLION)	111
TABLE 27	LIQUID MILK: MEMBRANE FILTRATION MARKET, BY REGION, 2023–2028 (USD MILLION)	111
TABLE 28	MILK PROTEIN FRACTIONATION: MEMBRANE FILTRATION MARKET, BY REGION, 2018–2022 (USD MILLION)	113

TABLE 29	MILK PROTEIN FRACTIONATION: MEMBRANE FILTRATION MARKET, BY REGION, 2023–2028 (USD MILLION)	113
TABLE 30	MILK CONCENTRATION: MEMBRANE FILTRATION MARKET, BY REGION, 2018–2022 (USD MILLION)	114
TABLE 31	MILK CONCENTRATION: MEMBRANE FILTRATION MARKET, BY REGION, 2023–2028 (USD MILLION)	114
TABLE 32	MILK PRE-CONCENTRATION: MEMBRANE FILTRATION MARKET, BY REGION, 2018–2022 (USD MILLION)	115
TABLE 33	MILK PRE-CONCENTRATION: MEMBRANE FILTRATION MARKET, BY REGION, 2023–2028 (USD MILLION)	115
TABLE 34	WATER RECOVERY: MEMBRANE FILTRATION MARKET, BY REGION, 2018–2022 (USD MILLION)	116
TABLE 35	WATER RECOVERY: MEMBRANE FILTRATION MARKET, BY REGION, 2023–2028 (USD MILLION)	116
TABLE 36	OTHER DAIRY PRODUCTS: MEMBRANE FILTRATION MARKET, BY SUBAPPLICATION, 2018–2022 (USD MILLION)	117
TABLE 37	OTHER DAIRY PRODUCTS: MEMBRANE FILTRATION MARKET, BY SUBAPPLICATION, 2023–2028 (USD MILLION)	117
TABLE 38	OTHER DAIRY PRODUCTS: MEMBRANE FILTRATION MARKET, BY REGION, 2018–2022 (USD MILLION)	117
TABLE 39	OTHER DAIRY PRODUCTS: MEMBRANE FILTRATION MARKET, BY REGION, 2023–2028 (USD MILLION)	118
TABLE 40	WHEY: MEMBRANE FILTRATION MARKET, BY REGION, 2018–2022 (USD MILLION)	118
TABLE 41	WHEY: MEMBRANE FILTRATION MARKET, BY REGION, 2023–2028 (USD MILLION)	119
TABLE 42	MILK AND WHEY-BASED INGREDIENTS: MEMBRANE FILTRATION MARKET, BY REGION, 2018–2022 (USD MILLION)	119
TABLE 43	MILK AND WHEY-BASED INGREDIENTS: MEMBRANE FILTRATION MARKET, BY REGION, 2023–2028 (USD MILLION)	120
TABLE 44	CHEESE: MEMBRANE FILTRATION MARKET, BY REGION, 2018–2022 (USD MILLION)	121
TABLE 45	CHEESE: MEMBRANE FILTRATION MARKET, BY REGION, 2023–2028 (USD MILLION)	121
TABLE 46	DRINKS & CONCENTRATES: MEMBRANE FILTRATION MARKET, BY REGION, 2018–2022 (USD MILLION)	122
TABLE 47	DRINKS & CONCENTRATES: MEMBRANE FILTRATION MARKET, BY REGION, 2023–2028 (USD MILLION)	122
TABLE 48	DRINKS & CONCENTRATES: MEMBRANE FILTRATION MARKET, BY TYPE, 2018–2022 (USD MILLION)	122
TABLE 49	DRINKS & CONCENTRATES: MEMBRANE FILTRATION MARKET, BY TYPE, 2023–2028 (USD MILLION)	123
TABLE 50	WINE & BEER: MEMBRANE FILTRATION MARKET, BY REGION, 2018–2022 (USD MILLION)	124
TABLE 51	WINE & BEER: MEMBRANE FILTRATION MARKET, BY REGION, 2023–2028 (USD MILLION)	124
TABLE 52	WINE & BEER: MEMBRANE FILTRATION MARKET, BY TYPE, 2018–2022 (USD MILLION)	124
TABLE 53	WINE & BEER: MEMBRANE FILTRATION MARKET, BY TYPE, 2023–2028 (USD MILLION)	125
TABLE 54	OTHER FOOD & BEVERAGE APPLICATIONS: MEMBRANE FILTRATION MARKET, BY REGION, 2018–2022 (USD MILLION)	125

TABLE 55	OTHER FOOD & BEVERAGE APPLICATIONS: MEMBRANE FILTRATION MARKET, BY REGION, 2023–2028 (USD MILLION)	126
TABLE 56	OTHER FOOD & BEVERAGE APPLICATIONS: MEMBRANE FILTRATION MARKET, BY TYPE, 2018–2022 (USD MILLION)	126
TABLE 57	OTHER FOOD & BEVERAGE APPLICATIONS: MEMBRANE FILTRATION MARKET, BY TYPE, 2023–2028 (USD MILLION)	126
TABLE 58	MEMBRANE FILTRATION MARKET, BY MEMBRANE MATERIAL, 2018–2022 (USD MILLION)	128
TABLE 59	MEMBRANE FILTRATION MARKET, BY MEMBRANE MATERIAL, 2023–2028 (USD MILLION)	129
TABLE 60	POLYMERIC: MEMBRANE FILTRATION MARKET, BY REGION, 2018–2022 (USD MILLION)	129
TABLE 61	POLYMERIC: MEMBRANE FILTRATION MARKET, BY REGION, 2023–2028 (USD MILLION)	130
TABLE 62	CERAMIC: MEMBRANE FILTRATION MARKET, BY REGION, 2018–2022 (USD MILLION)	131
TABLE 63	CERAMIC: MEMBRANE FILTRATION MARKET, BY REGION, 2023–2028 (USD MILLION)	131
TABLE 64	MEMBRANE FILTRATION MARKET, BY MODULE DESIGN, 2018–2022 (USD MILLION)	133
TABLE 65	MEMBRANE FILTRATION MARKET, BY MODULE DESIGN, 2023–2028 (USD MILLION)	133
TABLE 66	SPIRAL WOUND: MEMBRANE FILTRATION MARKET, BY REGION, 2018–2022 (USD MILLION)	134
TABLE 67	SPIRAL WOUND: MEMBRANE FILTRATION MARKET, BY REGION, 2023–2028 (USD MILLION)	135
TABLE 68	TUBULAR SYSTEMS: MEMBRANE FILTRATION MARKET, BY REGION, 2018–2022 (USD MILLION)	136
TABLE 69	TUBULAR SYSTEMS: MEMBRANE FILTRATION MARKET, BY REGION, 2023–2028 (USD MILLION)	136
TABLE 70	PLATE & FRAME AND HOLLOW FIBER: MEMBRANE FILTRATION MARKET, BY REGION, 2018–2022 (USD MILLION)	137
TABLE 71	PLATE & FRAME AND HOLLOW FIBER: MEMBRANE FILTRATION MARKET, BY REGION, 2023–2028 (USD MILLION)	137
TABLE 72	MEMBRANE FILTRATION MARKET, BY TYPE, 2018–2022 (USD MILLION)	140
TABLE 73	MEMBRANE FILTRATION MARKET, BY TYPE, 2023–2028 (USD MILLION)	140
TABLE 74	REVERSE OSMOSIS: MEMBRANE FILTRATION MARKET, BY REGION, 2018–2022 (USD MILLION)	141
TABLE 75	REVERSE OSMOSIS: MEMBRANE FILTRATION MARKET, BY REGION, 2023–2028 (USD MILLION)	141
TABLE 76	ULTRAFILTRATION: MEMBRANE FILTRATION MARKET, BY REGION, 2018–2022 (USD MILLION)	142
TABLE 77	ULTRAFILTRATION: MEMBRANE FILTRATION MARKET, BY REGION, 2023–2028 (USD MILLION)	142
TABLE 78	MICROFILTRATION: MEMBRANE FILTRATION MARKET, BY REGION, 2018–2022 (USD MILLION)	143
TABLE 79	MICROFILTRATION: MEMBRANE FILTRATION MARKET, BY REGION, 2023–2028 (USD MILLION)	144
TABLE 80	NANOFILTRATION: MEMBRANE FILTRATION MARKET, BY REGION, 2018–2022 (USD MILLION)	145

TABLE 81	NANOFILTRATION: MEMBRANE FILTRATION MARKET, BY REGION, 2023–2028 (USD MILLION)	145
TABLE 82	MEMBRANE FILTRATION MARKET, BY REGION, 2018–2022 (USD MILLION)	148
TABLE 83	MEMBRANE FILTRATION MARKET, BY REGION, 2023–2028 (USD MILLION)	148
TABLE 84	NORTH AMERICA: MEMBRANE FILTRATION MARKET, BY COUNTRY, 2018–2022 (USD MILLION)	155
TABLE 85	NORTH AMERICA: MEMBRANE FILTRATION MARKET, BY COUNTRY, 2023–2028 (USD MILLION)	155
TABLE 86	NORTH AMERICA: MEMBRANE FILTRATION MARKET, BY MODULE DESIGN, 2018–2022 (USD MILLION)	156
TABLE 87	NORTH AMERICA: MEMBRANE FILTRATION MARKET, BY MODULE DESIGN, 2023–2028 (USD MILLION)	156
TABLE 88	NORTH AMERICA: MEMBRANE FILTRATION MARKET, BY MEMBRANE MATERIAL, 2018–2022 (USD MILLION)	156
TABLE 89	NORTH AMERICA: MEMBRANE FILTRATION MARKET, BY MEMBRANE MATERIAL, 2023–2028 (USD MILLION)	156
TABLE 90	NORTH AMERICA: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2018–2022 (USD MILLION)	157
TABLE 91	NORTH AMERICA: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2023–2028 (USD MILLION)	157
TABLE 92	NORTH AMERICA: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY SUBAPPLICATION, 2018–2022 (USD MILLION)	157
TABLE 93	NORTH AMERICA: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY SUBAPPLICATION, 2023–2028 (USD MILLION)	157
TABLE 94	NORTH AMERICA: MEMBRANE FILTRATION MARKET FOR LIQUID MILK, BY SUBAPPLICATION, 2018–2022 (USD MILLION)	158
TABLE 95	NORTH AMERICA: MEMBRANE FILTRATION MARKET FOR LIQUID MILK, BY SUBAPPLICATION, 2023–2028 (USD MILLION)	158
TABLE 96	NORTH AMERICA: MEMBRANE FILTRATION MARKET FOR OTHER DAIRY PRODUCTS, BY SUBAPPLICATION, 2018–2022 (USD MILLION)	158
TABLE 97	NORTH AMERICA: MEMBRANE FILTRATION MARKET FOR OTHER DAIRY PRODUCTS, BY SUBAPPLICATION, 2023–2028 (USD MILLION)	159
TABLE 98	NORTH AMERICA: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2018–2022 (USD MILLION)	159
TABLE 99	NORTH AMERICA: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2023–2028 (USD MILLION)	159
TABLE 100	NORTH AMERICA: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2018–2022 (USD MILLION)	160
TABLE 101	NORTH AMERICA: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2023–2028 (USD MILLION)	160
TABLE 102	NORTH AMERICA: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2018–2022 (USD MILLION)	160
TABLE 103	NORTH AMERICA: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2023–2028 (USD MILLION)	161
TABLE 104	NORTH AMERICA: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2018–2022 (USD MILLION)	161
TABLE 105	NORTH AMERICA: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2023–2028 (USD MILLION)	161
TABLE 106	US: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2018–2022 (USD MILLION)	162

TABLE 107	US: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2023–2028 (USD MILLION)	162
TABLE 108	US: MEMBRANE FILTRATION MARKET, BY TYPE, 2018–2022 (USD MILLION)	163
TABLE 109	US: MEMBRANE FILTRATION MARKET, BY TYPE, 2023–2028 (USD MILLION)	163
TABLE 110	US: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2018–2022 (USD MILLION)	163
TABLE 111	US: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2023–2028 (USD MILLION)	164
TABLE 112	US: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2018–2022 (USD MILLION)	164
TABLE 113	US: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2023–2028 (USD MILLION)	164
TABLE 114	US: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2018–2022 (USD MILLION)	165
TABLE 115	US: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2023–2028 (USD MILLION)	165
TABLE 116	US: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2018–2022 (USD MILLION)	165
TABLE 117	US: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2023–2028 (USD MILLION)	166
TABLE 118	CANADA: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2018–2022 (USD MILLION)	167
TABLE 119	CANADA: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2023–2028 (USD MILLION)	167
TABLE 120	CANADA: MEMBRANE FILTRATION MARKET, BY TYPE, 2018–2022 (USD MILLION)	167
TABLE 121	CANADA: MEMBRANE FILTRATION MARKET, BY TYPE, 2023–2028 (USD MILLION)	168
TABLE 122	CANADA: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2018–2022 (USD MILLION)	168
TABLE 123	CANADA: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2023–2028 (USD MILLION)	168
TABLE 124	CANADA: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2018–2022 (USD MILLION)	169
TABLE 125	CANADA: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2023–2028 (USD MILLION)	169
TABLE 126	CANADA: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2018–2022 (USD MILLION)	169
TABLE 127	CANADA: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2023–2028 (USD MILLION)	170
TABLE 128	CANADA: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2018–2022 (USD MILLION)	170
TABLE 129	CANADA: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGES APPLICATIONS, BY TYPE, 2023–2028 (USD MILLION)	170
TABLE 130	MEXICO: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2018–2022 (USD MILLION)	171
TABLE 131	MEXICO: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2023–2028 (USD MILLION)	171
TABLE 132	MEXICO: MEMBRANE FILTRATION MARKET, BY TYPE, 2018–2022 (USD MILLION)	172
TABLE 133	MEXICO: MEMBRANE FILTRATION MARKET, BY TYPE, 2023–2028 (USD MILLION)	172
TABLE 134	MEXICO: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2018–2022 (USD MILLION)	172

TABLE 135	MEXICO: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2023–2028 (USD MILLION)	173
TABLE 136	MEXICO: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2018–2022 (USD MILLION)	173
TABLE 137	MEXICO: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2023–2028 (USD MILLION)	173
TABLE 138	MEXICO: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2018–2022 (USD MILLION)	174
TABLE 139	MEXICO: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2023–2028 (USD MILLION)	174
TABLE 140	MEXICO: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGES APPLICATIONS, BY TYPE, 2018–2022 (USD MILLION)	174
TABLE 141	MEXICO: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2023–2028 (USD MILLION)	175
TABLE 142	EUROPE: MEMBRANE FILTRATION MARKET, BY COUNTRY, 2018–2022 (USD MILLION)	177
TABLE 143	EUROPE: MEMBRANE FILTRATION MARKET, BY COUNTRY, 2023–2028 (USD MILLION)	178
TABLE 144	EUROPE: MEMBRANE FILTRATION MARKET, BY MODULE DESIGN, 2018–2022 (USD MILLION)	178
TABLE 145	EUROPE: MEMBRANE FILTRATION MARKET, BY MODULE DESIGN, 2023–2028 (USD MILLION)	178
TABLE 146	EUROPE: MEMBRANE FILTRATION MARKET, BY MEMBRANE MATERIAL, 2018–2022 (USD MILLION)	179
TABLE 147	EUROPE: MEMBRANE FILTRATION MARKET, BY MEMBRANE MATERIAL, 2023–2028 (USD MILLION)	179
TABLE 148	EUROPE: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2018–2022 (USD MILLION)	179
TABLE 149	EUROPE: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2023–2028 (USD MILLION)	179
TABLE 150	EUROPE: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY SUBAPPLICATION, 2018–2022 (USD MILLION)	180
TABLE 151	EUROPE: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY SUBAPPLICATION, 2023–2028 (USD MILLION)	180
TABLE 152	EUROPE: MEMBRANE FILTRATION MARKET FOR LIQUID MILK, BY SUBAPPLICATION, 2018–2022 (USD MILLION)	180
TABLE 153	EUROPE: MEMBRANE FILTRATION MARKET FOR LIQUID MILK, BY SUBAPPLICATION, 2023–2028 (USD MILLION)	180
TABLE 154	EUROPE: MEMBRANE FILTRATION MARKET FOR OTHER DAIRY PRODUCTS, BY SUBAPPLICATION, 2018–2022 (USD MILLION)	181
TABLE 155	EUROPE: MEMBRANE FILTRATION MARKET FOR OTHER DAIRY PRODUCTS, BY SUBAPPLICATION, 2023–2028 (USD MILLION)	181
TABLE 156	EUROPE: MEMBRANE FILTRATION MARKET, BY TYPE, 2018–2022 (USD MILLION)	181
TABLE 157	EUROPE: MEMBRANE FILTRATION MARKET, BY TYPE, 2023–2028 (USD MILLION)	181
TABLE 158	EUROPE: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2018–2022 (USD MILLION)	182
TABLE 159	EUROPE: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2023–2028 (USD MILLION)	182
TABLE 160	EUROPE: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2018–2022 (USD MILLION)	182

TABLE 161	EUROPE: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2023–2028 (USD MILLION)	183
TABLE 162	EUROPE: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2018–2022 (USD MILLION)	183
TABLE 163	EUROPE: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2023–2028 (USD MILLION)	183
TABLE 164	EUROPE: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2018–2022 (USD MILLION)	184
TABLE 165	EUROPE: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2023–2028 (USD MILLION)	184
TABLE 166	SPAIN: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2018–2022 (USD MILLION)	185
TABLE 167	SPAIN: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2023–2028 (USD MILLION)	185
TABLE 168	SPAIN: MEMBRANE FILTRATION MARKET, BY TYPE, 2018–2022 (USD MILLION)	185
TABLE 169	SPAIN: MEMBRANE FILTRATION MARKET, BY TYPE, 2023–2028 (USD MILLION)	186
TABLE 170	SPAIN: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2018–2022 (USD MILLION)	186
TABLE 171	SPAIN: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2023–2028 (USD MILLION)	186
TABLE 172	SPAIN: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2018–2022 (USD MILLION)	187
TABLE 173	SPAIN: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2023–2028 (USD MILLION)	187
TABLE 174	SPAIN: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2018–2022 (USD MILLION)	187
TABLE 175	SPAIN: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2023–2028 (USD MILLION)	188
TABLE 176	SPAIN: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2018–2022 (USD MILLION)	188
TABLE 177	SPAIN: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2023–2028 (USD MILLION)	188
TABLE 178	ITALY: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2018–2022 (USD MILLION)	189
TABLE 179	ITALY: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2023–2028 (USD MILLION)	189
TABLE 180	ITALY: MEMBRANE FILTRATION MARKET, BY TYPE, 2018–2022 (USD MILLION)	190
TABLE 181	ITALY: MEMBRANE FILTRATION MARKET, BY TYPE, 2023–2028 (USD MILLION)	190
TABLE 182	ITALY: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2018–2022 (USD MILLION)	190
TABLE 183	ITALY: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2023–2028 (USD MILLION)	191
TABLE 184	ITALY: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2018–2022 (USD MILLION)	191
TABLE 185	ITALY: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2023–2028 (USD MILLION)	191
TABLE 186	ITALY: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2018–2022 (USD MILLION)	192
TABLE 187	ITALY: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2023–2028 (USD MILLION)	192

TABLE 188	ITALY: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2018–2022 (USD MILLION)	192
TABLE 189	ITALY: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2023–2028 (USD MILLION)	193
TABLE 190	GERMANY: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2018–2022 (USD MILLION)	194
TABLE 191	GERMANY: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2023–2028 (USD MILLION)	194
TABLE 192	GERMANY: MEMBRANE FILTRATION MARKET, BY TYPE, 2018–2022 (USD MILLION)	194
TABLE 193	GERMANY: MEMBRANE FILTRATION MARKET, BY TYPE, 2023–2028 (USD MILLION)	195
TABLE 194	GERMANY: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2018–2022 (USD MILLION)	195
TABLE 195	GERMANY: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2023–2028 (USD MILLION)	195
TABLE 196	GERMANY: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2018–2022 (USD MILLION)	196
TABLE 197	GERMANY: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2023–2028 (USD MILLION)	196
TABLE 198	GERMANY: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2018–2022 (USD MILLION)	196
TABLE 199	GERMANY: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2023–2028 (USD MILLION)	197
TABLE 200	GERMANY: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2018–2022 (USD MILLION)	197
TABLE 201	GERMANY: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2023–2028 (USD MILLION)	197
TABLE 202	UK: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2018–2022 (USD MILLION)	198
TABLE 203	UK: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2023–2028 (USD MILLION)	198
TABLE 204	UK: MEMBRANE FILTRATION MARKET, BY TYPE, 2018–2022 (USD MILLION)	199
TABLE 205	UK: MEMBRANE FILTRATION MARKET, BY TYPE, 2023–2028 (USD MILLION)	199
TABLE 206	UK: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2018–2022 (USD MILLION)	199
TABLE 207	UK: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2023–2028 (USD MILLION)	200
TABLE 208	UK: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2018–2022 (USD MILLION)	200
TABLE 209	UK: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2023–2028 (USD MILLION)	200
TABLE 210	UK: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2018–2022 (USD MILLION)	201
TABLE 211	UK: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2023–2028 (USD MILLION)	201
TABLE 212	UK: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2018–2022 (USD MILLION)	201
TABLE 213	UK: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2023–2028 (USD MILLION)	202

TABLE 214	FRANCE: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2018–2022 (USD MILLION)	202
TABLE 215	FRANCE: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2023–2028 (USD MILLION)	203
TABLE 216	FRANCE: MEMBRANE FILTRATION MARKET, BY TYPE, 2018–2022 (USD MILLION)	203
TABLE 217	FRANCE: MEMBRANE FILTRATION MARKET, BY TYPE, 2023–2028 (USD MILLION)	203
TABLE 218	FRANCE: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2018–2022 (USD MILLION)	204
TABLE 219	FRANCE: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2023–2028 (USD MILLION)	204
TABLE 220	FRANCE: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2018–2022 (USD MILLION)	204
TABLE 221	FRANCE: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2023–2028 (USD MILLION)	205
TABLE 222	FRANCE: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2018–2022 (USD MILLION)	205
TABLE 223	FRANCE: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2023–2028 (USD MILLION)	205
TABLE 224	FRANCE: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2018–2022 (USD MILLION)	206
TABLE 225	FRANCE: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2023–2028 (USD MILLION)	206
TABLE 226	NETHERLANDS: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2018–2022 (USD MILLION)	207
TABLE 227	NETHERLANDS: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2023–2028 (USD MILLION)	207
TABLE 228	NETHERLANDS: MEMBRANE FILTRATION MARKET, BY TYPE, 2018–2022 (USD MILLION)	207
TABLE 229	NETHERLANDS: MEMBRANE FILTRATION MARKET, BY TYPE, 2023–2028 (USD MILLION)	208
TABLE 230	NETHERLANDS: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2018–2022 (USD MILLION)	208
TABLE 231	NETHERLANDS: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2023–2028 (USD MILLION)	208
TABLE 232	NETHERLANDS: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2018–2022 (USD MILLION)	209
TABLE 233	NETHERLANDS: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2023–2028 (USD MILLION)	209
TABLE 234	NETHERLANDS: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2018–2022 (USD MILLION)	209
TABLE 235	NETHERLANDS: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2023–2028 (USD MILLION)	210
TABLE 236	NETHERLANDS: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2018–2022 (USD MILLION)	210
TABLE 237	NETHERLANDS: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2023–2028 (USD MILLION)	210
TABLE 238	DENMARK: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2018–2022 (USD MILLION)	211
TABLE 239	DENMARK: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2023–2028 (USD MILLION)	211

TABLE 240	DENMARK: MEMBRANE FILTRATION MARKET, BY TYPE, 2018–2022 (USD MILLION)	212
TABLE 241	DENMARK: MEMBRANE FILTRATION MARKET, BY TYPE, 2023–2028 (USD MILLION)	212
TABLE 242	DENMARK: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2018–2022 (USD MILLION)	212
TABLE 243	DENMARK: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2023–2028 (USD MILLION)	213
TABLE 244	DENMARK: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2018–2022 (USD MILLION)	213
TABLE 245	DENMARK: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2023–2028 (USD MILLION)	213
TABLE 246	DENMARK: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2018–2022 (USD MILLION)	214
TABLE 247	DENMARK: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2023–2028 (USD MILLION)	214
TABLE 248	DENMARK: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2018–2022 (USD MILLION)	214
TABLE 249	DENMARK: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2023–2028 (USD MILLION)	215
TABLE 250	REST OF EUROPE: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2018–2022 (USD MILLION)	215
TABLE 251	REST OF EUROPE: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2023–2028 (USD MILLION)	215
TABLE 252	REST OF EUROPE: MEMBRANE FILTRATION MARKET, BY TYPE, 2018–2022 (USD MILLION)	216
TABLE 253	REST OF EUROPE: MEMBRANE FILTRATION MARKET, BY TYPE, 2023–2028 (USD MILLION)	216
TABLE 254	REST OF EUROPE: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2018–2022 (USD MILLION)	216
TABLE 255	REST OF EUROPE: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2023–2028 (USD MILLION)	217
TABLE 256	REST OF EUROPE: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2018–2022 (USD MILLION)	217
TABLE 257	REST OF EUROPE: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2023–2028 (USD MILLION)	217
TABLE 258	REST OF EUROPE: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2018–2022 (USD MILLION)	218
TABLE 259	REST OF EUROPE: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2023–2028 (USD MILLION)	218
TABLE 260	REST OF EUROPE: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2018–2022 (USD MILLION)	218
TABLE 261	REST OF EUROPE: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2023–2028 (USD MILLION)	219
TABLE 262	ASIA PACIFIC: MEMBRANE FILTRATION MARKET, BY COUNTRY, 2018–2022 (USD MILLION)	222
TABLE 263	ASIA PACIFIC: MEMBRANE FILTRATION MARKET, BY COUNTRY, 2023–2028 (USD MILLION)	223
TABLE 264	ASIA PACIFIC: MEMBRANE FILTRATION MARKET, BY MODULE DESIGN, 2018–2022 (USD MILLION)	223
TABLE 265	ASIA PACIFIC: MEMBRANE FILTRATION MARKET, BY MODULE DESIGN, 2023–2028 (USD MILLION)	223

TABLE 266	ASIA PACIFIC: MEMBRANE FILTRATION MARKET, BY MEMBRANE MATERIAL, 2018–2022 (USD MILLION)	224
TABLE 267	ASIA PACIFIC: MEMBRANE FILTRATION MARKET, BY MEMBRANE MATERIAL, 2023–2028 (USD MILLION)	224
TABLE 268	ASIA PACIFIC: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2018–2022 (USD MILLION)	224
TABLE 269	ASIA PACIFIC: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2023–2028 (USD MILLION)	224
TABLE 270	ASIA PACIFIC: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY SUBAPPLICATION, 2018–2022 (USD MILLION)	225
TABLE 271	ASIA PACIFIC: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY SUBAPPLICATION, 2023–2028 (USD MILLION)	225
TABLE 272	ASIA PACIFIC: MEMBRANE FILTRATION MARKET FOR LIQUID MILK, BY SUBAPPLICATION, 2018–2022 (USD MILLION)	225
TABLE 273	ASIA PACIFIC: MEMBRANE FILTRATION MARKET FOR LIQUID MILK, BY SUBAPPLICATION, 2023–2028 (USD MILLION)	225
TABLE 274	ASIA PACIFIC: MEMBRANE FILTRATION MARKET FOR OTHER DAIRY PRODUCTS, BY SUBAPPLICATION, 2018–2022 (USD MILLION)	226
TABLE 275	ASIA PACIFIC: MEMBRANE FILTRATION MARKET FOR OTHER DAIRY PRODUCTS, BY SUBAPPLICATION, 2023–2028 (USD MILLION)	226
TABLE 276	ASIA PACIFIC: MEMBRANE FILTRATION MARKET, BY TYPE, 2018–2022 (USD MILLION)	226
TABLE 277	ASIA PACIFIC: MEMBRANE FILTRATION MARKET, BY TYPE, 2023–2028 (USD MILLION)	226
TABLE 278	ASIA PACIFIC: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2018–2022 (USD MILLION)	227
TABLE 279	ASIA PACIFIC: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2023–2028 (USD MILLION)	227
TABLE 280	ASIA PACIFIC: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2018–2022 (USD MILLION)	227
TABLE 281	ASIA PACIFIC: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2023–2028 (USD MILLION)	228
TABLE 282	ASIA PACIFIC: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2018–2022 (USD MILLION)	228
TABLE 283	ASIA PACIFIC: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2023–2028 (USD MILLION)	228
TABLE 284	ASIA PACIFIC: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2018–2022 (USD MILLION)	229
TABLE 285	ASIA PACIFIC: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2023–2028 (USD MILLION)	229
TABLE 286	CHINA: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2018–2022 (USD MILLION)	230
TABLE 287	CHINA: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2023–2028 (USD MILLION)	230
TABLE 288	CHINA: MEMBRANE FILTRATION MARKET, BY TYPE, 2018–2022 (USD MILLION)	230
TABLE 289	CHINA: MEMBRANE FILTRATION MARKET, BY TYPE, 2023–2028 (USD MILLION)	230
TABLE 290	CHINA: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2018–2022 (USD MILLION)	231
TABLE 291	CHINA: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2023–2028 (USD MILLION)	231

TABLE 292	CHINA: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2018–2022 (USD MILLION)	231
TABLE 293	CHINA: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2023–2028 (USD MILLION)	232
TABLE 294	CHINA: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2018–2022 (USD MILLION)	232
TABLE 295	CHINA: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2023–2028 (USD MILLION)	232
TABLE 296	CHINA: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2018–2022 (USD MILLION)	233
TABLE 297	CHINA: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2023–2028 (USD MILLION)	233
TABLE 298	SOUTHEAST ASIA: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2018–2022 (USD MILLION)	234
TABLE 299	SOUTHEAST ASIA: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2023–2028 (USD MILLION)	234
TABLE 300	SOUTHEAST ASIA: MEMBRANE FILTRATION MARKET, BY TYPE, 2018–2022 (USD MILLION)	234
TABLE 301	SOUTHEAST ASIA: MEMBRANE FILTRATION MARKET, BY TYPE, 2023–2028 (USD MILLION)	235
TABLE 302	SOUTHEAST ASIA: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2018–2022 (USD MILLION)	235
TABLE 303	SOUTHEAST ASIA: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2023–2028 (USD MILLION)	235
TABLE 304	SOUTHEAST ASIA: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2018–2022 (USD MILLION)	236
TABLE 305	SOUTHEAST ASIA: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2023–2028 (USD MILLION)	236
TABLE 306	SOUTHEAST ASIA: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2018–2022 (USD MILLION)	236
TABLE 307	SOUTHEAST ASIA: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2023–2028 (USD MILLION)	237
TABLE 308	SOUTHEAST ASIA: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2018–2022 (USD MILLION)	237
TABLE 309	SOUTHEAST ASIA: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2023–2028 (USD MILLION)	237
TABLE 310	INDIA: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2018–2022 (USD MILLION)	238
TABLE 311	INDIA: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2023–2028 (USD MILLION)	239
TABLE 312	INDIA: MEMBRANE FILTRATION MARKET, BY TYPE, 2018–2022 (USD MILLION)	239
TABLE 313	INDIA: MEMBRANE FILTRATION MARKET, BY TYPE, 2023–2028 (USD MILLION)	239
TABLE 314	INDIA: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2018–2022 (USD MILLION)	240
TABLE 315	INDIA: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2023–2028 (USD MILLION)	240
TABLE 316	INDIA: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2018–2022 (USD MILLION)	240
TABLE 317	INDIA: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2023–2028 (USD MILLION)	241

TABLE 318	INDIA: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2018–2022 (USD MILLION)	241
TABLE 319	INDIA: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2023–2028 (USD MILLION)	241
TABLE 320	INDIA: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2018–2022 (USD MILLION)	242
TABLE 321	INDIA: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2023–2028 (USD MILLION)	242
TABLE 322	JAPAN: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2018–2022 (USD MILLION)	243
TABLE 323	JAPAN: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2023–2028 (USD MILLION)	243
TABLE 324	JAPAN: MEMBRANE FILTRATION MARKET, BY TYPE, 2018–2022 (USD MILLION)	243
TABLE 325	JAPAN: MEMBRANE FILTRATION MARKET, BY TYPE, 2023–2028 (USD MILLION)	244
TABLE 326	JAPAN: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2018–2022 (USD MILLION)	244
TABLE 327	JAPAN: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2023–2028 (USD MILLION)	244
TABLE 328	JAPAN: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2018–2022 (USD MILLION)	245
TABLE 329	JAPAN: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2023–2028 (USD MILLION)	245
TABLE 330	JAPAN: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2018–2022 (USD MILLION)	245
TABLE 331	JAPAN: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2023–2028 (USD MILLION)	246
TABLE 332	JAPAN: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2018–2022 (USD MILLION)	246
TABLE 333	JAPAN: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2023–2028 (USD MILLION)	246
TABLE 334	AUSTRALIA: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2018–2022 (USD MILLION)	247
TABLE 335	AUSTRALIA: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2023–2028 (USD MILLION)	248
TABLE 336	AUSTRALIA: MEMBRANE FILTRATION MARKET, BY TYPE, 2018–2022 (USD MILLION)	248
TABLE 337	AUSTRALIA: MEMBRANE FILTRATION MARKET, BY TYPE, 2023–2028 (USD MILLION)	248
TABLE 338	AUSTRALIA: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2018–2022 (USD MILLION)	249
TABLE 339	AUSTRALIA: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2023–2028 (USD MILLION)	249
TABLE 340	AUSTRALIA: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2018–2022 (USD MILLION)	249
TABLE 341	AUSTRALIA: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2023–2028 (USD MILLION)	250
TABLE 342	AUSTRALIA: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2018–2022 (USD MILLION)	250
TABLE 343	AUSTRALIA: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2023–2028 (USD MILLION)	250

TABLE 344	AUSTRALIA: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2018–2022 (USD MILLION)	251
TABLE 345	AUSTRALIA: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2023–2028 (USD MILLION)	251
TABLE 346	NEW ZEALAND: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2018–2022 (USD MILLION)	252
TABLE 347	NEW ZEALAND: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2023–2028 (USD MILLION)	252
TABLE 348	NEW ZEALAND: MEMBRANE FILTRATION MARKET, BY TYPE, 2018–2022 (USD MILLION)	252
TABLE 349	NEW ZEALAND: MEMBRANE FILTRATION MARKET, BY TYPE, 2023–2028 (USD MILLION)	253
TABLE 350	NEW ZEALAND: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2018–2022 (USD MILLION)	253
TABLE 351	NEW ZEALAND: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2023–2028 (USD MILLION)	253
TABLE 352	NEW ZEALAND: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2018–2022 (USD MILLION)	254
TABLE 353	NEW ZEALAND: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2023–2028 (USD MILLION)	254
TABLE 354	NEW ZEALAND: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2018–2022 (USD MILLION)	254
TABLE 355	NEW ZEALAND: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2023–2028 (USD MILLION)	255
TABLE 356	NEW ZEALAND: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2018–2022 (USD MILLION)	255
TABLE 357	NEW ZEALAND: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2023–2028 (USD MILLION)	255
TABLE 358	REST OF ASIA PACIFIC: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2018–2022 (USD MILLION)	256
TABLE 359	REST OF ASIA PACIFIC: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2023–2028 (USD MILLION)	257
TABLE 360	REST OF ASIA PACIFIC: MEMBRANE FILTRATION MARKET, BY TYPE, 2018–2022 (USD MILLION)	257
TABLE 361	REST OF ASIA PACIFIC: MEMBRANE FILTRATION MARKET, BY TYPE, 2023–2028 (USD MILLION)	257
TABLE 362	REST OF ASIA PACIFIC: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2018–2022 (USD MILLION)	258
TABLE 363	REST OF ASIA PACIFIC: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2023–2028 (USD MILLION)	258
TABLE 364	REST OF ASIA PACIFIC: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2018–2022 (USD MILLION)	258
TABLE 365	REST OF ASIA PACIFIC: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2023–2028 (USD MILLION)	259
TABLE 366	REST OF ASIA PACIFIC: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2018–2022 (USD MILLION)	259
TABLE 367	REST OF ASIA PACIFIC: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2023–2028 (USD MILLION)	259
TABLE 368	REST OF ASIA PACIFIC: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2018–2022 (USD MILLION)	260
TABLE 369	REST OF ASIA PACIFIC: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2023–2028 (USD MILLION)	260

TABLE 370	SOUTH AMERICA: MEMBRANE FILTRATION MARKET, BY COUNTRY, 2018–2022 (USD MILLION)	262
TABLE 371	SOUTH AMERICA: MEMBRANE FILTRATION MARKET, BY COUNTRY, 2023–2028 (USD MILLION)	263
TABLE 372	SOUTH AMERICA: MEMBRANE FILTRATION MARKET, BY MODULE DESIGN, 2018–2022 (USD MILLION)	263
TABLE 373	SOUTH AMERICA: MEMBRANE FILTRATION MARKET, BY MODULE DESIGN, 2023–2028 (USD MILLION)	263
TABLE 374	SOUTH AMERICA: MEMBRANE FILTRATION MARKET, BY MEMBRANE MATERIAL, 2018–2022 (USD MILLION)	263
TABLE 375	SOUTH AMERICA: MEMBRANE FILTRATION MARKET, BY MEMBRANE MATERIAL, 2023–2028 (USD MILLION)	264
TABLE 376	SOUTH AMERICA: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2018–2022 (USD MILLION)	264
TABLE 377	SOUTH AMERICA: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2023–2028 (USD MILLION)	264
TABLE 378	SOUTH AMERICA: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY SUBAPPLICATION, 2018–2022 (USD MILLION)	264
TABLE 379	SOUTH AMERICA: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY SUBAPPLICATION, 2023–2028 (USD MILLION)	265
TABLE 380	SOUTH AMERICA: MEMBRANE FILTRATION MARKET FOR LIQUID MILK, BY SUBAPPLICATION, 2018–2022 (USD MILLION)	265
TABLE 381	SOUTH AMERICA: MEMBRANE FILTRATION MARKET FOR LIQUID MILK, BY SUBAPPLICATION, 2023–2028 (USD MILLION)	265
TABLE 382	SOUTH AMERICA: MEMBRANE FILTRATION MARKET FOR OTHER DAIRY PRODUCTS, BY SUBAPPLICATION, 2018–2022 (USD MILLION)	265
TABLE 383	SOUTH AMERICA: MEMBRANE FILTRATION MARKET FOR OTHER DAIRY PRODUCTS, BY SUBAPPLICATION, 2023–2028 (USD MILLION)	266
TABLE 384	SOUTH AMERICA: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2018–2022 (USD MILLION)	266
TABLE 385	SOUTH AMERICA: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2023–2028 (USD MILLION)	266
TABLE 386	SOUTH AMERICA: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2018–2022 (USD MILLION)	267
TABLE 387	SOUTH AMERICA: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2023–2028 (USD MILLION)	267
TABLE 388	SOUTH AMERICA: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2018–2022 (USD MILLION)	267
TABLE 389	SOUTH AMERICA: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2023–2028 (USD MILLION)	268
TABLE 390	SOUTH AMERICA: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2018–2022 (USD MILLION)	268
TABLE 391	SOUTH AMERICA: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2023–2028 (USD MILLION)	268
TABLE 392	BRAZIL: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2018–2022 (USD MILLION)	269
TABLE 393	BRAZIL: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2023–2028 (USD MILLION)	269
TABLE 394	BRAZIL: MEMBRANE FILTRATION MARKET, BY TYPE, 2018–2022 (USD MILLION)	270
TABLE 395	BRAZIL: MEMBRANE FILTRATION MARKET, BY TYPE, 2023–2028 (USD MILLION)	270

TABLE 396	BRAZIL: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2018–2022 (USD MILLION)	270
TABLE 397	BRAZIL: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2023–2028 (USD MILLION)	271
TABLE 398	BRAZIL: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2018–2022 (USD MILLION)	271
TABLE 399	BRAZIL: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2023–2028 (USD MILLION)	271
TABLE 400	BRAZIL: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2018–2022 (USD MILLION)	272
TABLE 401	BRAZIL: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2023–2028 (USD MILLION)	272
TABLE 402	BRAZIL: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2018–2022 (USD MILLION)	272
TABLE 403	BRAZIL: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2023–2028 (USD MILLION)	273
TABLE 404	CHILE: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2018–2022 (USD MILLION)	273
TABLE 405	CHILE: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2023–2028 (USD MILLION)	274
TABLE 406	CHILE: MEMBRANE FILTRATION MARKET, BY TYPE, 2018–2022 (USD MILLION)	274
TABLE 407	CHILE: MEMBRANE FILTRATION MARKET, BY TYPE, 2023–2028 (USD MILLION)	274
TABLE 408	CHILE: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2018–2022 (USD MILLION)	275
TABLE 409	CHILE: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2023–2028 (USD MILLION)	275
TABLE 410	CHILE: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2018–2022 (USD MILLION)	275
TABLE 411	CHILE: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2023–2028 (USD MILLION)	276
TABLE 412	CHILE: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2018–2022 (USD MILLION)	276
TABLE 413	CHILE: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2023–2028 (USD MILLION)	276
TABLE 414	CHILE: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2018–2022 (USD MILLION)	277
TABLE 415	CHILE: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2023–2028 (USD MILLION)	277
TABLE 416	ARGENTINA: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2018–2022 (USD MILLION)	278
TABLE 417	ARGENTINA: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2023–2028 (USD MILLION)	278
TABLE 418	ARGENTINA: MEMBRANE FILTRATION MARKET, BY TYPE, 2018–2022 (USD MILLION)	278
TABLE 419	ARGENTINA: MEMBRANE FILTRATION MARKET, BY TYPE, 2023–2028 (USD MILLION)	279
TABLE 420	ARGENTINA: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2018–2022 (USD MILLION)	279
TABLE 421	ARGENTINA: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2023–2028 (USD MILLION)	279

TABLE 422	ARGENTINA: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2018–2022 (USD MILLION)	280
TABLE 423	ARGENTINA: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2023–2028 (USD MILLION)	280
TABLE 424	ARGENTINA: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2018–2022 (USD MILLION)	280
TABLE 425	ARGENTINA: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2023–2028 (USD MILLION)	281
TABLE 426	ARGENTINA: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2018–2022 (USD MILLION)	281
TABLE 427	ARGENTINA: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2023–2028 (USD MILLION)	281
TABLE 428	REST OF SOUTH AMERICA: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2018–2022 (USD MILLION)	282
TABLE 429	REST OF SOUTH AMERICA: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2023–2028 (USD MILLION)	282
TABLE 430	REST OF SOUTH AMERICA: MEMBRANE FILTRATION MARKET, BY TYPE, 2018–2022 (USD MILLION)	282
TABLE 431	REST OF SOUTH AMERICA: MEMBRANE FILTRATION MARKET, BY TYPE, 2023–2028 (USD MILLION)	283
TABLE 432	REST OF SOUTH AMERICA: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2018–2022 (USD MILLION)	283
TABLE 433	REST OF SOUTH AMERICA: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2023–2028 (USD MILLION)	283
TABLE 434	REST OF SOUTH AMERICA: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2018–2022 (USD MILLION)	284
TABLE 435	REST OF SOUTH AMERICA: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2023–2028 (USD MILLION)	284
TABLE 436	REST OF SOUTH AMERICA: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2018–2022 (USD MILLION)	284
TABLE 437	REST OF SOUTH AMERICA: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2023–2028 (USD MILLION)	285
TABLE 438	REST OF SOUTH AMERICA: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2018–2022 (USD MILLION)	285
TABLE 439	REST OF SOUTH AMERICA: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2023–2028 (USD MILLION)	285
TABLE 440	ROW: MEMBRANE FILTRATION MARKET, BY COUNTRY, 2018–2022 (USD MILLION)	287
TABLE 441	ROW: MEMBRANE FILTRATION MARKET, BY COUNTRY, 2023–2028 (USD MILLION)	288
TABLE 442	ROW: MEMBRANE FILTRATION MARKET, BY MODULE DESIGN, 2018–2022 (USD MILLION)	288
TABLE 443	ROW: MEMBRANE FILTRATION MARKET, BY MODULE DESIGN, 2023–2028 (USD MILLION)	288
TABLE 444	ROW: MEMBRANE FILTRATION MARKET, BY MEMBRANE MATERIAL, 2018–2022 (USD MILLION)	288
TABLE 445	ROW: MEMBRANE FILTRATION MARKET, BY MEMBRANE MATERIAL, 2023–2028 (USD MILLION)	289
TABLE 446	ROW: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2018–2022 (USD MILLION)	289
TABLE 447	ROW: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2023–2028 (USD MILLION)	289

TABLE 448	ROW: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY SUBAPPLICATION, 2018–2022 (USD MILLION)	289
TABLE 449	ROW: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY SUBAPPLICATION, 2023–2028 (USD MILLION)	290
TABLE 450	ROW: MEMBRANE FILTRATION MARKET FOR LIQUID MILK, BY SUBAPPLICATION, 2018–2022 (USD MILLION)	290
TABLE 451	ROW: MEMBRANE FILTRATION MARKET FOR LIQUID MILK, BY SUBAPPLICATION, 2023–2028 (USD MILLION)	290
TABLE 452	ROW: MEMBRANE FILTRATION MARKET FOR OTHER DAIRY PRODUCTS, BY SUBAPPLICATION, 2018–2022 (USD MILLION)	290
TABLE 453	ROW: MEMBRANE FILTRATION MARKET FOR OTHER DAIRY PRODUCTS, BY SUBAPPLICATION, 2023–2028 (USD MILLION)	291
TABLE 454	ROW: MEMBRANE FILTRATION MARKET, BY TYPE, 2018–2022 (USD MILLION)	291
TABLE 455	ROW: MEMBRANE FILTRATION MARKET, BY TYPE, 2023–2028 (USD MILLION)	291
TABLE 456	ROW: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2018–2022 (USD MILLION)	291
TABLE 457	ROW: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2023–2028 (USD MILLION)	292
TABLE 458	ROW: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2018–2022 (USD MILLION)	292
TABLE 459	ROW: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2023–2028 (USD MILLION)	292
TABLE 460	ROW: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2018–2022 (USD MILLION)	293
TABLE 461	ROW: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2023–2028 (USD MILLION)	293
TABLE 462	ROW: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2018–2022 (USD MILLION)	293
TABLE 463	ROW: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2023–2028 (USD MILLION)	294
TABLE 464	MIDDLE EAST: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2018–2022 (USD MILLION)	294
TABLE 465	MIDDLE EAST: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2023–2028 (USD MILLION)	295
TABLE 466	MIDDLE EAST: MEMBRANE FILTRATION MARKET, BY TYPE, 2018–2022 (USD MILLION)	295
TABLE 467	MIDDLE EAST: MEMBRANE FILTRATION MARKET, BY TYPE, 2023–2028 (USD MILLION)	295
TABLE 468	MIDDLE EAST: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2018–2022 (USD MILLION)	296
TABLE 469	MIDDLE EAST: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2023–2028 (USD MILLION)	296
TABLE 470	MIDDLE EAST: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2018–2022 (USD MILLION)	296
TABLE 471	MIDDLE EAST: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2023–2028 (USD MILLION)	297
TABLE 472	MIDDLE EAST: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2018–2022 (USD MILLION)	297
TABLE 473	MIDDLE EAST: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2023–2028 (USD MILLION)	297

TABLE 474	MIDDLE EAST: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2018–2022 (USD MILLION)	298
TABLE 475	MIDDLE EAST: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2023–2028 (USD MILLION)	298
TABLE 476	AFRICA: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2018–2022 (USD MILLION)	299
TABLE 477	AFRICA: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2023–2028 (USD MILLION)	299
TABLE 478	AFRICA: MEMBRANE FILTRATION MARKET, BY TYPE, 2018–2022 (USD MILLION)	299
TABLE 479	AFRICA: MEMBRANE FILTRATION MARKET, BY TYPE, 2023–2028 (USD MILLION)	299
TABLE 480	AFRICA: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2018–2022 (USD MILLION)	300
TABLE 481	AFRICA: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2023–2028 (USD MILLION)	300
TABLE 482	AFRICA: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2018–2022 (USD MILLION)	300
TABLE 483	AFRICA: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2023–2028 (USD MILLION)	301
TABLE 484	AFRICA: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2018–2022 (USD MILLION)	301
TABLE 485	AFRICA: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2023–2028 (USD MILLION)	301
TABLE 486	AFRICA: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2018–2022 (USD MILLION)	302
TABLE 487	AFRICA: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2023–2028 (USD MILLION)	302
TABLE 488	MEMBRANE FILTRATION MARKET: INTENSITY OF COMPETITIVE RIVALRY	304
TABLE 489	STRATEGIES ADOPTED BY KEY PLAYERS	306
TABLE 490	COMPANY FOOTPRINT, BY TYPE	311
TABLE 491	COMPANY FOOTPRINT, BY APPLICATION	311
TABLE 492	COMPANY FOOTPRINT, BY REGION	312
TABLE 493	OVERALL COMPANY FOOTPRINT	313
TABLE 494	DETAILED LIST OF STARTUPS/SMES	316
TABLE 495	OVERALL COMPETITIVE BENCHMARKING OF STARTUPS/SMES	317
TABLE 496	PRODUCT LAUNCHES, 2020–2023	318
TABLE 497	DEALS, 2020–2022	319
TABLE 498	OTHERS, 2022–2023	322
TABLE 499	ALFA LAVAL: BUSINESS OVERVIEW	323
TABLE 500	ALFA LAVAL: PRODUCTS OFFERED	324
TABLE 501	ALFA LAVAL: DEALS	326
TABLE 502	GEA GROUP AKTIENGESELLSCHAFT: BUSINESS OVERVIEW	328
TABLE 503	GEA GROUP AKTIENGESELLSCHAFT: PRODUCTS OFFERED	329
TABLE 504	GEA GROUP AKTIENGESELLSCHAFT: PRODUCT LAUNCHES	330
TABLE 505	DUPONT: BUSINESS OVERVIEW	332
TABLE 506	DUPONT: PRODUCTS OFFERED	333
TABLE 507	PALL CORPORATION: BUSINESS OVERVIEW	336
TABLE 508	PALL CORPORATION: PRODUCTS OFFERED	337

TABLE 509	PALL CORPORATION: DEALS	341
TABLE 510	PALL CORPORATION: OTHERS	341
TABLE 511	VEOLIA: BUSINESS OVERVIEW	343
TABLE 512	VEOLIA: PRODUCTS OFFERED	344
TABLE 513	3M: BUSINESS OVERVIEW	346
TABLE 514	3M: PRODUCTS OFFERED	347
TABLE 515	PENTAIR: BUSINESS OVERVIEW	350
TABLE 516	PENTAIR: PRODUCTS OFFERED	351
TABLE 517	PENTAIR: DEALS	352
TABLE 518	DONALDSON COMPANY, INC.: BUSINESS OVERVIEW	353
TABLE 519	DONALDSON COMPANY, INC.: PRODUCTS OFFERED	354
TABLE 520	PORVAIR FILTRATION GROUP: BUSINESS OVERVIEW	355
TABLE 521	PORVAIR FILTRATION GROUP: PRODUCTS OFFERED	356
TABLE 522	PORVAIR FILTRATION GROUP: PRODUCT LAUNCHES	358
TABLE 523	TORAY INDUSTRIES, INC.: BUSINESS OVERVIEW	359
TABLE 524	TORAY INDUSTRIES, INC.: PRODUCTS OFFERED	360
TABLE 525	TORAY INDUSTRIES, INC.: PRODUCT LAUNCHES	361
TABLE 526	HYDRANAUTICS - A NITTO GROUP COMPANY: BUSINESS OVERVIEW	363
TABLE 527	HYDRANAUTICS - A NITTO GROUP COMPANY: PRODUCTS OFFERED	364
TABLE 528	SPXFLOW: BUSINESS OVERVIEW	365
TABLE 529	SPXFLOW: PRODUCTS OFFERED	366
TABLE 530	SPXFLOW: PRODUCT LAUNCHES	367
TABLE 531	SPXFLOW: DEALS	367
TABLE 532	MMS MEMBRANE SYSTEMS: BUSINESS OVERVIEW	368
TABLE 533	MMS MEMBRANE SYSTEMS: PRODUCTS OFFERED	368
TABLE 534	MMS MEMBRANE SYSTEMS: PRODUCT LAUNCHES	369
TABLE 535	MMS MEMBRANE SYSTEMS: DEALS	369
TABLE 536	KOCH SEPARATION SOLUTIONS: BUSINESS OVERVIEW	370
TABLE 537	KOCH SEPARATION SOLUTIONS: PRODUCTS OFFERED	370
TABLE 538	KOCH SEPARATION SOLUTIONS: DEALS	371
TABLE 539	SYNDER FILTRATION, INC.: BUSINESS OVERVIEW	372
TABLE 540	SYNDER FILTRATION, INC.: PRODUCTS OFFERED	372
TABLE 541	SYNDER FILTRATION, INC.: PRODUCT LAUNCHES	373
TABLE 542	PROMINENT: BUSINESS OVERVIEW	374
TABLE 543	PROMINENT: PRODUCTS OFFERED	374
TABLE 544	PROMINENT: OTHERS	375
TABLE 545	MANN+HUMMEL: BUSINESS OVERVIEW	376
TABLE 546	MANN+HUMMEL: PRODUCTS OFFERED	376
TABLE 547	MANN+HUMMEL: DEALS	377
TABLE 548	GRAVER TECHNOLOGIES: BUSINESS OVERVIEW	378
TABLE 549	GRAVER TECHNOLOGIES: PRODUCTS OFFERED	378
TABLE 550	CRITICAL PROCESS FILTRATION INC.: BUSINESS OVERVIEW	380
TABLE 551	CRITICAL PROCESS FILTRATION INC.: PRODUCTS OFFERED	380
TABLE 552	NOVASEP: BUSINESS OVERVIEW	381

TABLE 553	NOVASEP: PRODUCTS OFFERED	381
TABLE 554	NILSAN NISHOTECH SYSTEMS PVT. LTD.: BUSINESS OVERVIEW	382
TABLE 555	NILSAN NISHOTECH SYSTEMS PVT. LTD.: PRODUCTS OFFERED	382
TABLE 556	MARKETS ADJACENT TO MEMBRANE FILTRATION MARKET	387
TABLE 557	MICROFILTRATION MEMBRANE MARKET, BY TYPE, 2018–2021 (USD MILLION)	388
TABLE 558	MICROFILTRATION MEMBRANE MARKET, BY TYPE, 2022–2027 (USD MILLION)	389
TABLE 559	MICROFILTRATION MEMBRANE MARKET, BY REGION, 2018–2021 (USD MILLION)	389
TABLE 560	MICROFILTRATION MEMBRANE MARKET, BY REGION, 2022–2027 (USD MILLION)	390
TABLE 561	MEMBRANE SEPARATION TECHNOLOGY MARKET, BY TECHNOLOGY, 2015–2022 (USD MILLION)	391
TABLE 562	MEMBRANE SEPARATION TECHNOLOGY MARKET, BY REGION, 2015–2022 (USD MILLION)	391

LIST OF FIGURES

FIGURE 1	RESEARCH DESIGN	44
FIGURE 2	BREAKDOWN OF PRIMARY INTERVIEWS: BY COMPANY TYPE, DESIGNATION, AND REGION	46
FIGURE 3	MEMBRANE FILTRATION MARKET SIZE ESTIMATION, BY TYPE (SUPPLY SIDE)	48
FIGURE 4	MEMBRANE FILTRATION MARKET SIZE ESTIMATION (DEMAND SIDE)	48
FIGURE 5	MARKET SIZE ESTIMATION METHODOLOGY: BOTTOM-UP APPROACH	49
FIGURE 6	MARKET SIZE ESTIMATION METHODOLOGY: TOP-DOWN APPROACH	50
FIGURE 7	MARKET BREAKDOWN AND DATA TRIANGULATION	51
FIGURE 8	MEMBRANE FILTRATION MARKET, BY TYPE, 2023 VS. 2028 (USD MILLION)	56
FIGURE 9	MEMBRANE FILTRATION MARKET, BY APPLICATION, 2023 VS. 2028 (USD MILLION)	56
FIGURE 10	MEMBRANE FILTRATION MARKET, BY MODULE DESIGN, 2023 VS. 2028 (USD MILLION)	57
FIGURE 11	MEMBRANE FILTRATION MARKET: REGIONAL SNAPSHOT, 2022	57
FIGURE 12	RAPID GROWTH IN DAIRY INDUSTRY AND RISING DEMAND FOR PREMIUM PRODUCTS TO DRIVE MEMBRANE FILTRATION MARKET	59
FIGURE 13	POLYMERIC SEGMENT AND CHINA TO ACCOUNT FOR SIGNIFICANT SHARE IN 2023	60
FIGURE 14	RO SEGMENT TO ACCOUNT FOR LARGEST SHARE IN 2023	61
FIGURE 15	US ACCOUNTED FOR LARGEST SHARE IN 2022	62
FIGURE 16	MEMBRANE FILTRATION MARKET DYNAMICS	65
FIGURE 17	GLOBAL CHEESE PRODUCTION, 2022–2031 (TONNE)	67
FIGURE 18	GLOBAL MILK PRODUCTION, 2022–2031 (TONNE)	67
FIGURE 19	GLOBAL BUTTER PRODUCTION, 2022–2031 (TONNE)	67
FIGURE 20	GLOBAL BUTTER CONSUMPTION, 2022–2031 (TONNE)	68
FIGURE 21	MEMBRANE FILTRATION MARKET: VALUE CHAIN ANALYSIS	78
FIGURE 22	MEMBRANE FILTRATION MARKET: SUPPLY CHAIN ANALYSIS	83
FIGURE 23	AVERAGE SELLING PRICE TREND, BY REGION (USD/SQUARE METER)	85
FIGURE 24	TOTAL PATENTS GRANTED, 2013–2022	89
FIGURE 25	REGIONAL ANALYSIS OF PATENTS GRANTED	89
FIGURE 26	ECOSYSTEM MAP	90
FIGURE 27	REVENUE SHIFT IN MEMBRANE FILTRATION MARKET	97
FIGURE 28	INFLUENCE OF STAKEHOLDERS ON BUYING PROCESS FOR MEMBRANE FILTRATION, BY TYPE	103
FIGURE 29	KEY CRITERIA FOR SELECTING SUPPLIER/VENDOR, BY TYPE	104
FIGURE 30	DAIRY PRODUCTS SEGMENT TO DOMINATE MARKET DURING FORECAST PERIOD	106
FIGURE 31	GLOBAL WINE CONSUMPTION, BY COUNTRY, 2021	123
FIGURE 32	MEMBRANE FILTRATION MARKET, BY MEMBRANE MATERIAL, 2023 VS. 2028 (USD MILLION)	128
FIGURE 33	SPIRAL WOUND SEGMENT TO DOMINATE MARKET DURING FORECAST PERIOD	133
FIGURE 34	MEMBRANE FILTRATION MARKET, BY TYPE, 2023 VS. 2028	139
FIGURE 35	INDIA TO RECORD HIGHEST GROWTH RATE DURING FORECAST PERIOD	147
FIGURE 36	RECESSION INDICATORS	149

FIGURE 37	GLOBAL INFLATION RATE, 2011–2022	149
FIGURE 38	GLOBAL GDP, 2011–2022 (USD TRILLION)	150
FIGURE 39	IMPACT OF RECESSION INDICATORS ON MEMBRANE FILTRATION MARKET	151
FIGURE 40	GLOBAL MEMBRANE FILTRATION MARKET: EARLIER FORECAST VS. RECESSION FORECAST	151
FIGURE 41	NORTH AMERICA: MEMBRANE FILTRATION MARKET SNAPSHOT	153
FIGURE 42	NORTH AMERICA: INFLATION RATES, BY KEY COUNTRY, 2017–2022	154
FIGURE 43	NORTH AMERICAN MEMBRANE FILTRATION MARKET: EARLIER FORECAST VS. RECESSION FORECAST	155
FIGURE 44	EUROPE: INFLATION RATES, BY KEY COUNTRY, 2017–2022	176
FIGURE 45	EUROPEAN MEMBRANE FILTRATION MARKET: EARLIER FORECAST VS. RECESSION FORECAST	177
FIGURE 46	ASIA PACIFIC: MEMBRANE FILTRATION MARKET SNAPSHOT	220
FIGURE 47	ASIA PACIFIC: INFLATION RATES, BY KEY COUNTRY, 2017–2022	221
FIGURE 48	ASIA PACIFIC MEMBRANE FILTRATION MARKET: EARLIER FORECAST VS. RECESSION FORECAST	222
FIGURE 49	SOUTH AMERICA: INFLATION RATES, BY KEY COUNTRY, 2017–2022	262
FIGURE 50	SOUTH AMERICAN MEMBRANE FILTRATION MARKET: EARLIER FORECAST VS. RECESSION IMPACT	262
FIGURE 51	ROW: INFLATION RATES, BY KEY COUNTRY, 2017–2022	287
FIGURE 52	ROW MEMBRANE FILTRATION MARKET: EARLIER FORECAST VS. RECESSION FORECAST	287
FIGURE 53	HISTORICAL REVENUE ANALYSIS FOR KEY PLAYERS, 2018–2022 (USD MILLION)	304
FIGURE 54	ANNUAL REVENUE, 2022 (USD BILLION) VS. REVENUE GROWTH, 2020–2022	305
FIGURE 55	EBITDA OF KEY PLAYERS, 2022 (USD BILLION)	306
FIGURE 56	GLOBAL SNAPSHOT OF KEY PARTICIPANTS, 2022	309
FIGURE 57	COMPANY EVALUATION MATRIX FOR KEY PLAYERS, 2022	310
FIGURE 58	COMPANY EVALUATION MATRIX FOR STARTUPS/SMES, 2022	315
FIGURE 59	ALFA LAVAL: COMPANY SNAPSHOT	324
FIGURE 60	GEA GROUP AKTIENGESELLSCHAFT: COMPANY SNAPSHOT	329
FIGURE 61	DUPONT: COMPANY SNAPSHOT	333
FIGURE 62	PALL CORPORATION: COMPANY SNAPSHOT	337
FIGURE 63	VEOLIA: COMPANY SNAPSHOT	344
FIGURE 64	3M: COMPANY SNAPSHOT	347
FIGURE 65	PENTAIR: COMPANY SNAPSHOT	351
FIGURE 66	DONALDSON COMPANY, INC.: COMPANY SNAPSHOT	354
FIGURE 67	PORVAIR FILTRATION GROUP: COMPANY SNAPSHOT	356
FIGURE 68	TORAY INDUSTRIES, INC.: COMPANY SNAPSHOT	360
FIGURE 69	HYDRANAUTICS - A NITTO GROUP COMPANY: COMPANY SNAPSHOT	364
FIGURE 70	SPXFLOW: COMPANY SNAPSHOT	366

LIST OF ABBREVIATIONS

ABBREVIATIONS	FULL FORMS
ABWA	Asia and Middle East Bottled Water Association
ABWI	Australasian Bottled Water Institute
CBIA	China Beverage Industry Association
CBWA	Canadian Bottled Water Association
CEO	Chief Executive Officer
EBWA	European Bottled Watercooler Association
EFSA	European Food Safety Agency
EPA	Environmental Protection Agency
EU	European Union
FDA	Food and Drug Administration
FSANZ	Food Safety Australia and New Zealand
GDP	Gross Domestic Product
IBWA	International Bottled Water Association
ICBWA	International Council of Bottled Waters Association
LABWA	Latin American Bottled Water Association
MEA	Middle East & Africa
MF	Microfiltration
NF	Nanofiltration
R&D	Research & Development
RO	Reverse Osmosis
RoW	Rest of the World
SMEs	Small and Medium-sized Enterprises
UAE	United Arab Emirates
UF	Ultrafiltration
UK	United Kingdom
US	United States

1 INTRODUCTION

1.1 STUDY OBJECTIVES

MARKET INTELLIGENCE

- Determining and projecting the size of the membrane filtration market based on application, membrane material, type, module design, and region over a five-year period ranging from 2023 to 2028
- Identifying the attractive opportunities in the market by determining the largest and fastest-growing segments across the key regions
- Analyzing the demand-side factors based on the following:
 - Impact of macro- and microeconomic factors on the market
 - Shifts in demand patterns across different subsegments and regions
 - Key drivers and restraints impacting the global market

COMPETITIVE INTELLIGENCE

- Identifying and profiling the key market players in the membrane filtration market
- Providing a comparative analysis of the market leaders based on the following:
 - Product offerings
 - Business strategies
 - Strengths and weaknesses
 - Key financials
- Understanding the competitive landscape and identifying the major growth strategies adopted by players across the key regions
- Analyzing the supply chain and regulatory frameworks across regions and their impact on prominent market players
- Providing insights into the key investments in product innovations and technology

1.2 MARKET DEFINITION

Membrane filtration is a technology used for desalination, separation, concentration, microbial inactivation, and clarification through a semi-permeable membrane of various pore sizes. The market study includes the market size for membrane system applications in the food, beverage, water, and wastewater industries. The study includes the market for overall membranes and modules, which include pumps, filters, and pipeline networks.

1.3 STUDY SCOPE

This study covers various segments of the membrane filtration market based on application, membrane material, type, module design, and region to arrive at the market size, in terms of value, from 2018 to 2028.

1.3.1 MARKET SEGMENTATION



Other Food & Beverage Applications include Sugar, Fish, and Poultry Products.

RoW includes Middle East & Africa.

Source: Secondary Literature, Expert Interviews, and MarketsandMarkets Analysis

1.3.2 REGIONS COVERED

 NORTH AMERICA	 EUROPE	 ASIA PACIFIC	 SOUTH AMERICA	 REST OF THE WORLD
<ul style="list-style-type: none"> ▪ US ▪ Canada ▪ Mexico 	<ul style="list-style-type: none"> ▪ Germany ▪ France ▪ Italy ▪ Spain ▪ UK ▪ Netherlands ▪ Denmark ▪ Rest of Europe 	<ul style="list-style-type: none"> ▪ China ▪ Southeast Asia ▪ India ▪ Australia ▪ New Zealand ▪ Japan ▪ Rest of Asia Pacific 	<ul style="list-style-type: none"> ▪ Brazil ▪ Chile ▪ Argentina ▪ Rest of South America 	<ul style="list-style-type: none"> ▪ Middle East ▪ Africa

Rest of Europe includes Finland and Sweden.

Rest of Asia Pacific includes South Korea, Taiwan, Pakistan, and Bangladesh.

Rest of South America includes Bolivia and Ecuador.

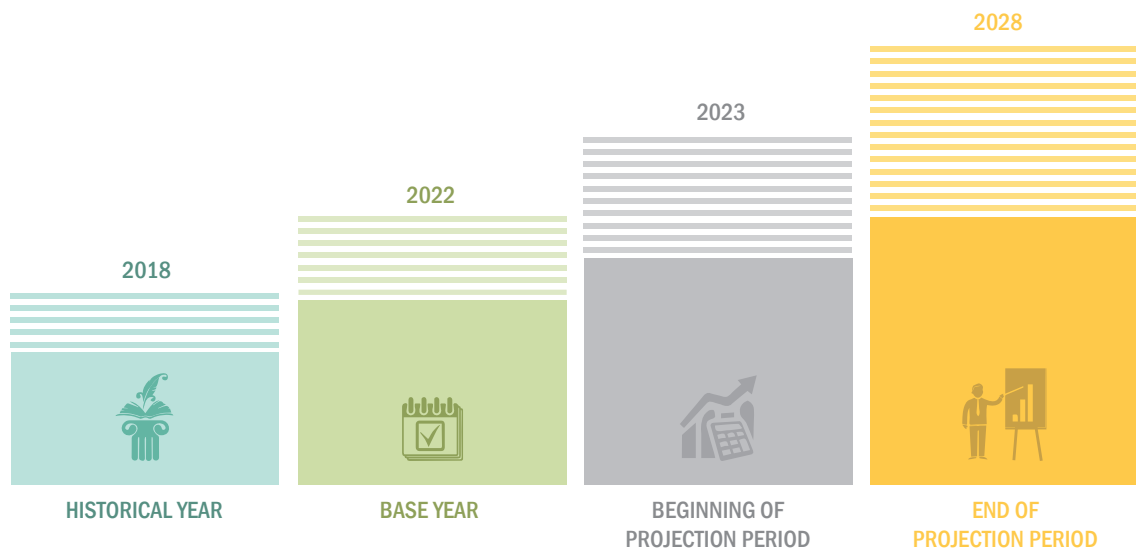
Source: Press Releases, Expert Interviews, Company Annual Reports, and MarketsandMarkets Analysis

1.3.3 INCLUSIONS & EXCLUSIONS

SEGMENT	INCLUSIONS	EXCLUSIONS
Application	<ul style="list-style-type: none"> ▪ Dairy Products <ul style="list-style-type: none"> • Liquid Milk <ul style="list-style-type: none"> ▫ Milk Protein Fractionation ▫ Milk Concentration ▫ Milk Pre-Concentration ▫ Water Recovery • Other Dairy Products <ul style="list-style-type: none"> ▫ Whey ▫ Milk & Whey based Ingredients ▫ Cheese ▪ Drinks & Concentrates ▪ Wine & Beer ▪ Other Food & Beverage Applications 	Water & wastewater treatment filtration equipment
Type	<ul style="list-style-type: none"> ▪ Reverse Osmosis (RO) ▪ Ultrafiltration (UF) ▪ Microfiltration (MF) ▪ Nanofiltration (NF) 	NA
Module Design	<ul style="list-style-type: none"> ▪ Spiral Wound ▪ Tubular Systems ▪ Plate & Frame and Hollow Fiber 	NA

Membrane Material	<ul style="list-style-type: none"> ▪ Polymeric ▪ Ceramic 	NA
Region	<ul style="list-style-type: none"> ▪ North America ▪ Europe ▪ Asia Pacific ▪ South America ▪ Rest of the World 	NA

1.4 YEARS CONSIDERED



- 2022 is considered the base year for most company profiles. Wherever recent financial data was not available, data for 2021 has been considered.
- The study period considered for the competitive landscape spans between January 2018 and August 2023.

1.5 CURRENCY CONSIDERED

The currency used in the report is US dollars, with market sizes indicated in terms of USD million.

- ISO 4217 codes are used to depict currency names; the market size, in terms of value, is represented using “USD.”
- The market has mainly been studied in terms of USD million, with certain values provided in USD billion; the denomination is based on the size of the values, enabling uniform accommodation of these values within the tables, figures, or any form of study of the particular segments.
- For companies reporting their revenues in US dollars (USD), the data has been taken from their annual reports.
- Companies that reported their revenues in other currencies used the average annual currency conversion rate for that particular year from the US IRS and Exchange-Rates.org to convert values to US dollars.

TABLE 1 USD EXCHANGE RATES, 2018–2021

Country/Region (Currency)	2018	2019	2020	2021
Euro Zone (Euro)	1.179	1.119	1.140	1.182
Swedish Krona (SEK)	0.115	0.116	0.109	0.117
India (INR)	0.015	0.014	0.014	0.013
Australia (AUD)	0.746	0.695	0.689	0.750

Source: IRS and Exchange-Rates.org

1.6 STAKEHOLDERS

- Membrane filtration equipment manufacturers, importers & exporters, traders, distributors, and suppliers
- Manufacturers of membrane filtration products for the food & beverage industry
- Manufacturers of dairy products, dairy concentrates, wine, and beer
- Beverage manufacturers, food processors, and municipal corporations
- Research & development institutions
- Regulatory bodies: Related government authorities, commercial research & development (R&D) institutions, Food and Drug Administration (FDA), European Food Safety Authority (EFSA), United States Department of Agriculture (USDA), Food Standards Australia and New Zealand (FSANZ), government agencies & NGOs, and other regulatory bodies
- Trade associations, industry bodies, and food safety agencies

1.7 SUMMARY OF CHANGES

- The new research study consists of a technical analysis of the membrane filtration market.
- The new research study consists of a value chain analysis of the membrane filtration market.
- The new research study consists of indicative pricing analysis for key players and indicative price trends at regional level.
- The new research study comprises the patent analysis of new membrane filtration solutions or products.
- The new research study comprises the trends/disruptions impacting customers' business in the membrane filtration market.
- The new research study comprises of Porter's Five Force analysis of the membrane filtration market.
- The new research study comprises of the key stakeholders and buying criteria for the membrane filtration market.
- In the latest edition of the report, the application segment has been revised, and further sub-segments to dairy products have been added.
- The new research study provides the company evaluation quadrant for 16 companies operating in the membrane filtration market.
- The study comprises the operational drivers for every segment of the membrane filtration market.
- The new market study consists of the historical revenue analysis for three years of the top five players in the membrane filtration market.
- The new research study comprises an annual revenue vs. growth analysis for key players.
- The new research study comprises of key player EBIT/EBITDA analysis for the membrane filtration market.
- The new study comprises of global snapshots of key market participants in the membrane filtration market.
- The new research study comprises 26 (16 top players and 10 startups/SMEs) players compared with 25 in the previous study.
- Updated financial information/product portfolio of players: The new edition of the report provides updated financial information in the context of the membrane filtration market from 2018 to 2022 for each listed company in a graphical representation.
- Updated market developments of profiled players: The current report includes the market developments from 2018 to 2023.

1.8 RECESSION IMPACT

- The impact of the recession for the period of 2022–2023 has been included in the report.
- A brief on Recession Impact Analysis has been included in the Research Methodology (RM) analysis section of the report.

The new edition of the report also provides insights into the Recession Impact Analysis on the membrane filtration market, along with its effect on different regional markets.

2 RESEARCH METHODOLOGY

2.1 RESEARCH DATA

This research study involved the extensive use of secondary sources (which included directories and databases)—such as Dun & Bradstreet, Forbes, Bloomberg Business, and Factiva—to identify and collect information useful for a market-oriented, technical, and commercial study of the membrane filtration market. Primary sources include industry experts from core and related industries and preferred suppliers, dealers, manufacturers, alliances, standards & certification organizations from companies, and organizations related to all segments of this industry's value chain. In-depth interviews were conducted with various primary respondents, such as key industry participants, subject-matter experts, C-level executives of key market players, and industry consultants, to obtain and verify critical qualitative and quantitative information as well as to assess future prospects of this market. The following figure depicts the market research methodology applied in making this report on the membrane filtration market.

FIGURE 1 RESEARCH DESIGN






Source: Industry Experts, Associations, Research Journals, Technology Journals, Publications, and MarketsandMarkets Analysis

2.1.1 SECONDARY DATA

In the secondary research process, various sources such as annual reports, press releases & investor presentations of companies, white papers, certified publications, articles by recognized authors, gold- & silver-standard websites, food safety organizations, regulatory bodies, trade directories, and databases were used to identify and collect information for this study.

Secondary research was mainly used to obtain key information about the industry's supply chain, the total pool of key players, market classification, and segmentation according to industry trends to the bottom-most level, and geographic markets. It was also used to obtain information about the key developments from a market-oriented perspective.

2.1.1.1 Key data from secondary sources

PARAMETER	SOURCE
 MARKET SIZE (Market Value)	<ul style="list-style-type: none"> ▪ Company Financials ▪ Magazines ▪ Journals ▪ Press Releases ▪ Paid Databases ▪ MarketsandMarkets Data Repository
 REVENUE OF COMPANIES	<ul style="list-style-type: none"> ▪ Annual Reports and 10-K Forms ▪ Company Websites ▪ Investor Presentations ▪ Public Databases ▪ MarketsandMarkets Data Repository
 QUALITATIVE INFORMATION (Market Dynamics and Trends)	<ul style="list-style-type: none"> ▪ Company Websites ▪ Annual Reports ▪ Published Expert Interviews ▪ Press Releases ▪ MarketsandMarkets Data Repository

2.1.2 PRIMARY DATA

The membrane filtration market comprises several stakeholders in the supply chain, including membrane filter suppliers, processors, raw material suppliers, membrane filtration product manufacturers, and regulatory organizations. Extensive primary research was conducted after obtaining information about the membrane filtration market through secondary research. Several primary interviews were conducted with experts from the demand side (food & beverage manufacturers, key opinion leaders, executives, and government organizations) and supply side (manufacturers, distributors, and exporters of membrane filtration equipment) across 5 major regions: North America, Europe, Asia Pacific, Middle East & Africa, and South America. This primary data was collected through questionnaires, e-mails, and telephonic interviews.

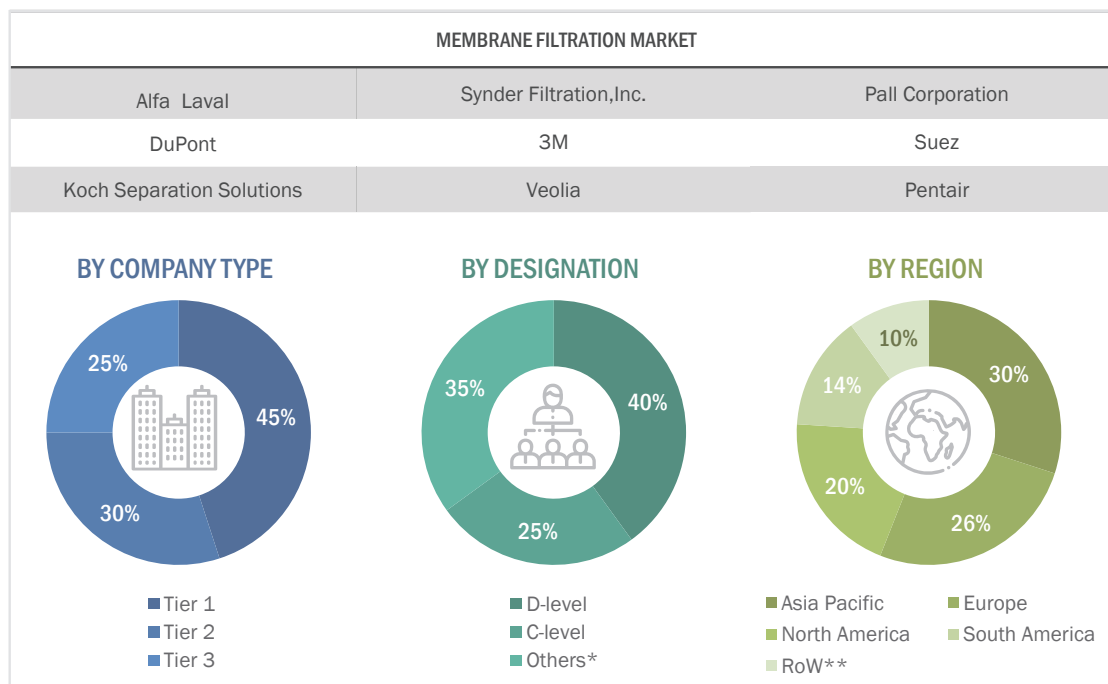
2.1.2.1 Key data from primary sources

SEGMENT	MARKET DEFINITION
Geographical scope	This includes 5 main regions: North America (US, Canada, and Mexico), Europe (Germany, UK, Italy, France, Spain, Netherlands, Denmark and the Rest of Europe), Asia Pacific (China, Japan, India, Australia, New Zealand & Southeast Asia, and the Rest of Asia Pacific), South America (Brazil, Argentina, and Rest of South America), and Rest of the World (Africa and the Middle East).
Type	The major types of membrane filtration covered in the study are reverse osmosis, ultrafiltration, microfiltration, and nanofiltration.
Module Design	The major module designs covered in the study are spiral wound, tubular systems, and plate & frame and hollow fiber.
Application	The major applications for membrane filtration covered in the study are dairy products (Liquid milk & other dairy products), drinks & concentrates, wine & beer, and other food & beverage applications.
Membrane Material	The major membrane materials covered in the study are ceramic & polymeric.

Source: Secondary Research, Primary Interviews, Industry Journals, Related Research Publications, Press Releases, and MarketsandMarkets Analysis

2.1.2.2 Breakdown of primary interviews

FIGURE 2 BREAKDOWN OF PRIMARY INTERVIEWS: BY COMPANY TYPE, DESIGNATION, AND REGION



*Others include sales managers, marketing managers, and product managers.

**RoW includes the Middle East & Africa.

Note: The 3 tiers of the companies are defined based on their total revenues. As of 2021, Tier 1: Revenue = >USD 1 billion, Tier 2: Revenue = USD 500 million to <USD 1 billion, and Tier 3: Revenue = <USD 500 million.

2.1.2.3 Key primary insights



Strict regulations related to the quality of food products will create new growth opportunities for market players in the membrane filtration market. Increasing focus on reducing food & beverage contamination and compliance with safety requirements will be essential in driving the growth of the market.

– Director Sales,
Membrane Filtration Manufacturer, North America

Filtration largely serves as a process in industrial manufacturing, which minimizes contamination from a product by removing impurities and protects the taste and quality of the food or beverage.

– Global Sales Manager,
Membrane Filtration Manufacturer, Asia Pacific



2.2 MARKET SIZE ESTIMATION

Both top-down and bottom-up approaches were used to estimate and validate the total size of the membrane filtration market. These approaches were also used extensively to determine the size of various subsegments in the market. The research methodology used to estimate the market size includes the following details:

- The key players in the industry and markets were identified through extensive secondary research.
- The membrane filtration market size was determined through primary and secondary research.
- All percentage shares, splits, and breakdowns were determined using secondary sources and verified through primary sources.
- All the macroeconomic and microeconomic factors affecting the growth of the membrane filtration market were considered while estimating the market size.
- All the possible parameters affecting the markets covered in this research study were accounted for, viewed in extensive detail, verified through primary research, and analyzed to obtain the final quantitative and qualitative data.
- The research includes the study of reports, reviews, and newsletters of top market players, along with extensive interviews for key opinions from industry experts (such as CEOs, vice presidents, directors, and marketing executives).

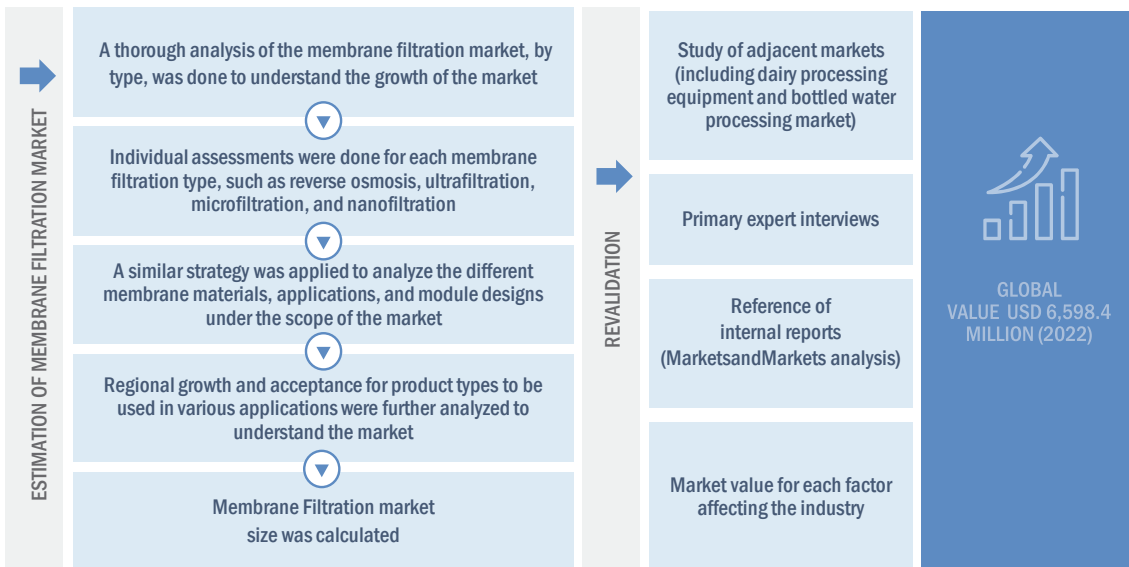
Below is an illustration of the overall market size estimation process employed for this study. The following sections (bottom-up and top-down) (supply-demand) depict the overall market size estimation process employed for this study.

FIGURE 3 MEMBRANE FILTRATION MARKET SIZE ESTIMATION, BY TYPE (SUPPLY SIDE)

STEP 1	STEP 2	STEP 3	STEP 4	STEP 5
Identification of top companies, such as Alfa Laval, Koch, GEA Group, Pall Corporation, DowDuPont, 3M Company, and SPX Flow, operating in the membrane filtration market	Estimation of combined revenues of the top players in the membrane filtration market	Identification of combined share of the top companies in the total membrane filtration market	Calculation of the total size for the membrane filtration market using the combined shares of the top companies and their revenues	Revalidation of the total market size and share estimations through primary respondents
KEY SOURCE OF INFORMATION				
Secondary sources, such as company financials, press releases, paid databases (such as Factiva), and primary research	Secondary sources, such as company financials, press releases, paid databases (such as Factiva), and primary research	Primary research with CEOs, VPs, marketing directors, and technology & innovation directors	MarketsandMarkets Calculations	Primary research with CEOs, VPs, marketing directors, and technology & innovation directors

Source: Secondary Research, Company Annual Reports, White Papers, Press Releases, and MarketsandMarkets Analysis

FIGURE 4 MEMBRANE FILTRATION MARKET SIZE ESTIMATION (DEMAND SIDE)

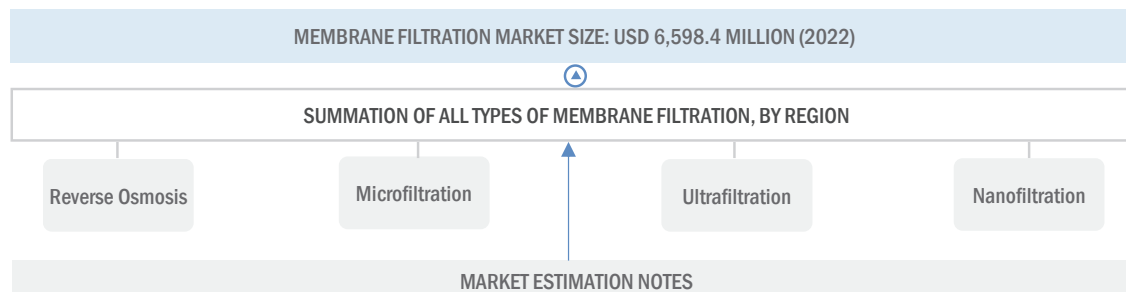


Source: Secondary Research, Company Annual Reports, White Papers, Press Releases, and MarketsandMarkets Analysis

The following figure provides an illustrative representation of the complete market size estimation process implemented in this research study for an overall estimation of the membrane filtration market in a consolidated format.

2.2.1 MARKET SIZE ESTIMATION METHODOLOGY: BOTTOM-UP APPROACH

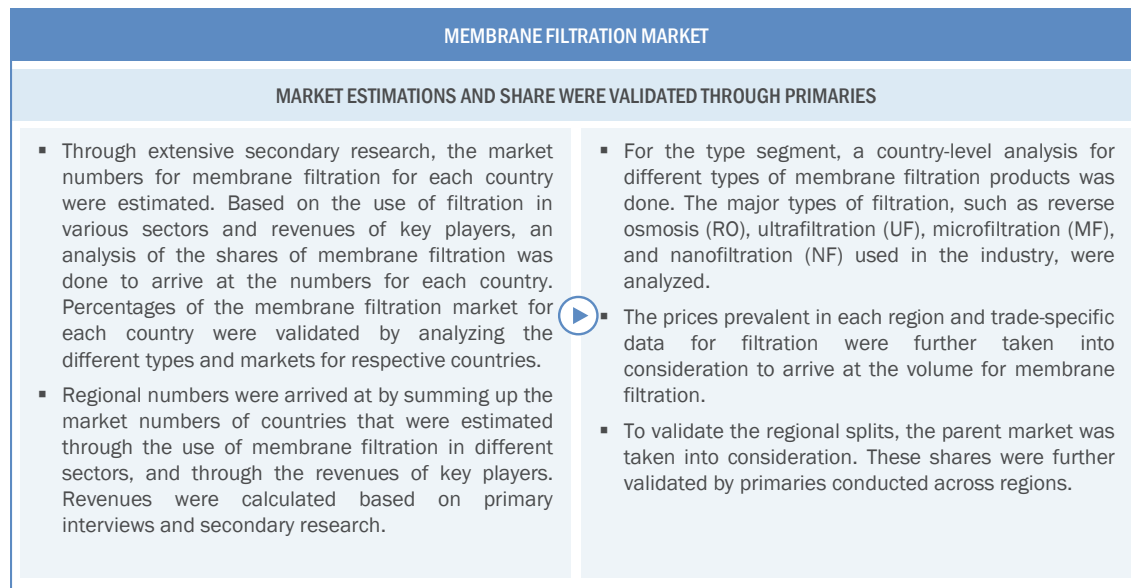
FIGURE 5 MARKET SIZE ESTIMATION METHODOLOGY: BOTTOM-UP APPROACH



- Global market estimates are derived through the market sizes of each type segment. Various types of membrane filtration technologies adopted in various application industries were studied.
- Various application industries were studied at regional & country levels to understand the penetration rate of various membrane filtration technologies in the application industry.
- Technological advancements in membrane filtration were studied to understand the market trends.
- Investments as well as developments in membrane filtration were studied.
- The market estimates are derived through the market size of each type of membrane filtration product offered by top players in the membrane filtration market (based on their product portfolios, geographical presence, and segmental revenues).
- For the market split of each type, the demand for membrane filtration products, application, module design, membrane material, and country, was considered. This data was obtained from secondary sources and confirmed through primary inputs.
- The market size for each region is calculated by analyzing the demand for different types of membrane filtration products used across different applications; manufacturing and; adoption rate of membrane filtration products based on type; patents registered; and organic & inorganic growth attempts by key players operating in the regional membrane filtration market.

2.2.2 MARKET SIZE ESTIMATION METHODOLOGY: TOP-DOWN APPROACH

FIGURE 6 MARKET SIZE ESTIMATION METHODOLOGY: TOP-DOWN APPROACH



In the top-down approach, the overall market size was used to estimate the size of individual markets (mentioned in the market segmentation) through percentage splits from secondary and primary research.

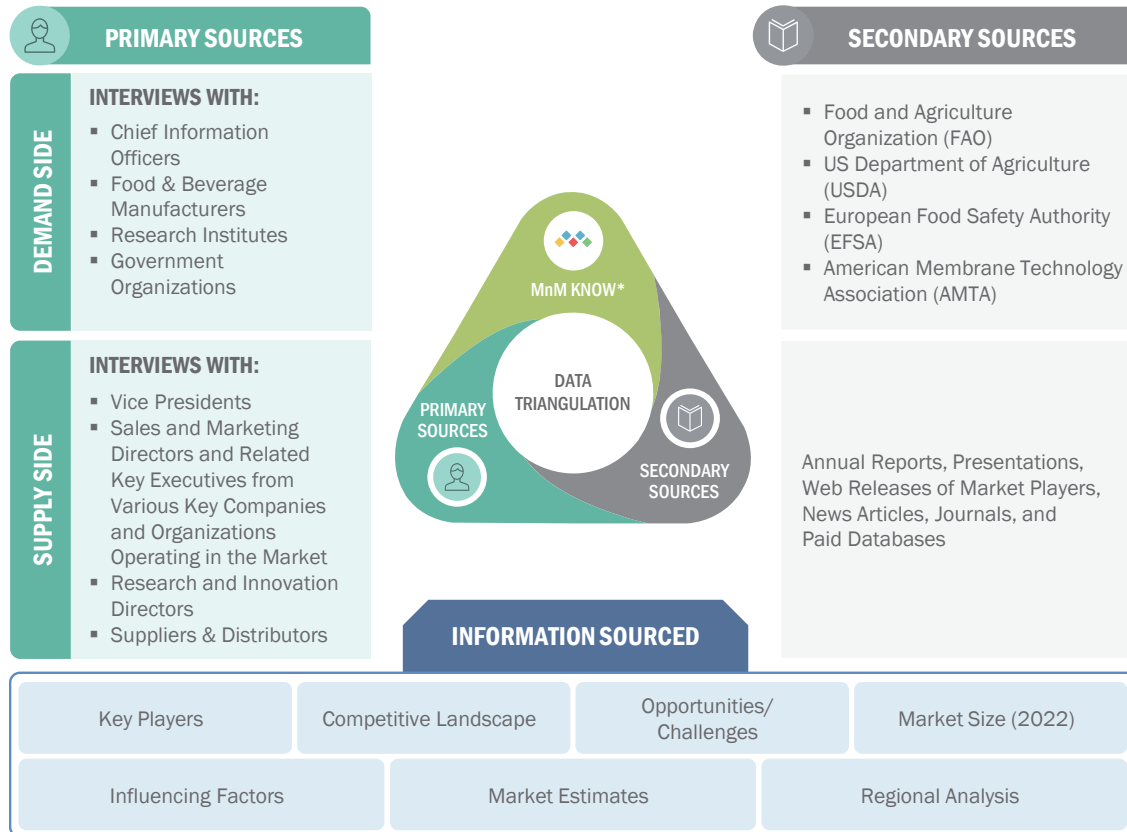
To calculate each specific market segment, the most appropriate immediate parent market size was used to implement the top-down approach. The bottom-up approach was also implemented for data extracted from secondary research to validate the market segment sizes obtained.

Market share was then estimated for each company to verify the revenue share used earlier in the bottom-up procedure. A detailed product and regional mapping were conducted to derive the application, type, and country-level segmentation. The data triangulation procedure and data validation through primaries determined and confirmed the overall parent market size and each individual market size. The data triangulation procedure used for this study is explained in the next section.

2.3 MARKET BREAKDOWN AND DATA TRIANGULATION

After arriving at the overall market size—using the estimation processes explained above—the total market was split into several segments and subsegments. To complete the overall market engineering process and arrive at the exact statistics of each market segment and subsegment, data triangulation and market breakdown procedures were employed, wherever applicable. The data was triangulated by studying various factors and trends from both the demand and supply sides in the membrane filtration industry. The market size was validated using the top-down and bottom-up approaches.

FIGURE 7 MARKET BREAKDOWN AND DATA TRIANGULATION



*MnM KNOW stands for MarketsandMarkets' 'Knowledge Asset Management' framework. In this context, it stands for existing market research knowledge repository of over 5,000 granular markets, our flagship competitive intelligence and market research platform "Knowledge Store", subject matter experts, and independent consultants. MnM KNOW acts as an independent source that helps us validate information gathered from primary and secondary sources.

2.4 RESEARCH ASSUMPTIONS

TABLE 2 RESEARCH ASSUMPTIONS

PARAMETER	ASSUMPTION
Economic Stability	<ul style="list-style-type: none"> A positive economic climate is assumed to continue in all regions until 2028. The growing economies in the Asia Pacific are projected to attract key companies to the market.
Exchange Rate	<ul style="list-style-type: none"> The average USD exchange rates of all foreign currencies were considered for the respective years. MarketsandMarkets assumes that fluctuations in USD values will not be significant enough to affect the projections to a notable extent.
Political Stability	<ul style="list-style-type: none"> A stable political environment is assumed to prevail in the key regions. It is also assumed that political tensions in countries such as Iraq, Syria, and Libya will have little effect on global economic stability.
Qualitative Analysis	<ul style="list-style-type: none"> The qualitative analysis conducted from the quantitative data arrived at is solely based on the understanding of the market and its trends by the team of experts involved in compiling this report.
CAGR (Growth Rate)	<ul style="list-style-type: none"> The growth rates of the revenues of the top players in the market were analyzed. Based on the historical revenue growth trend of key players and equipment under development, the future trend is calculated. From these assumptions, we have analyzed the global CAGR of the market.
Market Share Estimation	<ul style="list-style-type: none"> The share of segments was arrived at by analyzing the products available in the market for each category, the use of different membrane materials, and the various module designs. The same has been validated through primary respondents active in the market. International trade barriers and supply chain hindrances were considered significant, which disrupted market growth. These trends were considered for calculating the global market size for membrane filtration.

2.5 LIMITATIONS AND RISK ASSESSMENT

PARAMETER	LIMITATIONS AND RISK ASSESSMENT
PRIMARIES, BY KEY PLAYER	The quantitative information for some segments is kept confidential by industry players. Hence, the qualitative insights gathered during the course of the study were used to arrive at the market size of those subsegments.
PRIMARIES, BY REGION	There are a limited number of experts in some regions. In such cases, the regional market size was derived on the basis of weightages assigned to these markets based on the qualitative insights from global industry experts.
MARKET, BY MODULE DESIGN, TYPE, & REGION	The market size for the module design, type, and regional segments was derived for the food & beverage sector only.
MARKET SCOPE	<p>The quantitative information for some market segments is kept confidential by industry players. Hence, qualitative insights gathered during the course of the study were used to arrive at the market size for certain subsegments in the Asia Pacific, Middle East & Africa, and South American regions.</p> <p>There is a limited number of industry experts in developing markets across the , Middle East & Africa and South American regions, which provide market-related insights for subsegments. In such cases, the market size was derived based on the qualitative insights from global industry experts.</p>

2.6 RECESSION IMPACT

The impact of the recession is an aftermath of the COVID-19 pandemic and the Russia-Ukraine war. The impact has been studied from 2019 to 2023, providing a contrast between the pre-impact forecasts and updated forecasts.

The analysis has considered the following factors:

- Domestic Demand
- Unemployment
- GDP Growth
- Inflation
- Supply Chain Disruptions

3 EXECUTIVE SUMMARY

Membrane filtration is an advanced technology applied mainly in dairy, food & beverage, and many other industries for functions such as desalination, separation, concentration, microbial inactivation, and clarification. The 4 significant types of membrane filtration types include reverse osmosis (RO), ultrafiltration (UF), microfiltration (MF), and nanofiltration (NF) based on different pore sizes and pressure differences.

Premium-quality products such as purified packaged drinking water, concentrated proteins & juices, clarified wine & beer, and high-quality cheese are processed through membrane filtration, as the technique requires a high amount of recovery and efficiency during product processing. The rising demand for premium products is one of the major drivers of the membrane filtration market.

Membrane filtration is essential to the dairy processing industry as this technology finds a wide range of applications in this sector. According to the Food and Agriculture Organization (FAO) of the United Nations, milk and dairy products account for about 14% of the global agricultural trade, and world milk production is projected to increase by 177 million tonnes by 2025. Regulations for water safety and filtration have also propelled the growth of the market due to the growing incidence of waterborne diseases and the need for purified water.

Polymeric membrane materials are widely used for their low cost and flexibility in membrane configuration. However, innovations are being carried out with ceramic membranes, which, in turn, will fuel the growth of these membranes in the future due to their product optimization, high mechanical strength, and chemically inert nature. RO is widely used in water, wastewater, dairy products, juices, and alcoholic drinks for its efficiency and because it can remove 99% of mineral contaminants. Innovations in the microfiltration market have been growing in combination with ceramic membranes, due to which the microfiltration market is projected to witness high growth in the coming years.

Based on module design, the membrane filtration market is segmented into spiral wound, tubular systems, and plate & frame and hollow fiber. The spiral wound segment dominated the food & beverage applications market because of its ease of use in various functions. The market for tubular systems is steadily growing in the dairy and wine industries.

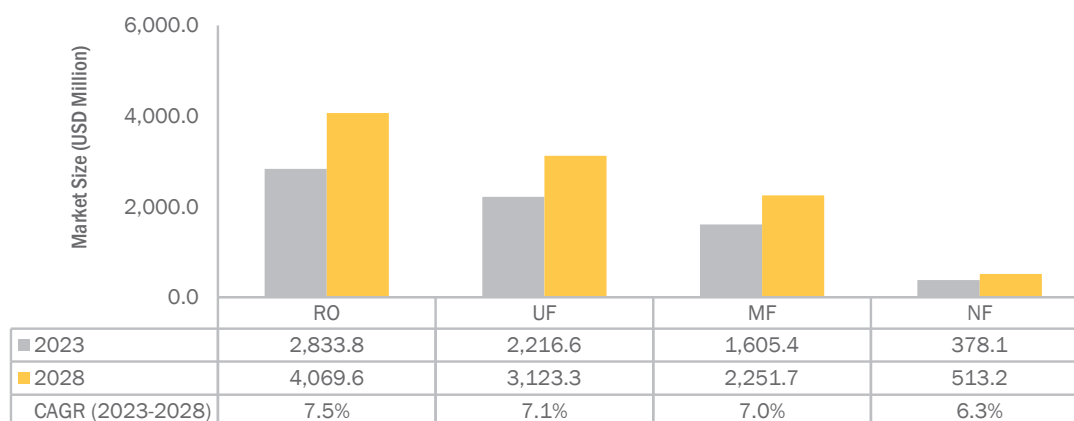
Although the technology is effective in terms of purification, function, and product optimization, the initial setup cost is substantially high, due to which manufacturers are slow to adopt this technique and continue using conventional techniques such as heating, traditional purifying, and enzyme or chemical inclusions. Lack of awareness of the long-term advantages of membrane technologies is a challenging factor in this market. However, the growing global incidence of waterborne diseases and the subsequent need for safe products will provide opportunities for market growth.

The rising spending power of consumers in the Asian and Middle Eastern regions has created opportunities for premium products and, in turn, for the membrane filtration market. The rising adoption of functional food products in Saudi Arabia due to the growing health awareness among consumers and rising efforts to prevent diseases such as diabetes is also expected to fuel the growth of the functional food industry and, in turn, the demand for membrane filtration technologies such as UF and NF.

TABLE 3 MEMBRANE FILTRATION MARKET SNAPSHOT, 2023 VS. 2028

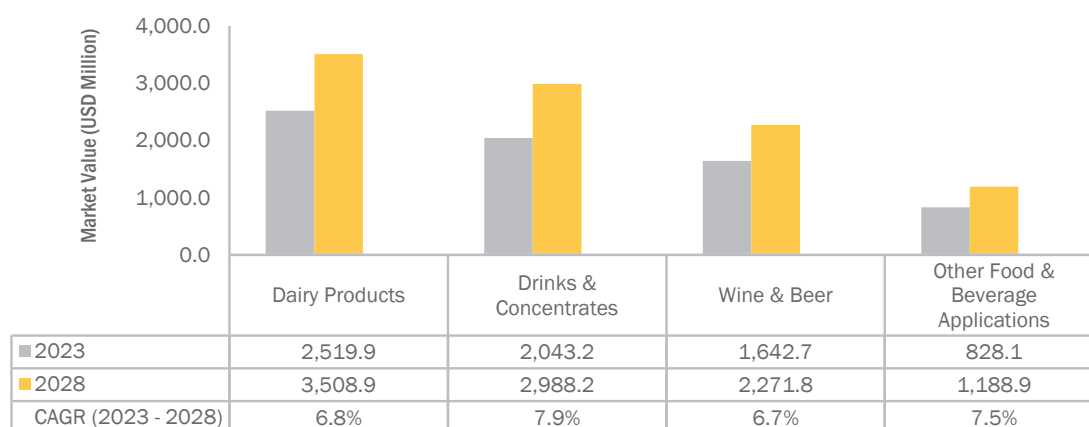
PARTICULARS	2023	2028
Global Value (USD Million)	7,033.9	9,957.8
Regional Share	<ul style="list-style-type: none"> ▪ North America: 24.7% ▪ Europe: 18.5% ▪ Asia Pacific: 40.7% ▪ South America: 3.8% ▪ Rest of the World: 12.3% 	<ul style="list-style-type: none"> ▪ North America: 23.7% ▪ Europe: 17.3% ▪ Asia Pacific: 43.0% ▪ South America: 3.9% ▪ Rest of the World: 12.2%
By Application	<ul style="list-style-type: none"> ▪ Dairy Products: 35.8% ▪ Drinks & Concentrates: 29.0% ▪ Wine & Beer: 23.4% ▪ Other Food & Beverage Applications: 11.8% 	<ul style="list-style-type: none"> ▪ Dairy Products: 35.2% ▪ Drinks & Concentrates: 30.0% ▪ Wine & Beer: 22.8% ▪ Other Food & Beverage Applications: 11.9%
By Type	<ul style="list-style-type: none"> ▪ Reverse Osmosis (RO): 40.3% ▪ Ultrafiltration (UF): 31.5% ▪ Microfiltration (MF): 22.8% ▪ Nanofiltration (NF): 5.4% 	<ul style="list-style-type: none"> ▪ Reverse Osmosis (RO): 40.9% ▪ Ultrafiltration (UF): 31.4% ▪ Microfiltration (MF): 22.6% ▪ Nanofiltration (NF): 5.2%
By Module Design	<ul style="list-style-type: none"> ▪ Spiral Wound: 62.1% ▪ Tubular Systems: 16.8% ▪ Plate & Frame and Hollow Fiber: 21.1% 	<ul style="list-style-type: none"> ▪ Spiral Wound: 62.0% ▪ Tubular Systems: 17.1% ▪ Plate & Frame and Hollow Fiber: 20.9%
By Membrane Material	<ul style="list-style-type: none"> ▪ Polymeric: 90.2% ▪ Ceramic: 9.8% 	<ul style="list-style-type: none"> ▪ Polymeric: 89.8% ▪ Ceramic: 10.2%
Global CAGR (2023–2028)	7.2%	

Source: Secondary Research, Primary Interviews, Related Research Publications, Press Releases, Industry Journals, and MarketsandMarkets Analysis

FIGURE 8 MEMBRANE FILTRATION MARKET, BY TYPE, 2023 VS. 2028 (USD MILLION)

Source: Secondary Literature, Expert Interviews, and MarketsandMarkets Analysis

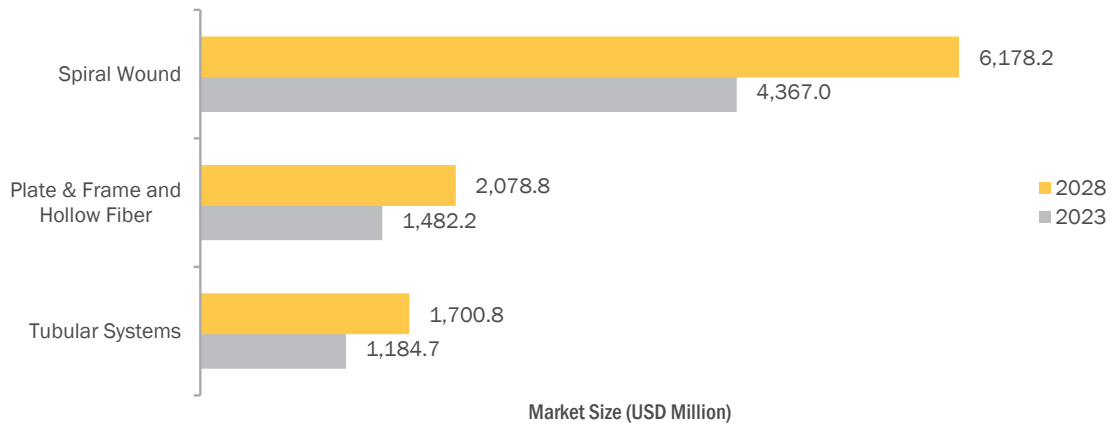
The reverse osmosis segment is projected to be the largest and fastest-growing segment by 2028. It is projected to reach USD 4,069.6 million by 2028, growing at the highest CAGR of 7.5%. Membrane technologies are used in the food & beverage industry to successfully remove contaminants such as harmful bacteria, yeast, and minerals. These methods are used for liquid separation, concentration, and clarification. They operate to remove contaminants while maintaining the flavor and general quality of the food or beverage product.

FIGURE 9 MEMBRANE FILTRATION MARKET, BY APPLICATION, 2023 VS. 2028 (USD MILLION)

Source: Secondary Literature, Expert Interviews, and MarketsandMarkets Analysis

The dairy products segment is to dominate the membrane filtration market by applications in 2023. This segment is projected to reach USD 3,508.9 million by 2028 at a CAGR of 6.8%. The large share of this segment can be attributed to the growing demand for milk variants and whey products across the globe. The market for drinks & concentrates is projected to grow at the highest CAGR due to the high adoption of RO and UF membranes in juice clarification and concentrates.

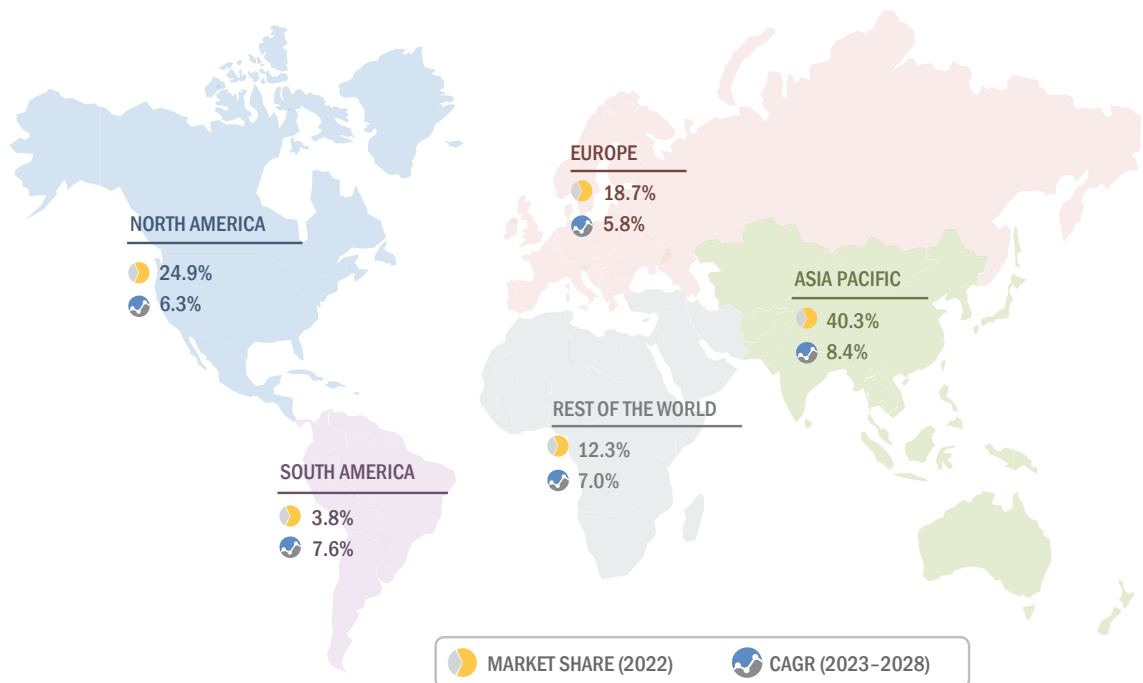
FIGURE 10 MEMBRANE FILTRATION MARKET, BY MODULE DESIGN, 2023 VS. 2028 (USD MILLION)



Source: Secondary Literature, Expert Interviews, and MarketsandMarkets Analysis

The spiral wound segment is the largest due to its wide areas of applications. Tubular systems are more suitable for various food applications and offer a high removal efficiency of microorganisms and other unwelcome components. Due to these factors, it is projected to reach USD 1700.8 million by 2028 at the highest CAGR of 7.5%.

FIGURE 11 MEMBRANE FILTRATION MARKET: REGIONAL SNAPSHOT, 2022



Source: Secondary Literature, Expert Interviews, and MarketsandMarkets Analysis

The Asia Pacific region accounted for the largest share of the membrane filtration market and was valued at USD 2,657.3 million in 2022, with China being the largest contributor. After Asia Pacific, South America is projected to grow at a significant CAGR of 7.6% by 2028.

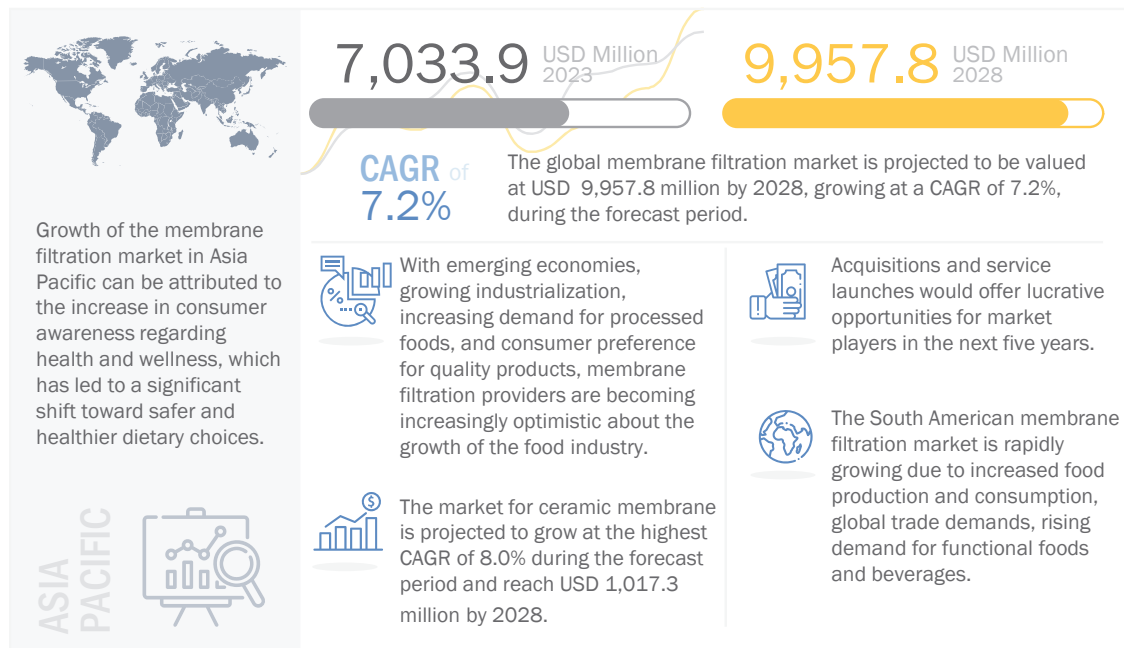
The key players in the membrane filtration market include DuPont (US), Veolia (France), Alfa Laval (Sweden), GEA Group (Germany), Pall Corporation (US), 3M (US), Koch Separation Solutions (US), Pentair (US), SPX Flow (US), ProMinent (Germany), Pentair (US), Toray Industries, Inc. (Japan), and Porvair Filtration Group (UK).

The key market players adopted various business strategies, such as new product & technology launches, expansions, acquisitions, agreements, collaborations, and partnerships during the last few years to meet the growing demand for membrane filtration. In May 2021, Pentair (US) acquired Ken's Beverage, Inc. (US). This strategic step is aimed at enhancing Pentair's beverage dispensing offerings, allowing them to provide more comprehensive solutions to their customers. In February 2021, Toray Industries, Inc. (Japan) launched a Polyvinylidene fluoride (PVDF) ultrafiltration (UF) membrane with virus removal capabilities and high water permeability. This innovation targets safe and economical water supplies treated with minimal energy for various applications, from food and beverages to wastewater reuse.

4 PREMIUM INSIGHTS

4.1 OPPORTUNITIES FOR PLAYERS IN MEMBRANE FILTRATION MARKET

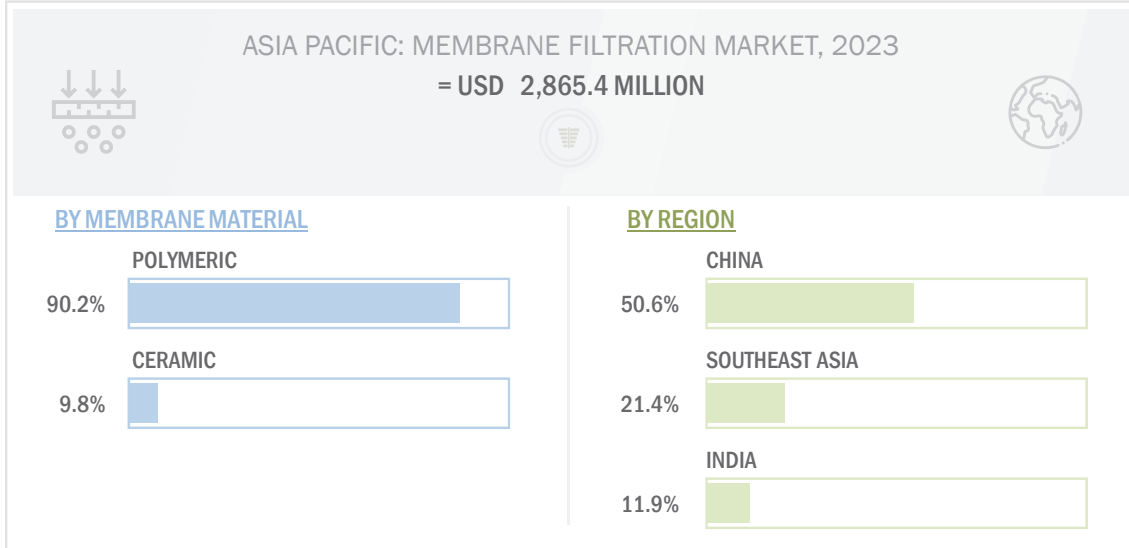
FIGURE 12 RAPID GROWTH IN DAIRY INDUSTRY AND RISING DEMAND FOR PREMIUM PRODUCTS TO DRIVE MEMBRANE FILTRATION MARKET



Source: Secondary Sources, Company Annual Reports, Industry Journals, Expert Interviews, and MarketsandMarkets Analysis

4.2 ASIA PACIFIC: MEMBRANE FILTRATION MARKET, BY MEMBRANE MATERIAL AND KEY REGION

FIGURE 13 POLYMERIC SEGMENT AND CHINA TO ACCOUNT FOR SIGNIFICANT SHARE IN 2023



Source: Expert Interviews, Government Authorities, Related Research Publications, Government Publications, and MarketsandMarkets Analysis

4.3 MEMBRANE FILTRATION MARKET, BY TYPE AND REGION

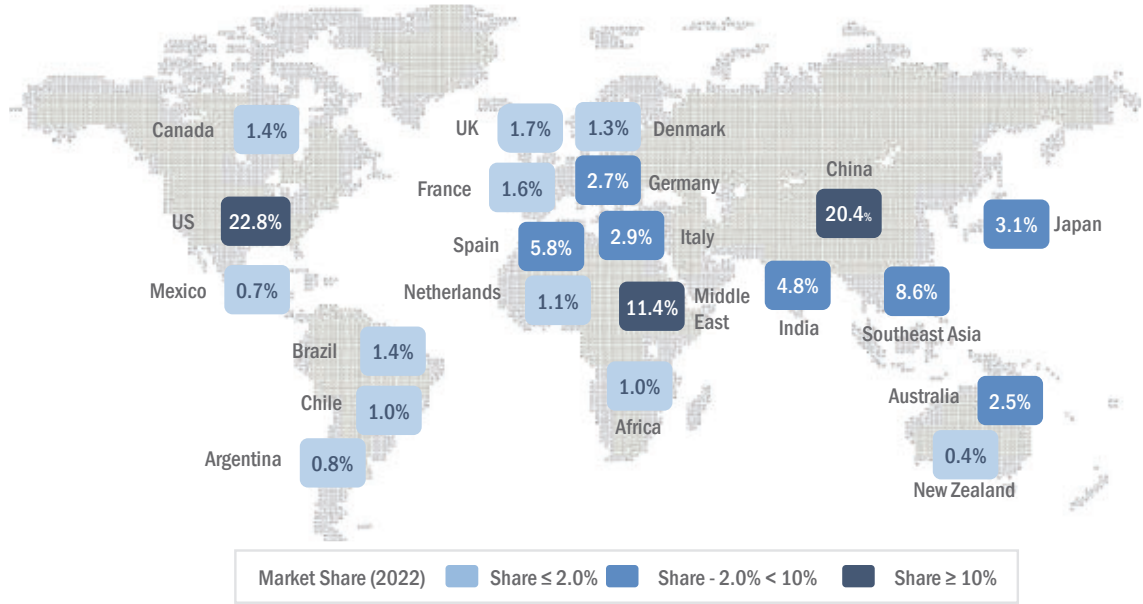
FIGURE 14 RO SEGMENT TO ACCOUNT FOR LARGEST SHARE IN 2023



Source: Industry Journals, Company Websites, Company Publications, Secondary Literature, Expert Interviews, and MarketsandMarkets Analysis

4.4 MEMBRANE FILTRATION MARKET, BY KEY REGION

FIGURE 15 US ACCOUNTED FOR LARGEST SHARE IN 2022



Source: Investor Presentations, Expert Interviews, Related Research Publications, and MarketsandMarkets Analysis

5 MARKET OVERVIEW

5.1 INTRODUCTION

Membrane technologies play a significant role in the purification and filtration of food & beverage products, dairy products, wineries, and breweries. Some prominent membrane filtration technologies, such as ultrafiltration, microfiltration, nanofiltration, and reverse osmosis, are already applied in the above-mentioned industries on a large scale. A few applications include desalination by reverse osmosis (RO), wastewater treatment by membrane reactors (MBR), and water sterilization through ultrafiltration (UF) for food & beverages. Moreover, membrane technologies effectively meet the sustainability criteria in terms of ease of use, energy consumption, environmental impact, land usage, flexibility, and adaptability, which fuels the demand for this technology.

The fast-growing dairy industry across the world, emerging technologies in membrane filtration, advantages offered by membrane filtration technologies (UF, MF, NF, and RO), and the rising demand for high-quality and safe food products are some of the major factors that are expected to drive the global membrane filtration market during the review period. The rapid urbanization, income growth, and consumers' willingness to pay for premium products are also expected to influence the demand for membrane filtration technologies to a certain extent.

However, the high installation cost of membrane filtration equipment and its associated technologies is expected to be a major restraint that would impact the global membrane filtration market growth during the review period. Additionally, the lack of awareness among food, beverage, and processed water producers in developing countries about the advantages offered by these products may act as a prominent challenge for future market growth. Despite these challenges, new opportunities are being created for membrane filtration market players due to the growing desalination projects in the Middle East and the increasing incidence of waterborne diseases worldwide.

5.2 MACROECONOMIC INDICATORS

5.2.1 GROWTH IN INDUSTRIAL AND URBAN INFRASTRUCTURE

The surge in industrial and urban development has been a pivotal driver for the membrane filtration market, with a pronounced emphasis on applications within the dairy, food & beverages, and wine industries. This momentum is fueled by the escalating need for top-notch products, stringent regulatory demands, and the imperative to cater to evolving consumer preferences.

In sectors such as dairy, membrane filtration technologies have ushered in a new era by facilitating processes like milk clarification, protein concentration, and lactose extraction. The rapid urbanization and increased disposable incomes have led to a spike in dairy consumption, prompting producers to bolster their output without compromising on product purity. Similarly, in the food and beverages arena, the burgeoning urban populace seeks minimally processed and microbiologically safe consumables. Membrane filtration steps up to meet these needs by effectively eliminating bacteria, viruses, and particulates, thus finding applications in juice clarification, sugar syrup purification, and the production of low-alcohol beverages. Additionally, the wine industry has witnessed a transformative effect, with membrane filtration techniques enabling winemakers to fine-tune wine characteristics while maintaining consistent quality. In essence, as industrial and urban landscapes continue to expand, the membrane filtration market takes center stage, proving its worth across various sectors where ensuring product integrity remains paramount.

5.2.2 HEALTH & ENVIRONMENTAL AWARENESS

Health and environmental awareness have emerged as a powerful driving force behind the increasing demand for membrane filtration, fostering a commitment to cleaner processes and products across various industries. The intricate link between public health and environmental safety has prompted a profound shift in perspective, leading to a concerted effort to adopt sustainable alternatives and practices. This awareness underscores the need to strike a delicate balance between enhancing the quality of life and safeguarding the environment, particularly as traditional practices often come at the cost of pollution and resource depletion.

In healthcare settings, stringent environmental cleaning procedures have been established to mitigate the risk of pathogen transmission, ensuring patient safety and well-being. Moreover, substantial strides have been made in improving air quality, with concerted efforts to reduce pollutants and emissions. These endeavors have yielded tangible benefits in terms of public health, showcasing the tangible impact of environment-conscious initiatives.

Within the context of membrane filtration, the impetus provided by health and environmental concerns is readily apparent. Membrane technology has proven invaluable in wastewater treatment processes, facilitating the removal of contaminants and pollutants and enabling the safe reuse of water. In industrial sectors, membrane filtration plays a pivotal role in achieving cleaner production processes. By efficiently removing impurities from liquids, membrane filtration significantly contributes to the reduction of waste and pollution, aligning with the overarching goals of sustainability. This emphasis on cleaner production methodologies not only addresses pressing environmental challenges but also streamlines production workflows, enhancing overall efficiency.

In essence, health and environmental awareness act as catalysts for change, prompting industries to embrace membrane filtration to achieve cleaner processes and products. This symbiotic relationship between the drive for improved public health and the pursuit of environmental preservation underscores the multidimensional benefits that membrane filtration offers, making it a pivotal technology in the contemporary landscape.

5.3 MARKET DYNAMICS

FIGURE 16 MEMBRANE FILTRATION MARKET DYNAMICS

 DRIVERS	<ul style="list-style-type: none"> ▪ Rapid growth of dairy industry ▪ Rise in demand for premium food and beverage products ▪ Consumers' inclination toward high-quality products ▪ Emerging technologies in membrane filtration field ▪ Optimization of product efficiency in food processing due to innovations in ceramic membranes ▪ Efficiencies offered by membrane filtration technologies <ul style="list-style-type: none"> • Product efficiency • Energy efficiency
 RESTRAINTS	<ul style="list-style-type: none"> ▪ High setup cost ▪ Maintenance and cleaning involved in membrane filtration
 OPPORTUNITIES	<ul style="list-style-type: none"> ▪ Growth in markets for plant-based and dairy alternatives ▪ Rise in demand for extended shelf life
 CHALLENGES	<ul style="list-style-type: none"> ▪ Lack of awareness about advantages of membrane filtration ▪ Membrane integrity and lifespan

Source: Related Associations/Institutes, Company Press Releases, Annual Reports, Investor Presentations, Journals, Expert Interviews, and MarketsandMarkets Analysis

5.3.1 DRIVERS

5.3.1.1 Rapid growth of dairy industry

Membrane technology has been used in the dairy industry since its introduction in the late 1960s. This technology plays a major role in the dairy industry due to multiple factors. Membrane filtration clarifies, concentrates, and fractionates several varieties of dairy products, including whey, milk, yogurt, ice cream, and cheese. This technology aids in retaining important nutrients, such as soluble vitamins and minerals, during the cheese-making process. Membrane filtration also removes unwanted microorganisms and ingredients, such as drugs and sediments, that have a negative impact on product quality, texture, and shelf-life. Microfiltration (MF), ultrafiltration (UF), nanofiltration (NF), and reverse osmosis (RO) are the four membrane filtration techniques utilized in the dairy sector.

Reverse Osmosis (RO): RO is the most effective membrane filtration technique for liquid separation. Only water can pass through the membrane, which concentrates the total solids; all dissolved and suspended matter is excluded. Reverse osmosis is commonly used in the dairy sector for water reclamation, milk solids recovery, and milk and whey volume reduction.

Nanofiltration (NF): With NF, a variety of minerals can be separated from a liquid while only letting the liquid and specific monovalent ions flow through the membrane.

Ultrafiltration (UF): UF membranes divide the feed (for instance, skimmed milk) into two streams and enable water, dissolved salts, lactose, and acids to pass through it in either direction while keeping (and consequently concentrating) proteins and fats.

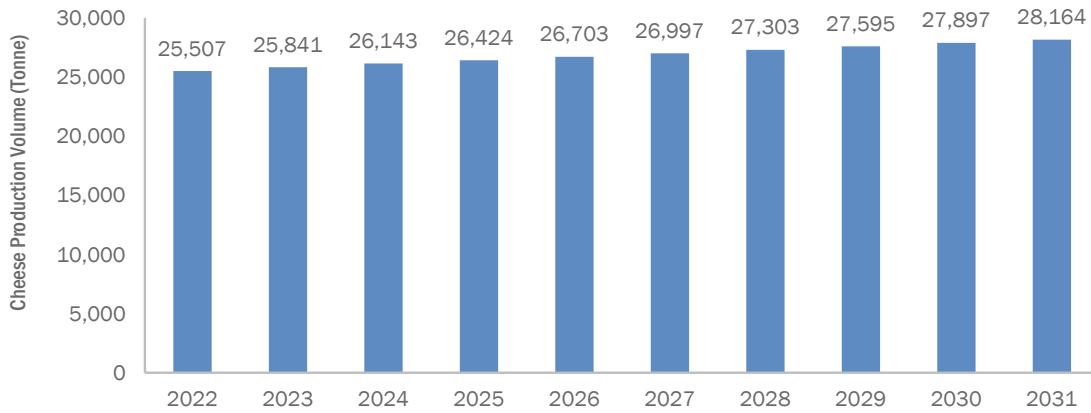
Microfiltration (MF): MF is a popular method in the dairy industry for reducing bacteria and spores, removing fat from milk and whey, and standardizing casein and protein.

In the last ten years, there has been a substantial increase in consumer knowledge of the environmental impact of various food products. Many dairies have already established sustainability targets meant to improve resource efficiency and minimize their environmental footprint to meet the demands of customers and authorities. As a result, sustainable products and manufacturing processes have been incorporated into the dairy sector. The dairy business offers numerous alternatives for implementing more sustainable procedures, resulting in lower production costs, mainly because of membrane filtration. Some benefits include the following:

- Concentration or volume reduction reduces the cost of processing and transportation
- Product recovery, which reduces waste and increases yield
- Water recovery, which reduces water use and wastewater volumes
- Cheese brine sanitation improves cheese brine recycling and results in fewer effluents
- Clarification of CIP solutions, which promotes the recycling of CIP chemicals
- Pre-concentration, which reduces the amount of energy used

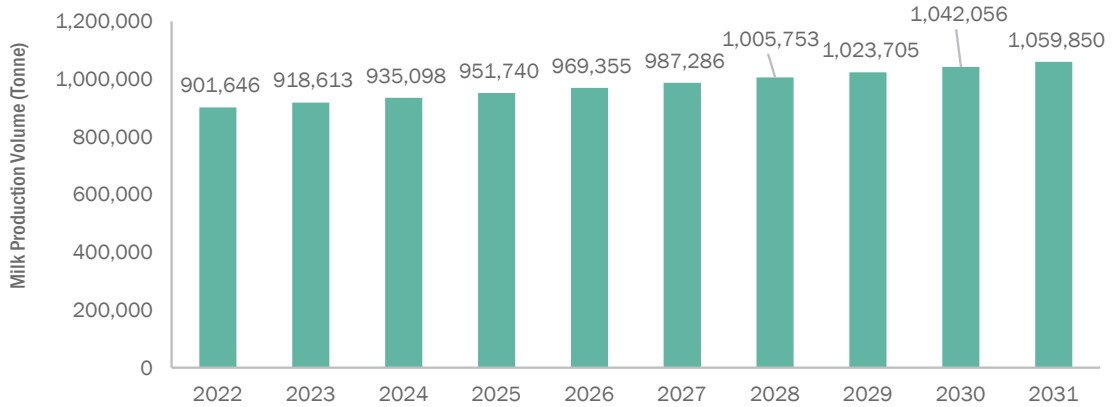
Currently, membrane filtration is an essential part of the dairy product manufacturing process, as it helps maintain quality and ensures that the safety standards of these products are followed. Thus, the global membrane filtration market is expected to be largely driven by the dairy industry in the coming years, as this sector is witnessing rapid growth. According to OECD-FAO Agricultural Outlook 2020–2029, the amount of milk produced worldwide in 2019 increased by 1.3% to roughly 852 tonnes (939.16 tons), consisting primarily of cow milk (81%), buffalo milk (15%), and goat, sheep, and camel milk (4%) combined. India, the world's largest milk producer, saw a 4.2% increase in production to 192 tonnes (211.6 tons). During the study period, global milk output is estimated to grow by 1.6 p.a. (to 997 tonnes [1,099 tons] by 2029, faster than most other main agricultural commodities). The demand for dairy products is expected to surge as the world's population and consumption per person increase. The constant increase in the production of dairy products such as cheese and processed milk drives the global membrane filtration market, and this trend is projected to continue in the coming years as well.

FIGURE 17 GLOBAL CHEESE PRODUCTION, 2022-2031 (TONNE)



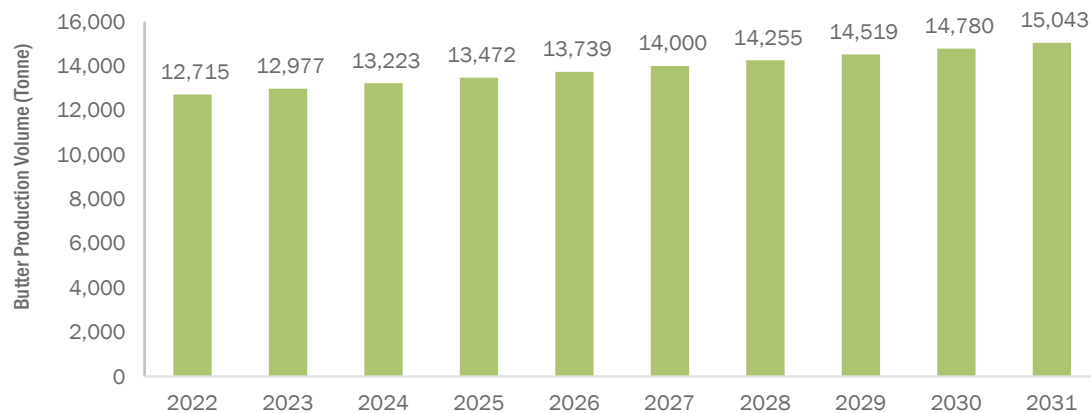
Source: OECD STAT

FIGURE 18 GLOBAL MILK PRODUCTION, 2022-2031 (TONNE)

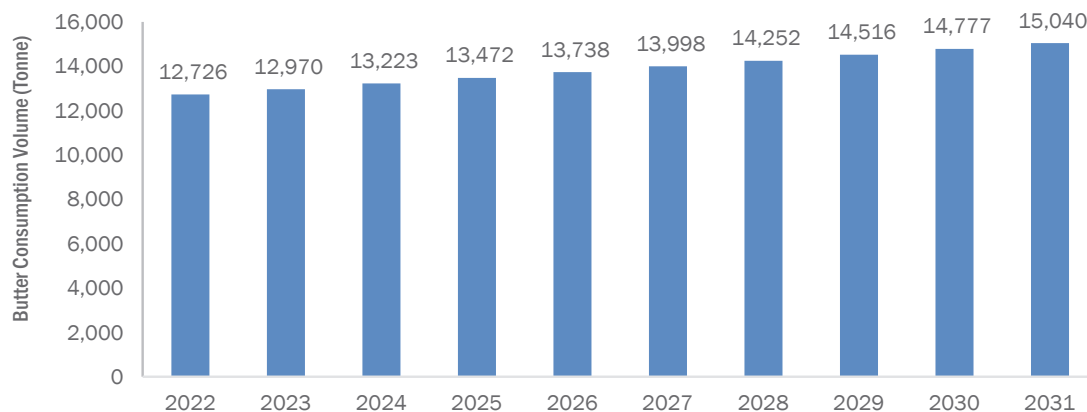


Source: OECD STAT

FIGURE 19 GLOBAL BUTTER PRODUCTION, 2022-2031 (TONNE)



Source: OECD STAT

FIGURE 20 GLOBAL BUTTER CONSUMPTION, 2022–2031 (TONNE)

Source: OECD STAT

5.3.1.2 Rise in demand for premium food and beverage products

The demand for membrane filtration technologies in food & beverage applications has grown significantly in recent years, owing to its primary function of removing harmful microorganisms. Currently, food & beverage manufacturers are increasingly adopting proactive food safety technologies due to the continuous rise in the demand for high-quality, safe, and value-added food products across the world. Membrane technologies are widely used in the food industry because they combine the functions of separation, concentration, purification, and refining, as well as the characteristics of high efficiency, energy savings, and environmental protection. Dairy products, soy products, fruit and vegetable juices, the brewing and sugar industries, purification and concentration of enzyme preparations, the concentration of egg whites, and the separation and concentration of food additives such as natural colors and spices are only a few of the main applications.

The food & beverage industry has its own set of trends, processes, and technologies. According to an article published in *Filtration+Separation*, the growing trend of organic farming and food production has raised issues about food safety; artificial sweeteners continue to pose a threat to the sugar industry, and increased awareness of sustainability has also had an impact on the food & beverage industry as more consumers try to minimize their carbon footprints by selecting foods with low “food miles.” Food production is also impacted by the disposal of food waste and surplus product packaging intended to keep products fresh. If the appropriate technologies are used, filtration technologies can filter, separate, concentrate, and clarify liquid solutions in addition to complying with regulations.

Wine and beer both go through the processes of clarification and fine filtration. Cold stabilization and sterile membrane filtration are two sterilization techniques used in beer production. Filtration is used in the production of soda to control microorganisms, clarify ingredients and the finished product, and filter and dechlorinate water. Compared to the traditional methods of producing food and beverages, filtration has several benefits. Cold stabilization in the manufacturing of beer is an affordable and effective substitute for flash pasteurization. By utilizing filtration technologies, wine producers can optimize the wine production process and produce high-quality wines in less time. Filtration technologies used in wine production include the following:

- Clarifying or trap filtration: Removes dirt and other foreign objects from wine while also “polishing” it
- Fine filtration: Removes yeast and is frequently used as a pre-sterilization step
- Filtration using sterile membranes: Removes spoilage organisms

Standardization of milk by UF technology regulates the protein content without the need for adding milk powders, casein, and whey protein concentrates. This improves the appearance and viscosity of milk. This technique is also used in improving the quality of ice cream, yogurt, and cottage cheese. Milk protein concentrates (MPC), with 50–58% protein, are processed through UF and MF, which are used as food additives. Value-added protein ingredients can be achieved by fractionating milk proteins using membrane technology. MF membranes in beer clarification aid in beer yields by separating yeast and microorganisms efficiently without modifying the taste. Applying RO removes 50% of the water from fruit juices before evaporation to produce fruit juice concentrates. This aids in the better retention of sugars, acids, and volatile flavors compared to traditional methods. The production of other functional ingredients, such as concentrated whole eggs, chicken blood plasma, and the extraction of vegetable oils, also drives the market for membrane filtration in the food industry.

5.3.1.3 Consumers' inclination toward high-quality products

Due to the rising awareness of the role of diets in obesity, high cholesterol, digestive ailments, and other similar common health problems, people are becoming increasingly concerned about food safety and quality standards. Food quality is a key concern in the food economy, and recent years have shown that consumers' opinions on food quality and their desire for healthy lifestyles and environmental protection are driving forces for reshaping food buying intentions. In most industrial countries, such as the UK and the US, increased income results in the growing demand for quality diets, better healthcare, and lower morbidity. The quality of a product is one of the top three attributes considered by consumers in these countries when making a purchase decision for food products.

Due to the growing demand for quality and safe food products, food & beverage manufacturers have been opting for membrane filtration, as it efficiently removes the bacteria and other unwanted elements from the food and enhances their quality as well as shelf-life. Membrane technology has gained widespread application as a means of processing and separation in the food industry. Membrane separation can be used to process new ingredients and foods or as an alternative to traditional methods. Membrane technologies often outperform traditional ones in terms of benefits. For instance, it is more energy-efficient to use cold pasteurization and sterilization with suitable membranes rather than high-temperature treatment to eliminate microorganisms. Consequently, prominent companies, such as Pall Corporation, 3M Company, and Koch Membrane Systems, are providing effective membrane filtration products to food & beverage manufacturers, considering the growing food industry, mounting demand for high-value products, and consumers' willingness to pay for quality food products.

Some of the other advantages of membrane filtration over traditional methods in the food & beverage industry include:

- No chemical reagents or additives are utilized, and the product is clean
- Carried out in a closed system; the separated food does not experience browning or pigment decomposition
- Excellent adaptability and a wide variety of applications; can be used for processes such as separation, concentration, purification, and clarity
- Good selectivity, the ability to separate materials at the molecular level, and excellent performance that regular filter materials cannot match

- Performed at room temperature with little nutritional loss, making it especially ideal for the separation, classification, concentration, and enrichment of heat-sensitive compounds like fruit juices and enzymes
- Membrane modules can be used separately or in combination, and the treatment scale can be large or small, continuous, or intermittent; the procedure is easy to handle and simple to automate and understand
- Since there is no phase change, less volatile elements, such as aromatic compounds, are lost, allowing the original fragrance to be preserved; the energy usage is negligible compared to other separation methods

5.3.1.4 Emerging technologies in membrane filtration field

Consistent technological advancements in the membrane filtration industry have fueled the growth of the global membrane filtration market. Emerging membrane filtration technologies such as membrane distillation (MD) and forward osmosis (FO) have proven to be beneficial in terms of low energy consumption.

Membrane distillation is a separation technique that uses a porous, liquid-unwetable lipophilic membrane. Due to the polymer's lipophilicity, only vapors may pass through membrane pores. On the other side of the membrane, in an air gap, a cooling liquid, or an inert carrier gas, condensation occurs. MD is typically used to treat water solutions; therefore, hydrophobic membranes made of polymers like polypropylene (PP), polytetrafluoroethylene (PTFE), or poly (vinylidene fluoride) (PVDF) are utilized in the process.

Forward osmosis (FO) uses membranes like those used in reverse osmosis but uses the natural phenomenon of osmotic pressure. For example, on the permeating side of the membrane is a “draw solution” used to desalt saltwater. Pure water will depart from the seawater and pass through the membrane into the draw solution (normal osmotic flow) because this solution has a greater TDS (total dissolved solids) than the seawater. Listed below are some other benefits of forward osmosis over reverse osmosis:

- No need for high-pressure pumps
- Uses readily accessible membranes (mainly cellulose triacetate)
- Chlorine removal is not required
- Less fouling in general
- Draw solution can be reused

Both MD and FO are characterized by lower fouling propensity than RO. This is due to the absence of applied hydraulic pressure in these technologies, which helps reduce energy usage. MD is a membrane-based desalination technology that utilizes low-grade heat to drive separation. Forward osmosis provides a higher salt rejection capacity that is equal to or greater than 99%. Therefore, this technology can be potentially used to treat high-salinity water and is expected to have immense scope in the water industry in the coming years.

Currently, researchers are developing the Forward Osmosis Bag (FOB) that converts dirty water into a liquid that is safe to drink. It uses a semi-permeable membrane and a concentrated sugar solution. These bags utilize osmotic pressure gradients and do not require direct energy input. FOB allows the removal of a wide range of contaminants compared with traditional membrane processes.

5.3.1.5 Optimization of product efficiency in food processing due to innovations in ceramic membranes

Ceramic membranes are artificial membranes constructed from inorganic substances such as silicon carbide, alumina, titania, and zirconia oxide. A tubular membrane element, also known as a ceramic element, is made by layering the ceramic membrane material. Ceramic microfiltration has a crossflow design in which a large portion of the feed flow moves tangentially across the filter's surface rather than through it. Ceramic membranes can be used in high-temperature processes and in separations where aggressive media, such as acids and strong solvents, are present because of their great thermal stability. Each element has a number of channels with varying porosities (diameters) from 0.05 to 0.2 microns that allow feed water to pass through.

Ceramic membranes are simple to clean since they are resistant to temperature and chemicals. These membranes also have a longer lifespan than polymeric membranes. Ceramic membranes offer a significantly higher flux than polymeric membranes, but because of their tubular shape, they have a smaller membrane area per element.

Ceramic membranes are widely used to separate and concentrate molecular components in the ultrafiltration process. These membranes aid in the enhanced purification and filtration mechanisms in beverage processing due to their high mechanical strength and chemically inert nature over polymeric ones. Processing chicken protein concentrates is found to be highly efficient with ceramic membranes for hygienic reasons compared to polymeric membranes. Ceramic membranes, in combination with microfiltration, are also used in dairy processing for increased efficiency. According to the Journal of Food Process Techno, 95% of serum proteins can be recovered through ceramic membranes, whereas 70% can be recovered through polymeric membranes under similar conditions.

Concentration and purification of sweeteners can also be accomplished via ceramic membrane filtration. Additionally, it can be utilized to create isolated and concentrated milk proteins. Wine, fruit, and vegetable juices, as well as other liquids, are commonly purified using crossflow filtration. To get rid of bacteria in milk, membrane separation is utilized. Ceramic membranes are widely used in the processing of flavoring and seasoning of natural herb extracts, enzymes, and so on.

Evaporation and spray drying are the typical processes used to transform chicken protein into granulates. Pre-concentration with ceramic membranes results in better product quality and energy savings in the subsequent stages of the process. Water, sugar, and mineral matter are eliminated with the filtrate from the chicken protein during pre-concentration since the ceramic membrane does not retain these substances. Pre-concentration reduces the undesirable browning reaction (Maillard reaction), which results from the combination of sugar and protein in the presence of heat and leaves the concentrate mainly free of sugar. As a result, the concentrate is more suited for the subsequent spray-drying process. Therefore, better granulates are produced. Ceramic membranes, which can be sterilized by steam and are preferred to polymeric membranes for a variety of reasons, including hygiene concerns, are employed in the filtering process.

In 2014, GEA Group (Germany) used its ceramic membrane filtration system to recover beer from tank bottoms with the help of crossflow membrane filtration. The application of UHT for pasteurization damages the properties of milk. With the commercial process system developed by Alfa Laval (Sweden), the skimmed milk passed through MF with ceramic membranes of pore size 1.4 μm contains almost all the bacteria in the retentate and less than 0.5% in the permeate.

5.3.1.6 Efficiencies offered by membrane filtration technologies

The efficiency and effectiveness of membrane filtration products are important factors driving the rapid adoption of filtration membranes in the water and food & beverage industries. Membrane selection is based on the size of the pores. It mainly constitutes four major technologies: ultrafiltration, microfiltration, nanofiltration, and reverse osmosis, which are available in various pore sizes depending on the applications they serve. The efficiency offered by membrane filtration has the following two crucial aspects: product efficiency and energy efficiency.

5.3.1.6.1 Product efficiency

In terms of product efficiency, membrane filtration has several advantages over conventional technologies. For instance, membrane filtration provides a physical barrier and is a reliable method; conversely, conventional filtration is gravity-driven and provides coarse filtration. In membrane filtration, the use of chemicals is minimal, whereas traditional methods are chemical-intensive. One benefit of membrane filtration is that its systems are frequently more affordable than alternative technologies—both the installation and energy costs are reduced. Membrane filtration has fewer processing steps, allowing for greater levels of purity as well as higher overall yields. Additionally, because membrane filtration does not produce a filter cake, there are no expenses related to the removal and disposal of this residue. The technology for membrane filtration is clean. However, the use of additives is unnecessary because the separation process is purely based on molecular size. This produces a top-quality finished product and makes it simpler to meet the many strict requirements set by both consumers and public authorities.

Membrane processes are very versatile. For instance, ultrafiltration and microfiltration effectively remove turbidity-suspended particles and microbes; nanofiltration and ultrafiltration membranes are used to separate organics (such as DBP precursors, micropollutants, and viruses); and reverse osmosis is used to desalinate water and remove small organic contaminants.

The selection of membrane technologies depends on the applications they will be used for and the size of the pores. For instance, microfiltration (MF) membranes have a pore size of approximately 0.03 to 10 microns (1 micron = 0.0001 millimeter). These membranes are very efficient for removing elements such as sand, silt, clay, microbials such as *Giardia lamblia*, *Cryptosporidium* cysts, algae, and some bacterial species. Considering the pore size, the major applications of MF are pretreatment in desalination plants and preparation of sterile water for the food & beverage industry. Ultrafiltration (UF) also allows particles smaller than 20 nm to pass through, wherein the pore size varies between 20 nm and 0.1 microns. Owing to this, it is widely used in drinking water treatment and has a strong demand in the dairy industry. Quark and cream cheeses are classic examples of products efficiently processed out of membrane filtration.

5.3.1.6.2 Energy efficiency

The world's population is increasing rapidly, and industrial production is rising, steadily increasing the global energy demand. On the other hand, fossil fuels such as coal, gas, and oil are gradually becoming depleted. Energy-saving measures should be undertaken, and the development of energy-saving technologies should be encouraged to safeguard the energy supply. In this regard, membrane technology is a cutting-edge technology with a wide range of potential applications in the field of energy-efficient separation. Several traditional separation methods, including distillation, evaporation, refrigeration, and condensation, involve phase changes and are associated with high energy consumption. Since there is no phase change apart from pervaporation, membrane technology is a novel separation technique with a comparatively low requirement for energy consumption.

Membrane filtration uses less energy than conventional filtration methods; this, in turn, leads to reductions in overall operating costs. Moreover, as mentioned in the previous point, emerging membrane filtration technologies such as MD and FO have brought advancements in terms of reduced energy consumption. Feed products with a variety of viscosities, including high-viscosity goods that might normally be difficult to

process, can be processed using membrane filtration. Many membrane filtration products guarantee that the best possible solution is available for each specific application. This reduces unnecessary energy costs. The feed properties, the characteristics of the membrane, and the operating parameters are just a few of the factors that influence energy consumption. These factors have an impact on the overall membrane performance.

According to the Government of Canada, a study was carried out by a US fruit processor that installed an ultrafiltration module followed by a reverse osmosis module to concentrate juices from the original 5–10% dry matter. The study revealed an annual reduction in natural gas and power use by around 40%. This technology largely replaced the energy-intensive evaporation process.

Here are a few other advantages of membrane processing over traditional processing:

- Decrease in energy and equipment costs due to an increase in the total solids, which, in turn, increases the yield of cheese
- Enzymatic coagulation through UF reduces the use of starter culture rennet requirements for cheese making
- Reductions in the cost of wastewater treatment

5.3.2 RESTRAINTS

5.3.2.1 High setup cost

Membrane filtration is very effective in terms of purification and reducing the overall operation cost. However, the setup cost for membrane filtration equipment is substantially high, which is expected to be a major challenge during the review period.

Additionally, a process known as fouling affects practically all membrane filtration systems. One of the most common issues that membrane filtration end users deal with is membrane fouling. Fouling can decrease production levels, increase energy consumption, and damage equipment in membrane filtration systems, particularly in microfiltration (MF), ultrafiltration (UF), reverse osmosis (RO), and nanofiltration (NF). All these factors can result in unnecessary expenses for the business. The corrective actions required to maintain the functionality of membranes can be altered even slightly by changes in operating procedures, stream composition, pH, and temperature, among other factors. This makes treating and identifying problems very challenging.

Membrane fouling happens when impurities are left on a filtration membrane's surface, obstructing the flow of liquids through the membrane's pores. Fouling can be caused by several things, including excess metals; biological, colloidal, and/or organic particles in the source water; an incorrect choice of membrane material; unsuitable flow rate, temperature, and pressure; and/or one or more other factors.

In developing countries where membrane filtration technology does not have full penetration yet, the high cost of membrane filtration technology acts as a prominent restraint.

5.3.2.2 Maintenance and cleaning involved in membrane filtration

Maintenance and cleaning present notable restraints within the realm of membrane filtration across industries like food and beverages, dairy, wine, and beer. Despite the evident advantages of membrane filtration in achieving precise separation, its effectiveness hinges on meticulous maintenance and cleaning protocols. The complexity of these processes cannot be understated. Membrane surfaces tend to accumulate particles, microorganisms, and other substances, leading to fouling that diminishes filtration efficiency and overall product quality. Mitigating fouling requires intricate procedures, often involving a blend of chemical, mechanical, and backflushing techniques to dislodge and eliminate unwanted materials.

Resource and time consumption represent additional challenges. The cleaning of membrane systems necessitates substantial resources such as cleaning agents, water, and energy. This intensive consumption affects not only operational costs but also the production schedule, as cleaning cycles can extend system downtime. Moreover, the need for specialized expertise in conducting these cleaning processes is paramount. Inadequate cleaning methods can inadvertently damage delicate membranes, culminating in elevated replacement and repair expenses. Skilled personnel are required to administer proper cleaning practices, compounding the operational intricacy.

Furthermore, regulatory compliance adds another layer of complexity. Industries like food and beverages operate under stringent hygiene and safety regulations. Effective cleaning of membrane systems is indispensable to meet these standards and mitigate contamination risks. Non-compliance not only jeopardizes product quality but also exposes the organization to potential legal and reputational consequences.

In response to these challenges, industries are actively investing in research and development to engineer innovative membrane materials and designs that resist fouling and facilitate more streamlined cleaning. Additionally, automation and remote monitoring technologies are being integrated to optimize cleaning cycles and minimize the need for constant manual oversight. While maintenance and cleaning present hurdles, their meticulous execution is fundamental to ensuring consistent, high-quality filtration performance and reaping the benefits of membrane filtration without compromising the end product's integrity.

5.3.3 OPPORTUNITIES

5.3.3.1 Growth of markets for plant-based and dairy alternatives

The expanding market for plant-based and dairy alternatives represents a tremendous opportunity for the membrane filtration sector, with the potential to redefine how these products are manufactured and processed. This trend coincides with the growing need for cleaner, more sustainable, and creative solutions in the food and beverage industry, allowing membrane filtering technologies to play an important role.

To attain the required flavor, texture, and nutritional characteristics, plant-based and dairy replacements frequently require precise filtering techniques. Membrane filtering is an adaptable method for purifying these goods. Membranes, for example, may quickly separate and concentrate desired components, such as proteins, while eliminating undesired molecules, resulting in products that nearly resemble the qualities of regular dairy milk. Similarly, membrane filtering can help to produce smoother textures and enhance flavors in vegan cheeses and yogurts.

As the demand for these alternatives grows, so does the necessity for efficient and sustainable manufacturing techniques. The potential of membrane filtering to decrease waste, save resources, and cut energy usage is well aligned with the plant-based and dairy alternative market's sustainability goals. This method helps producers to obtain better yields while producing fewer byproducts, hence increasing cost-effectiveness and lowering environmental impact.

The diversification of the plant-based and dairy alternative landscape also drives the demand for specialized filtration processes. For example, producing meat analogs involves processing plant proteins into products with meat-like textures. Membrane filtration can assist in refining these proteins and creating the desired textures, ensuring consistent quality and improving consumer acceptance.

As companies innovate and expand their offerings within this market, membrane filtration suppliers can provide tailored solutions that cater to the specific filtration requirements of plant-based and dairy alternative production. This could involve developing membranes optimized for the separation of proteins, flavors, and nutrients from plant sources, enhancing the overall quality and sensory attributes of the final products.

The growing market for plant-based and dairy alternatives presents a compelling opportunity for the membrane filtration industry. By addressing the unique filtration challenges and requirements of these alternatives, membrane filtration technologies can support manufacturers in creating high-quality, sustainable, and innovative products that cater to evolving consumer preferences. This convergence of trends not only propels the membrane filtration market forward but also contributes to the broader transformation of the food and beverage industry toward more sustainable and diverse offerings.

5.3.3.2 Rise in demand for extended shelf life

The rising need for longer shelf life represents a substantial and expanding potential for the membrane filtration industry, notably in the dairy, food and beverage, wine, and beer industries. Consumers' demand for fresher, safer, and longer-lasting products has driven businesses to pursue better preservation technologies, with membrane filtration serving as a crucial enabler.

Perishable dairy products such as milk, yogurt, and cheese are subject to spoiling due to microbial growth and enzymatic activity. Membrane filtration provides a solution by eliminating spoiling microbes, enzymes, and particles, prolonging the shelf life of these items without the need for significant heat treatment or chemical preservatives. This not only improves food safety but also protects nutritional content and quality, which aligns with customers' health-conscious decisions.

Membrane filtration's fine filtering capabilities enable the removal of pollutants that lead to spoiling, such as bacteria and yeast, in the food and beverage sector, where freshness is at a premium. This means longer shelf life without sacrificing taste or nutritional value. Furthermore, in the wine and beer sectors, membrane filtration assists in product stabilization by eliminating undesirable particles, resulting in increased clarity and stability, both of which are critical for sustaining product integrity over time.

The use of membrane filtration not only meets customer desires for longer shelf life, but it also fits with industry goals to decrease food waste. Membrane filtering aids waste reduction at both the consumer and production levels by prolonging the period items stay viable and safe for consumption.

As the emphasis on sustainability grows, the potential for membrane filtration to provide prolonged shelf life becomes increasingly apparent. Manufacturers may make products that fulfill consumer expectations for both quality and environmental responsibility by using fewer artificial preservatives and additives. This intersection of consumer tastes and industry sustainability goals places membrane filtration as a critical technology in satisfying the increased demand for products with prolonged shelf life across all industries.

5.3.4 CHALLENGES

5.3.4.1 Lack of awareness about advantages of membrane filtration

Most of the processed water, food, and beverage manufacturers utilize conventional purification and filtration methods such as biological or chemical treatment. Membrane filtration provides high efficiency and requires less preparation in food, beverage, or water processing. Desalination, fractionation, standardization, concentration, and clarifying or separation are some of the main functions of membrane technologies in the food industry. The emulsified oils in foods and beverages are also separated using membrane filtration systems. Membrane filtration has fewer processing stages, allowing for greater levels of purity as well as higher total yields. The technology is employed in numerous industrial large-scale applications, making it possible for industries to run cleaner, more cost-effective, and legal operations free of contaminants and harmful particles. Additionally, it consumes less energy than traditional methods and reduces the total production cost. These are some key advantages that make this technology a vital investment. Yet, due to the lack of awareness regarding the above-mentioned advantages, most food, beverage, and processed water manufacturers still utilize conventional filtration technologies and methods.

5.3.4.2 Membrane integrity and lifespan

Membrane integrity and lifetime are key problems in membrane filtering operations, notably in the food and beverage, dairy, wine, and beer sectors. Membranes, while excellent in separating particles and pollutants, degrade over time due to a variety of causes, such as fouling, chemical exposure, and mechanical stress.

The breakdown of membrane integrity over time can have a considerable impact on separation efficiency and total production. As membranes get clogged or damaged, their capacity to efficiently separate required components from feedstock deteriorates, resulting in lower product quality and yields. This can lead to costly setbacks such as greater energy usage, higher operating expenses, and significant manufacturing process interruptions.

A multimodal strategy is required to prevent premature membrane breakdown. Regular maintenance and cleaning activities are required to reduce fouling and improve membrane lifespan. Furthermore, choosing the right membrane materials and designs can improve their resilience to chemical exposure and mechanical stress, resulting in longer-lasting performance.

Investing in modern monitoring and control systems can aid in the early detection of indicators of membrane breakdown. Operators can take proactive actions to address problems, such as increasing pressure differentials or lowering flux rates by recognizing them and addressing them before they worsen, minimizing downtime, and optimizing membrane performance.

6 INDUSTRY TRENDS

6.1 INTRODUCTION

A membrane is a thin layer of a semi-permeable material that separates substances when a driving force is applied across the membrane. Membrane techniques are increasingly being used to remove bacteria, microorganisms, particles, and naturally occurring organic material. These contaminants can change the color, flavor, and odor of water as well as react with disinfectants to produce harmful byproducts.

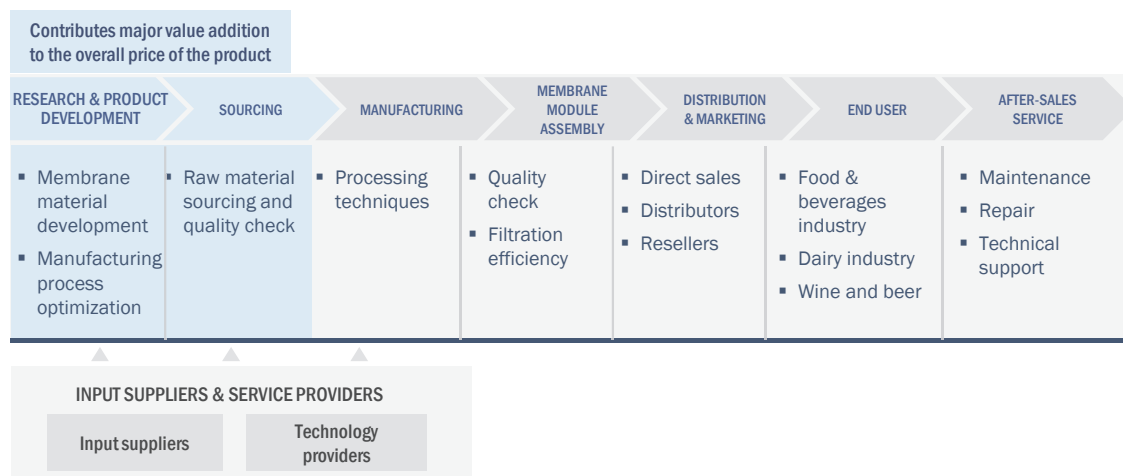
Membranes are a physical barrier and act as a thin layer of porous, semi-permeable material. Membranes can have highly specialized properties that allow just a limited number of desirable components to flow through.

Membrane filtration was introduced in the late 1950s and is widely accepted by the US Environmental Protection Agency (EPA). According to the EPA, membrane filtration is the best technique for water analysis since it enables rapid testing of a large volume of water samples.

6.2 VALUE CHAIN ANALYSIS

This section of the report categorizes the value chain representatives for a more comprehensive understanding of the effective distribution of products to the end-user and its stakeholders, resulting in the smooth functioning of the business and expanding the opportunities globally. This value chain plays an important role in the development of the membrane filtration market by increasing awareness about the products. It helps understand the membrane filtration market by recognizing the most valuable activities. The value chain analysis also helps understand the market for membrane filtration and the relationship between stakeholders and their participation. It helps carry out business operations smoothly, as it identifies the key activities, expands opportunities, and facilitates coordination across the value chain. The entire value chain for the market is highly integrated.

The membrane filtration value chain encompasses various interconnected stages, from research and development to end-user consumption. Each phase contributes to creating a safe, nutritious, and appealing product for membrane filtration while addressing consumer demands and regulatory requirements. The effectiveness of the value chain relies on seamless coordination and collaboration between stakeholders at each stage, ultimately delivering quality membrane filtration products to the market.

FIGURE 21 MEMBRANE FILTRATION MARKET: VALUE CHAIN ANALYSIS

Source: Secondary Research, Primary Interviews, Industry Journals, Related Research Publications, Press Releases, and MarketsandMarkets Analysis

6.2.1 RESEARCH AND PRODUCT DEVELOPMENT

Research and development (R&D) efforts are instrumental in advancing the membrane filtration industry. Through dedicated R&D initiatives, researchers continually seek to innovate and enhance membrane materials, manufacturing processes, and system designs. This innovation drive aims to develop membranes with improved properties, such as increased selectivity, permeability, and resistance to fouling. Moreover, R&D focuses on optimizing manufacturing processes to reduce production costs and improve energy efficiency, making membrane filtration systems more cost-effective and environmentally sustainable. The integration of advanced technologies and modular system designs also contributes to the evolution of membrane filtration solutions, allowing for greater versatility and adaptability to diverse applications. Ultimately, the outcomes of R&D efforts enable the development of more efficient, cost-effective, and environmentally friendly membrane filtration solutions that benefit a wide range of industries, from water treatment to pharmaceutical production.

6.2.2 SOURCING

The value chain for the membrane filtration market commences with raw material suppliers that provide essential materials for membrane production. These materials encompass polymers, ceramics, and metals. Key polymeric materials involve polyethersulfone (PES), polyvinylidene fluoride (PVDF), and cellulose acetate, while ceramic materials such as alumina and zirconia are also crucial components. Suppliers in this stage may additionally offer various chemicals and additives that are vital for the manufacturing process of membranes. These suppliers play a foundational role in ensuring a steady supply of high-quality materials, which are the building blocks to produce membranes used in a variety of applications, including water purification, food processing, and pharmaceutical manufacturing. Owing to this, research, development, and sourcing of products contribute significantly to the value of the membrane filtration technologies offered to the end user.

6.2.3 MANUFACTURING

Membrane manufacturers play a critical role in the membrane filtration market. They are responsible for the production of various types of filtration membranes, including microfiltration (MF), ultrafiltration (UF), nanofiltration (NF), and reverse osmosis (RO) membranes. These manufacturers source raw materials, such as polymers, ceramics, and metals, from suppliers and then employ processes like phase inversion, extrusion, and sintering to create membranes of different sizes and configurations.

Quality control is paramount in this stage to ensure that the membranes meet specific performance standards and are free from defects. Additionally, research and development efforts are ongoing to continually enhance membrane materials and manufacturing techniques. This continuous improvement is vital for achieving higher filtration efficiency, durability, and selectivity, as well as for adapting membranes to diverse applications. Ultimately, membrane manufacturers are pivotal in delivering high-quality membranes that serve industries ranging from water treatment, food and beverages, and pharmaceuticals.

6.2.4 MEMBRANE MODULE ASSEMBLY

Membrane module assembly is a crucial step in the membrane filtration value chain, where manufactured membranes are transformed into functional filtration units. These modules come in various sizes and designs, including spiral-wound, tubular, and hollow fiber configurations. The assembly process involves housing the membranes, sealing them securely, and attaching essential components like feed and permeating channels. Module design and engineering are essential during this phase to optimize filtration efficiency, ensuring that the membranes perform effectively in their intended applications.

Following module assembly, companies specializing in membrane filtration systems take the lead in system integration. They incorporate these membrane modules into complete filtration systems tailored to meet specific industry needs. Whether it is for water treatment, food processing, pharmaceutical production, or other applications, system integration is a comprehensive process. It encompasses the inclusion of pumps, controls, instrumentation, and monitoring components to create fully functional and efficient filtration systems that provide clean, purified fluids according to industry standards and requirements. This integrated approach ensures that membrane filtration systems are ready to deliver reliable results in a variety of settings.

6.2.5 DISTRIBUTION AND MARKETING

Distribution and marketing are critical steps in the membrane filtration value chain because they focus on getting constructed filtration systems to the target consumers. Following thorough assembly and testing, these systems are offered to potential clients via a range of channels, including direct sales, distributor networks, and reseller alliances.

Marketing initiatives are crucial during this stage. They include advertising, internet marketing, trade exhibitions, and technical publications as methods of promoting the filtration systems. Furthermore, organizations give critical technical assistance to help clients understand and efficiently use these technologies.

Customer education is also a significant component of marketing efforts. Companies aim to educate potential buyers about the advantages and benefits of membrane filtration, demonstrating how these systems can address specific needs and improve processes in various industries, whether it is ensuring clean water, enhancing food and beverage quality, or maintaining high standards in pharmaceutical production. In summary, distribution and marketing ensure that membrane filtration solutions reach their target markets and that potential customers are well-informed about the advantages they offer.

6.2.6 END USERS

Membrane filtration solutions are a cornerstone for a wide range of industries, with notable applications in the dairy, food & beverage, and wine and beer sectors. In the dairy industry, membrane filtration is pivotal for separating milk into its components, standardizing fat content, and producing essential products like whey protein concentrates. It ensures product consistency and efficiency, benefiting cheese, yogurt, and infant formula production. Similarly, in the food and beverage industry, it plays a crucial role in juice and beverage clarification, preserving flavors and aromas, and removing undesirable components. In the wine and beer industry, membrane filtration is indispensable for clarifying and stabilizing these alcoholic beverages, enhancing microbial stability, and preserving their sensory characteristics.

The versatility and precision of membrane filtration make it an essential tool in these industries, improving product quality while minimizing the need for energy-intensive processes and chemicals. Whether it is ensuring the purity of dairy products, enhancing the clarity of beverages, or fine-tuning the characteristics of wine and beer, membrane filtration plays a vital role in meeting the exacting standards of these sectors.

6.2.7 AFTER-SALES SERVICE

After-sales services in the membrane filtration industry are a pivotal stage post-purchase, dedicated to sustaining the functionality and performance of filtration systems. This phase includes a spectrum of services, such as maintenance, repair, and technical support. Regular maintenance routines, like inspections and preventive measures, are conducted to preserve system efficiency and longevity. In cases of malfunctions or breakdowns, timely repair services are provided, encompassing troubleshooting and component replacements. Technical support acts as a lifeline for customers, offering remote diagnostics, on-site visits, and expert guidance to tackle operational challenges. Additionally, educational programs equip end-users with the knowledge to operate and maintain their systems effectively. The availability of spare parts, consumables, and continuous performance monitoring further enriches the after-sales experience. These services are not only essential for minimizing downtime but also for enhancing overall customer satisfaction, fostering long-term relationships, and upholding the reputation of filtration solution providers.

The significance of after-sales services transcends technical assistance; it serves as a cornerstone of customer satisfaction and retention. By demonstrating a commitment to customers' success and system performance, companies in the membrane filtration market can instill trust, encourage repeat business, and generate positive word-of-mouth referrals. Moreover, offering comprehensive after-sales support is not just a service but a strategic imperative, ensuring that filtration solutions continue to operate at peak efficiency throughout their lifecycle, ultimately benefiting both customers and providers in a mutually beneficial relationship.

6.3 TRADE ANALYSIS

The tables below signify the trade of raw materials used in dairy alternative product manufacturing. This data indicates the favorability of various dairy alternative sources in key markets/countries.

Radioactive chemical elements and radioactive isotopes, incl. their fissile or fertile chemical elements and isotopes, and their compounds; mixtures and residues containing these products

TABLE 4 TOP 10 IMPORTERS AND EXPORTERS OF ALMONDS, 2022 (USD THOUSANDS)

COUNTRY	IMPORT (USD THOUSANDS)	COUNTRY	EXPORT (USD THOUSANDS)
United States of America	4,006,997	Kazakhstan	2,641,656
China	2,040,106	Russian Federation	2,122,384
Canada	1,378,868	Canada	1,886,454
France	1,265,296	France	1,639,554
Germany	1,075,195	Netherlands	1,613,443
Russian Federation	970,448	Germany	1,180,953
Sweden	600,032	United States of America	431,999
Netherlands	527,621	Belgium	134,549
Korea, Republic of	524,657	China	82,786
Spain	464,340	South Africa	67,965

HS Code for radioactive chemical elements and radioactive isotopes, incl. their fissile or fertile chemical elements and isotopes, and their compounds; mixtures and residues containing these products: 284410.

Source: International Trade Centre.

Note: Since data pertaining to membrane filtration market was unavailable, trade data in general is provided.

6.3.1 AMINO-RESINS, PHENOLIC RESINS, AND POLYURETHANES IN PRIMARY FORMS

TABLE 5 TOP 10 IMPORTERS AND EXPORTERS OF AMINO-RESINS, PHENOLIC RESINS, AND POLYURETHANES IN PRIMARY FORMS, 2022 (USD THOUSANDS)

COUNTRY	IMPORT (USD THOUSANDS)	COUNTRY	EXPORT (USD THOUSANDS)
United States of America	1,884,352	Germany	3,813,522
China	1,863,076	China	3,554,743
Germany	1,564,769	Belgium	2,421,293
Netherlands	1,084,636	United States of America	1,995,449
Italy	1,032,862	Netherlands	1,774,239
France	971,494	Korea, Republic of	1,196,528
India	939,645	Italy	845,021
Canada	933,722	Japan	838,117
Poland	867,263	Spain	730,488
Viet Nam	801,652	Taipei, Chinese	662,157
Türkiye	787,254	Hungary	634,166
Belgium	753,648	Saudi Arabia	629,720

HS Code for Amino-resins, phenolic resins and polyurethanes, in primary forms: 390931

Source: International Trade Centre

Note: Since data pertaining to membrane filtration market was unavailable, trade data in general is provided.

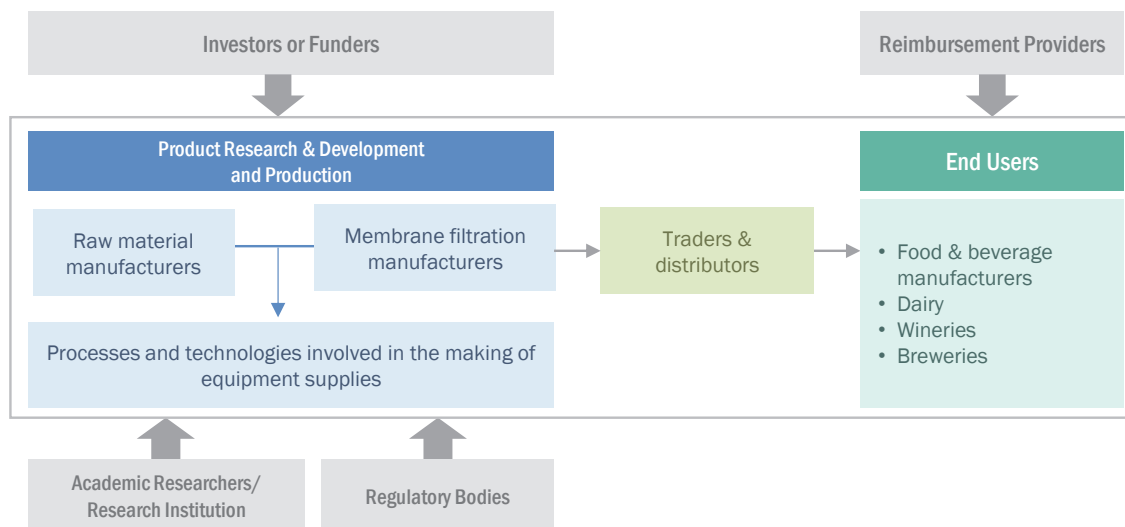
6.4 SUPPLY CHAIN ANALYSIS

The supply chain of the membrane filtration market is a complex and multifaceted network that involves various key players. It begins with raw material suppliers providing essential materials such as polymers and chemicals to membrane manufacturers who use specialized processes to create membranes of different types and specifications. These membranes are then integrated into modules by module manufacturers, and system integrators and equipment manufacturers design and build complete filtration systems for specific applications. Distributors and wholesalers play a pivotal role in making membrane filtration products readily available to end-users across different industries, including water treatment, pharmaceuticals, food and beverage, biotechnology, and more. End users rely on membrane filtration technology for a wide range of processes, from purifying water to ensuring the sterility of pharmaceutical products. Service and maintenance providers support the ongoing operation of these systems, and research and development efforts continue to drive innovation in membrane materials and technology. Regulatory bodies and standards organizations establish guidelines to ensure the safety and quality of membrane filtration products and processes. Overall, the membrane filtration supply chain is a critical component in meeting the growing demand for clean water and high-quality products in various industries, constantly evolving to adapt to changing needs and advancements in technology.

Along with R&D, manufacturing is also an important aspect of the supply chain. These two stages contribute major value to membrane filtration products. Quality assessment is done throughout the manufacturing process to maintain the quality standards imposed by regulatory bodies.

A proper distribution channel is one of the most important parts of the supply chain, as it provides access to the customers and instant feedback.

FIGURE 22 MEMBRANE FILTRATION MARKET: SUPPLY CHAIN ANALYSIS



Source: Related Associations/Institutes, Related Research Publications, Government Publications, Company Publications, and MarketsandMarkets Analysis

6.5 TECHNOLOGY ANALYSIS

Some other membrane developments that could either compete with or supplement the mentioned technologies are:

6.5.1 GRAPHENE

Graphene, often referred to as a nanoporous atomically thin membrane (NATM), is made of a one-atom-thick carbon mesh that resembles chicken wire. The hexagonal openings in this structure can be designed to let only water molecules pass while blocking salts and other molecules. The “sweet spot” size range (a nanometer is one-thousandth of a micron) for pores appears to be between 0.7 and 0.9 nanometers (7–9 angstrom units). Theoretically, compared to polymeric RO membranes, graphene-based membranes have flux (permeate) rates that are 1,000 times higher and salt rejection rates approaching 100%.

Chemical vapor deposition is used to constantly cast graphene onto a roll of copper foil. The next step is to cast a thin layer of polyether sulfone (PES) onto this surface, which is then interracially polymerized to provide a porous support layer. The copper foil has this layer stripped off, leaving a roll of graphene NATM with a PES backing. The PES polymer is important for strength and support, even if it somewhat reduces membrane flux.

6.5.2 BIOMIMETIC

Biomimetic materials are based on nature or natural materials. Examples include shark skin, spider silk, and the honeycomb structure of a beehive. By introducing aquaporin proteins into the membrane layer, aquaporin produces a membrane with water channels. It is believed that only water can go via these channels while all contaminants, regardless of molecular weight, are blocked. Aquaporins, also known as “the plumbing system for cells,” were found in 1999, and a Danish company called Aquaporin was formed in 2005. The company claims that the new technology causes more flux and rejection. They have so far commercialized small residential RO membranes and FO membranes. Currently, they are developing large brackish and seawater membranes.

The “DNA Templated Ceramic Nanofiltration Membrane” is a new type of biomimetic membrane available in the market and made by Cerahelix, Inc. in Orono, Maine. This ceramic layer is applied to ceramic elements to produce inside-out membranes with molecular weight cutoffs (MWCs) of 400, 800, and 1,200 Daltons. The company claims that membranes have all the benefits of ceramics but with lower MWCs and fouling characteristics.

6.5.3 MILK FRACTIONATION

Utilizing artificial membranes to fractionate milk proteins is gaining popularity in the dairy sector due to its favorable impact on the environment and economics. The practice of segregating milk into distinct components is anticipated to enhance the efficient utilization of its constituents, such as milk fat, casein, and serum proteins, along with their functional attributes. However, the challenge of fouling has historically hindered the progress of milk fractionation.

Arla has announced the development of a patented technique for milk fractionation—a significant scientific accomplishment that addresses the challenge of empowering scientists, nutritionists, and health experts to create innovative dairy products. This achievement allows Arla to selectively isolate pure milk proteins, including casein and serum whey proteins. The application of this novel method presents promising prospects in various domains, such as infant formula, sports nutrition, and medical nutrition. Arla envisions catering to vulnerable populations such as older people and individuals with specific medical and nutritional requirements. This breakthrough ushers in a range of possibilities for revolutionizing dairy product development and meeting diverse consumer needs.

In the past, the separation of different proteins in milk and whey was dependent on the cheese-making process, as whey is a byproduct of this procedure. Owing to Arla’s newly patented milk fractionation technology, the conventional need for cheese production is circumvented. This innovation not only expands the potential pool of raw materials but also produces distinct protein streams through a unique and tightly controlled process. This approach significantly reduces processing steps and treats the milk with more gentleness.

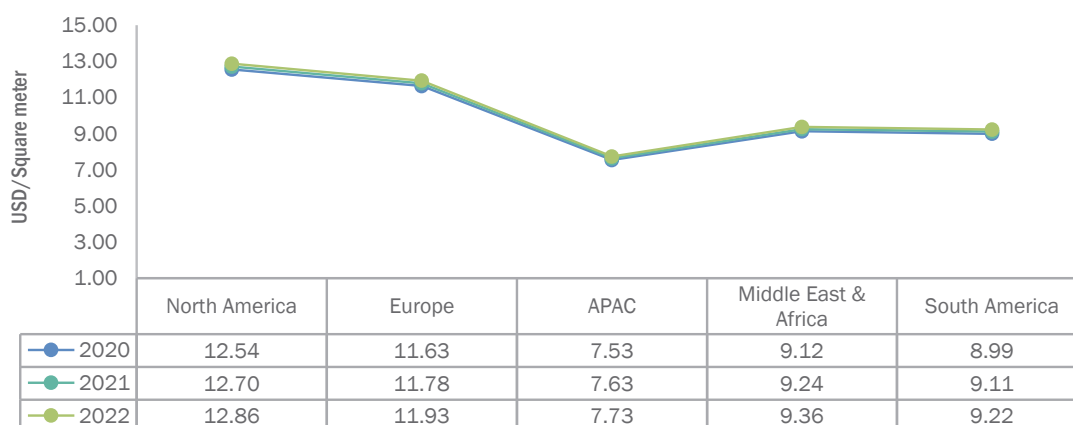
6.6 PRICING ANALYSIS

6.6.1 AVERAGE SELLING PRICE TREND, BY REGION

Price analysis is done based on the average selling price of raw materials for membranes sold globally. The global price for membranes is likely to vary in the future and depends largely on raw material prices. Price competitiveness and regular fluctuations are also the challenges faced by producers. The price also varies according to the demand for various applications.

The prices have been analyzed for membranes in different regions for 2020–2027.

FIGURE 23 AVERAGE SELLING PRICE TREND, BY REGION (USD/SQUARE METER)



Source: Secondary Research and MarketsandMarkets Analysis

6.6.2 INDICATIVE PRICING ANALYSIS, BY MEMBRANE MATERIAL

TABLE 6 INDICATIVE PRICING ANALYSIS, BY MEMBRANE MATERIAL (USD/SQUARE METER)

Material	2020	2021	2022
Polymeric	8.54	8.62	8.72
Ceramic	39.30	39.72	40.19

Source: Secondary Research and MarketsandMarkets Analysis

6.7 PATENT ANALYSIS

With the rise in demand for dairy alternative products, FMCG companies are now investing and carrying out research and development activities. The report studies some key patents being applied across regions and organizations. Below are some of the important patents in the membrane filtration market.

TABLE 7 KEY PATENTS PERTAINING TO MEMBRANE FILTRATION MARKET, 2013–2022

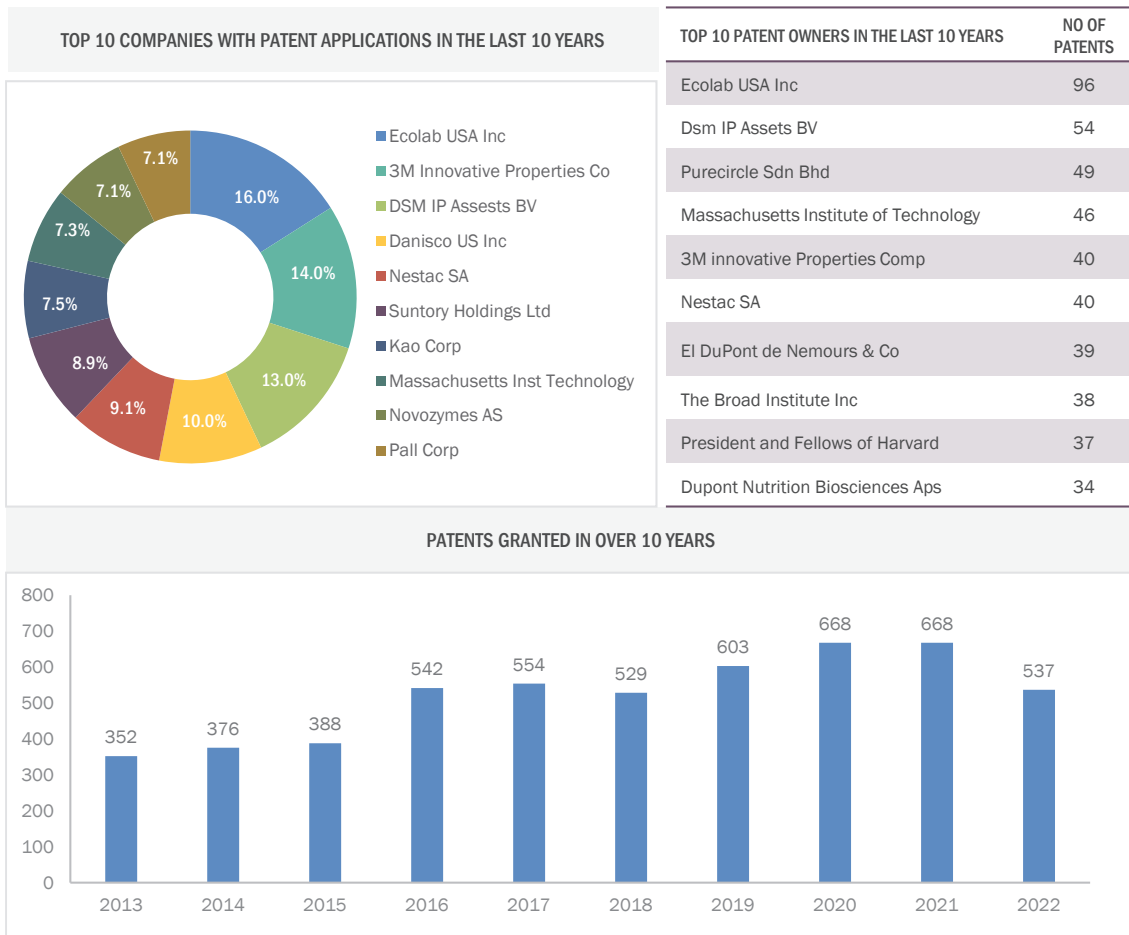
TITLE	PUBLICATION NUMBER	IPCR CLASSIFICATIONS	YEAR	INVENTORS
Method for manufacturing brewed alcoholic beverages using porous membrane	US 11492577 B2	<ul style="list-style-type: none"> ▪ B01D65/02 ▪ B01D69/02 ▪ B01D69/08 ▪ B01D71/34 ▪ B01D71/36 ▪ B01D71/68 ▪ C12H1/07 	November 2022	Nakazawa Yukio
Membrane with increased surface area	EP 3169425 B1	<ul style="list-style-type: none"> ▪ B01D67/00 ▪ B01D69/06 	August 2022	Mundrigi Ashok, Gowda Jahnavi, Mundlamuri Ramesh, Loewe Thomas, Linne Holger, Handt Sebastian
System and method for filtering beverages	US 11324238 B2	<ul style="list-style-type: none"> ▪ A23L2/46 ▪ A23L2/02 ▪ A23L2/08 ▪ A23L2/10 ▪ A23L2/72 ▪ A23L2/74 ▪ A23L3/005 ▪ A23L3/48 ▪ A61L2/00 ▪ A61L2/02 ▪ A61L2/04 ▪ B01D61/02 ▪ B01D61/14 ▪ B01D61/18 ▪ B01D61/20 ▪ B01D61/58 ▪ B01D65/10 ▪ C12H1/07 ▪ C12H1/16 ▪ C12H1/18 	May 2022	Otterstatter Matthew R, Shrikhande Prashant V

Method for manufacturing brewed alcoholic beverages using porous membrane	AU 2018/327797 B2	<ul style="list-style-type: none"> ▪ C12H1/07 ▪ B01D61/14 ▪ B01D65/06 ▪ B01D69/00 ▪ B01D69/08 ▪ B01D71/30 ▪ B01D71/32 ▪ B01D71/34 ▪ B01D71/36 ▪ B01D71/68 	May 2021	Nakazawa Yukio
Production Method for Concentrated Product Using Membrane-Concentration Method and Freeze-Concentration Method	EP 3040108 B1	<ul style="list-style-type: none"> ▪ B01D9/04 ▪ A23C1/06 ▪ A23C9/142 ▪ B01D9/00 ▪ B01D61/04 ▪ B01D61/16 	February 2021	Kashiwagi Kazunori, Ichimura Takefumi, Satake Yoshinori, Kamiya Tetsu, Omori Toshihiro, Matsubara Hiroki
Method for permeate flow path sanitization in a reverse osmosis system	US 10906005 B2	<ul style="list-style-type: none"> ▪ B01D65/02 ▪ B01D61/02 ▪ B01D61/10 ▪ B01D71/16 ▪ B01D71/56 ▪ C02F1/44 ▪ C02F1/66 ▪ C02F1/76 ▪ C02F103/32 	February 2021	Glanz Douglas P, Majerle Randall, Van't Hul Jason
Membrane With Performance Enhancing Multi-Level Macroscopic Cavities	EP 3169424 B1	<ul style="list-style-type: none"> ▪ B01D67/00 ▪ B01D69/06 	October 2020	Mundrigi Ashok, Gowda Jahnavi, Mundlamuri Ramesh, Loewe Thomas, Linne Holger, Handt Sebastian
Method for Checking the Functionality of a Membrane Filtration Module and Filtration Assembly for Carrying Out the Method	EP 3047899 B1	<ul style="list-style-type: none"> ▪ B01D65/10 ▪ B67C3/02 	April 2020	Zacharias Joerg, Scheu Dirk
Ceramic multilayer filter membrane	US 10413870 B2	<ul style="list-style-type: none"> ▪ B01D69/08 ▪ B01D61/14 ▪ B01D69/12 ▪ B01D71/02 	September 2019	Ehlen Frank

Membrane with performance-enhancing multi-level macroscopic cavities	US 10384168 B2	<ul style="list-style-type: none"> ▪ B01D67/00 ▪ A23L2/74 ▪ B01D61/14 ▪ B01D69/06 ▪ B01D71/68 ▪ C02F1/44 ▪ C12H1/07 ▪ C12N1/02 	August 2019	Mundrigi Ashok, Gowda Jahnvi, Mundlamuri Ramesh, Loewe Thomas, Linne Holger, Handt Sebastian
Process for Producing Sugar Cane Potable Water and Blended Sugar Cane Juice Beverage	AU 2016/228592 B2	<ul style="list-style-type: none"> ▪ A23L2/02 ▪ A23L2/08 ▪ A23L2/52 ▪ A23L2/74 ▪ A23L33/00 ▪ A23L33/105 	April 2019	Ye Lina, Ling Guoqing, Peng Wenbo, Lin Xingsheng, Zhang Yu, Fan Keyin, Chen Jiaquan, Feng Chunya
High-velocity cross-flow dynamic membrane filter	US 10246350 B2	<ul style="list-style-type: none"> ▪ C02F1/44 ▪ B01D61/14 ▪ B01D61/18 ▪ B01D61/22 ▪ B01D63/08 ▪ B01D63/16 ▪ B01D65/08 ▪ C02F1/66 	April 2019	Davie Richard, Hwang Ingchen Douglas, Zatopek Ludek, Vokurka Karel
Concentration control in filtration systems and associated methods	US 9925494 B2	<ul style="list-style-type: none"> ▪ B01D61/02 ▪ B01D61/08 ▪ B01D61/12 ▪ B01D61/14 ▪ B01D61/18 ▪ B01D61/22 ▪ C12C11/11 ▪ C12G3/08 ▪ C12H6/00 	March 2018	McGovern Ronan K, Lienhard v John H
Method of sports beverage by using Forward Osmosis	KR 101680160 B1	<ul style="list-style-type: none"> ▪ A23L2/38 ▪ A23L2/52 ▪ B01D61/00 ▪ C02F1/44 	November 2016	Choi Joon Young.

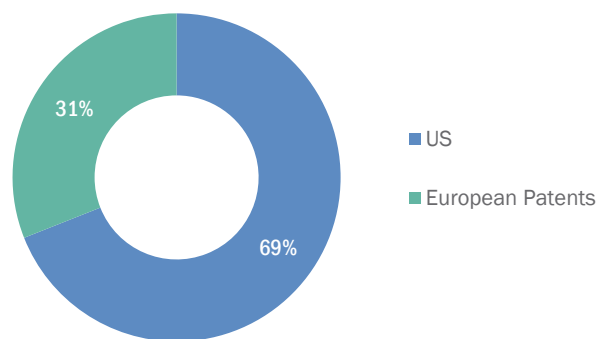
Source: Lens.org

FIGURE 24 TOTAL PATENTS GRANTED, 2013–2022



Source: Lens.org

FIGURE 25 REGIONAL ANALYSIS OF PATENTS GRANTED



Source: Lens.org

6.8 ECOSYSTEM ANALYSIS

FIGURE 26 ECOSYSTEM MAP



Source: Secondary Research, Primary Interviews, Industry Journals, Related Research Publications, Press Releases, and MarketsandMarkets Analysis

The membrane filtration ecosystem comprises membrane filtration manufacturers who develop filters to be distributed and supplied to end users from different industries. Membrane filtration can be labeled as one of the products emerging from the filtration market. Membrane filtration is also used in large-scale industrial use. It is mostly used to remove microscopic particles and objects from solutions, and it has the potential to continually separate them as well as concentrate dyes from emissions.

TABLE 8 **ROLE OF PLAYERS IN MARKET ECOSYSTEM**

COMPANY	ROLE IN ECOSYSTEM
Alfa Laval (Sweden)	Manufacturer/Distributor
GEA Group Aktiengesellschaft (Germany)	Manufacturer/Distributor
DuPont (US)	Manufacturer/Distributor
Veolia (US)	Manufacturer/Distributor
Pall Corporation (US)	Manufacturer/Distributor
3M (US)	Manufacturer/Distributor
Koch Separation Solutions (US)	Manufacturer/Distributor
Veolia (France)	Manufacturer/Distributor
ProMinent (Germany)	Manufacturer/Distributor
Pentair (US)	Manufacturer/Distributor
SPX Flow (US)	Manufacturer/Distributor
Porvair Filtration Group (UK)	Manufacturer/Distributor
Donaldson Company, Inc. (US)	Manufacturer/Distributor
MANN+HUMMEL (Germany)	Manufacturer/Distributor
Graver Technologies (US)	Manufacturer/Distributor
Novasep (France)	Manufacturer/Distributor
Synder Filtration, Inc. (US)	Manufacturer/Distributor
Nitto Denko Corporation (Japan)	Manufacturer/Distributor
ZwitterCo (US)	Manufacturer/Distributor

Source: Company Website, Annual Reports, and MarketsandMarkets Analysis

6.9 KEY CONFERENCES & EVENTS

TABLE 9 MEMBRANE FILTRATION MARKET: DETAILED LIST OF CONFERENCES & EVENTS, 2022-2023

YEAR/QUARTER	NORTH AMERICA	EUROPE	ASIA PACIFIC	SOUTH AMERICA	REST OF THE WORLD
Q3 '23	NA	https://sites.google.com/view/2m3s-conference [September]	NA	NA	NA
Q4 '23	NA	https://www.elsevier.com/event/conferences/desalination-using-membrane [November]	https://msppf2023.in/ [October]	NA	NA
Q1 '24	http://www.amta.org.com/awwa-amta-membrane-technology-conference-exposition [March]	NA	NA	NA	NA
Q2 '24	NA	https://iwa-let.org/ [June]	NA	NA	NA
Q3 '24	https://worldwatercongress.org/ [August]	NA	NA	https://icim2024.org/ [July]	NA
Q4 '24	NA	NA	NA	https://filtech.de/conference/present-your-paper/ [November]	https://www.saim-ptf.com/ [November]

Source: Conference and Event Websites and Press Releases

6.10 REGULATORY LANDSCAPE

6.10.1 INTRODUCTION

Regulations regarding water and food safety play an important role in the global membrane filtration industry. Regulatory frameworks ensure that quality products are used in the manufacturing of membrane filtration products by establishing necessary guidelines regarding the raw material used during manufacturing. These regulations prevent potential microbial adulteration in food, beverages, or water. Owing to these factors, regulatory frameworks are essential to protect human health.

6.10.1.1 US

6.10.1.1.1 Food and Drug Administration (FDA)

According to Sec. 177.2910 of the FDA.

Ultrafiltration membranes identified in paragraphs (a)(1), (a)(2), (a)(3), and (a)(4) of this section may be safely used in the processing of food under the following prescribed conditions:

- (a)(1) Ultrafiltration membranes that consist of paper impregnated with cured phenol-formaldehyde resin, which is used as a support and is coated with a vinyl chloride-acrylonitrile copolymer.
- (a)(2) Ultrafiltration membranes that consist of a sintered carbon support that is coated with zirconium oxide (CAS Reg. No. 1314-23-4) containing up to 12% yttrium oxide (CAS Reg. No. 1314-36-9)
- (3) Ultrafiltration membranes that consist of an aluminum oxide support that is coated with zirconium oxide (CAS Reg. No. 1314-23-4) containing up to 5% yttrium oxide (CAS Reg. No. 1314-36-9)
- (4) Ultrafiltration membranes that consist of a microporous poly (vinylidene fluoride) membrane with a hydrophilic surface modifier consisting of a hydroxypropyl acrylate/tetraethylene glycol diacrylate copolymer
- (b) Any substance employed in the production of ultrafiltration membranes that is the subject of a regulation in parts 174, 175, 176, 177, 178, and 179.45 of this chapter conforms with the specifications of such regulation
- (c) Ultrafiltration membranes are used in the physical separation of dissolved or colloiddally suspended varying molecular size components of liquids during the commercial processing of bulk quantities of food
- (d) Ultrafiltration membranes shall be maintained in a sanitary manner in accordance with good manufacturing practices to prevent potential microbial adulteration of the food
- (e) Ultrafiltration membranes identified in paragraph (a)(4) may be used to filter aqueous or acidic foods containing up to 13% alcohol at temperatures not exceeding 21 deg. C (70 deg. F)
- (f) To ensure the safe use of ultrafiltration membranes, the label or labeling shall include adequate directions for a pre-use treatment, consisting of conditioning and washing with a minimum of 8 gallons of potable water prior to their first use in contact with food.

6.10.1.2 India

6.10.1.2.1 Bureau of Indian Standards (BIS)

- The manufacturer shall declare the chemical preservative used in the membrane and the flushing requirement in the consumer user guide.
- The manufacturer shall declare the product performance about the reduction capabilities of RO membrane for chemical pollutants, namely, pesticides, nitrate, fluoride, arsenic, lead, mercury, etc.
- When tested in accordance with Annex A, the RO unit shall deliver microbiologically safe drinking water.
- A hydrostatic test shall check all the portions of the purifier through which the water passes at a pressure of 294.24 Kpa. The membrane cartridge and other accessories connected to the system from the booster pump discharge, such as pipes, fittings, and instruments up to the product discharge valve and reject discharge point to the booster, shall be:
 - For all filtration components such as sediment filters, activated carbon filters, and RO membrane filters, the manufacturer shall declare the maximum possible life in terms of liters of water that can be processed through each filter. The factors affecting the performance of the filters shall be mentioned. All this information shall be provided in the user manual.
 - TDS reduction tests, microbiological tests, pesticide reduction tests, and all other chemical tests are to be done on four different membranes independently, ensuring that the metallic solutions do not precipitate while preparing Challenge water. Testing laboratories shall standardize the sequence of addition of these metals into Challenge water to avoid precipitation.

6.10.2 REGULATORY BODIES, GOVERNMENT AGENCIES, AND OTHER ORGANIZATIONS

TABLE 10 NORTH AMERICA: LIST OF REGULATORY BODIES, GOVERNMENT AGENCIES, AND OTHER ORGANIZATIONS

COUNTRY	ORGANIZATION NAME	ORGANIZATION TYPE	SHORT DESCRIPTION
US	US Environmental Protection Agency	Government Regulatory Body	The US federal government's independent Environmental Protection Agency (EPA) is tasked with environmental protection issues. The agency carries out environmental assessment, research, and education. In cooperation with state, tribal, and local governments, it is responsible for maintaining and enforcing national standards under a variety of environmental laws.
US	American Membrane Technology Association	Association	AMTA is a leading voice for legislative and regulatory changes necessary for understanding, accepting, and applying membrane technologies. AMTA's vision is to use membrane technology to address water supply and quality issues.

US	Southwest Membrane Operator Association	Association	An affiliate of the American Membrane Technology Association (AMTA), the Southwest Membrane Operator Association (SWMOA) is focused on the Southwest United States region, including but not limited to Arizona, California, Colorado, Hawaii, New Mexico, Nevada, and Utah. The SWMOA is a group of membrane operators created to give membrane operators a forum for information exchange, knowledge sharing, training, and acquiring the continuing education credits necessary for Operator Certification requirements.
US	World Association of Membrane Societies	Association	The World Association of Membrane Societies (WAMS) is a global collaborative framework of regional and national membrane societies to promote the use of membrane technology.
US	FAO	Government Regulatory Body	The United Nations Food and Agriculture Organization (FAO) is a specialized agency that directs international efforts to defeat hunger and enhance nutrition and food security. It aids in coordinating government and development agency activities to improve and develop agriculture, forestry, fisheries, and land and water resources.
US	US FDA	Government Regulatory Body	The United States Food and Drug Administration (FDA or USFDA) is a federal agency of the Department of Health and Human Services.

Source: Regulatory Body and Association Websites

TABLE 11 EUROPE: LIST OF REGULATORY BODIES, GOVERNMENT AGENCIES, AND OTHER ORGANIZATIONS

COUNTRY/ REGION	ORGANIZATION NAME	ORGANIZATION TYPE	SHORT DESCRIPTION
Europe	The European Membrane Society	Non-profit Organization	The European Membrane Society (EMS) is an international non-profit organization established in 1982 to promote collaboration between researchers and engineers involved in research & development in the field of synthetic membranes and membrane processes.
Europe	The European Membrane House	Non-profit Organization	The European Membrane House is Europe's one-stop center for assistance with membrane R&D.
Spain	AEDyR	Association	The International Desalination Association (IDA) Congress held in Madrid at the end of 1997 led to a huge amount of interest in Spanish desalination technologies worldwide, which prompted the creation of the Spanish Desalination and Reuse Association (AEDyR) in 1998. The Association's goal, as stated in its regulations, is to "promote the appropriate use of seawater and brackish water desalination and the reuse of reclaimed wastewater, thereby contributing to the sustainable management of water resources."

Germany	DGMT	Association	The DGMT is a professional association aiming to represent and promote membrane technology in Germany. DGMT's purpose is to provide the membrane technology industry with a communication network and platform for cooperation.
Italy	European Desalination Society	Association	EDS is an organization with members from all around Europe, including universities, businesses, research institutions, and governmental organizations, as well as all concerned with and interested in desalination and membrane technology for water.
France	ANSES		ANSES regulates the usage of products and equipment for water treatments in France. Regulations (Article R. 1321-50-IV of the Public Health Code (CSP), Circular no.2000/166 of March 28, 2000, concerning products and processes for treating water intended for human consumption and the Order of August 17, 2007, as amended concerning the drawing up of an application for permission to market a product or process for treating water intended for human consumption, listed in Article R.1321-50-IV of the Public Health Code).

Source: Organization and Association Websites

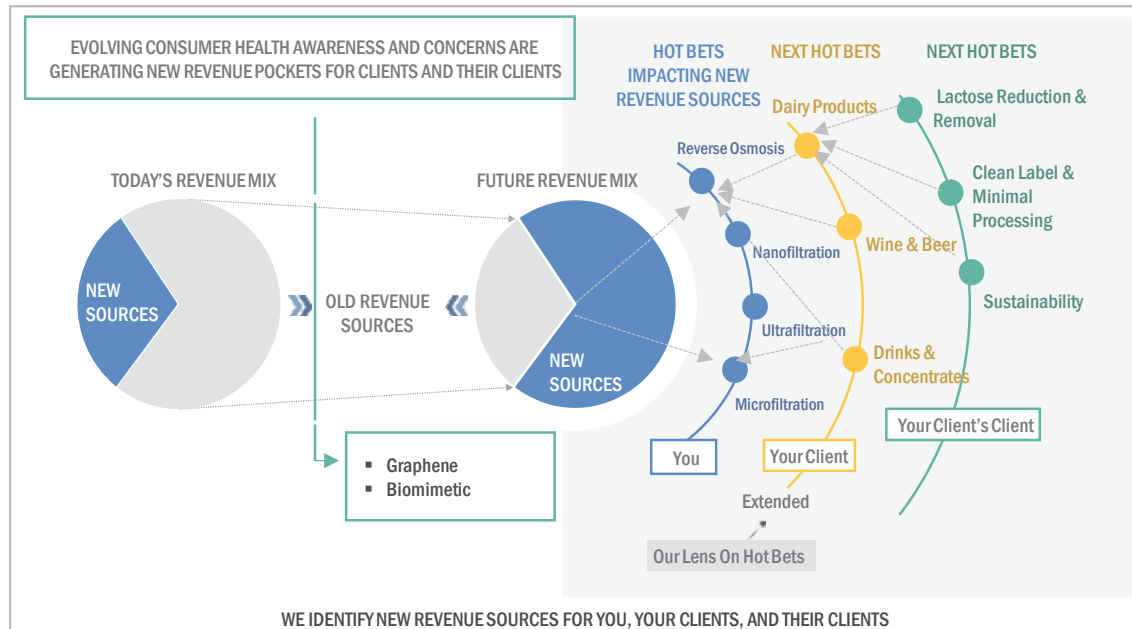
TABLE 12 ASIA PACIFIC: LIST OF REGULATORY BODIES, GOVERNMENT AGENCIES, AND OTHER ORGANIZATIONS

COUNTRY	ORGANIZATION NAME	ORGANIZATION TYPE	SHORT DESCRIPTION
India	Indian Membrane Society	Association	The Indian Membrane Society (IMS) is a registered society of scientists, academicians, technologists, consultants, and engineers from India and abroad working in the field of membranes.
Australia	MSA	Association	The Membrane Society of Australasia (MSA) aims to represent and advance membrane science and technology activities in both the research and business sectors.
Japan	Association of Membrane Separation Technology	Association	In 1983, the Japan-based Association of Membrane Separation Technology (AMST) was established. AMST is the leading organization promoting membrane technologies like desalination, water filtration, and reuse. The AMST is the only organization with a certification function for membrane filters in Japan.

Source: Association Websites

6.11 TRENDS/DISRUPTIONS IMPACTING CUSTOMERS' BUSINESSES

FIGURE 27 REVENUE SHIFT IN MEMBRANE FILTRATION MARKET



Source: Secondary Research, Primary Interviews, Industry Journals, Related Research Publications, Press Releases, and MarketsandMarkets Analysis

This section provides an overview of the revenue shift of the membrane filtration market for your clients (YC) and your client's clients (YCC). The revenue shift for membrane filtration manufacturers in the market is projected to appear across segments such as the food & beverage industry and dairy industry. Membrane technologies are increasingly being used in the productive processes of numerous industries. Membrane filtration is a more profitable technological advancement than other conventional methods because of its ability to separate extracts and specific natural essences at low or ambient temperatures.

The membrane filtration market is bringing transformative trends and disruptions to businesses, particularly in the food & beverage and dairy sectors. These industries are embracing membrane filtration to meet stringent regulations and consumer demands for product quality and safety. In the food and beverage sector, membrane filtration ensures pathogen removal and gentle processing, preserving taste and nutritional value. Similarly, the dairy industry benefits from membrane technology, using it for milk standardization, cheese production, and transforming whey into high-value products. As businesses in these sectors pivot towards sustainability, energy-efficient membranes, and resource-conserving systems are gaining ground. While these advancements offer substantial benefits, integrating them into existing processes and ensuring consistent performance pose challenges that require strategic planning and maintenance. The membrane filtration market's impact on the food & beverage and dairy industries is substantial, driven by regulatory compliance and consumer preferences. These businesses are adopting membrane filtration to enhance quality, safety, and sustainability. Navigating this evolving landscape will require a balance between leveraging the benefits of advanced membrane technology and addressing the associated implementation challenges.

6.12 PORTER'S FIVE FORCES ANALYSIS

Porter's five forces analysis is an important business analysis model that helps better understand the market dynamics and current positioning of the market stakeholders, which are buyers, suppliers, and major players in the value chain. It also helps understand the threat posed by substitutes and new entrants, the two major factors that can influence the market drastically over time. The five forces model measures competitive intensity, attractiveness, and profitability.

The competitive environment prevailing in the global membrane filtration market can be analyzed with the help of Porter's five forces analysis. Porter's five forces model provides a framework to analyze the implications of market trends and consumer demand through a deeper look at each of the five factors of the industry. The analysis below enables an improved understanding of market dynamics in the market. The factors that affect the existing business environment, along with the demand and supply in the market, are analyzed.

TABLE 13 MEMBRANE FILTRATION MARKET: PORTER'S FIVE FORCES ANALYSIS

PORTER'S FIVE FORCES	IMPACT
Threat of New Entrants	Moderate
Threat of Substitutes	Low
Bargaining Power of Buyers	Moderate
Bargaining Power of Suppliers	Moderate
Intensity of Competitive Rivalry	High

Source: Secondary Literature and MarketsandMarkets Analysis

6.12.1 THREAT OF NEW ENTRANTS

The threat of new entrants into the membrane filtration market is tempered by substantial barriers that challenge their potential impact. These barriers are multifaceted, encompassing factors ranging from financial demands to regulatory intricacies.

To effectively establish a presence in the membrane filtration market, new entrants must possess considerable capital resources. Research, development, and production of advanced filtration technologies require substantial financial investments. The market's complexity demands innovative solutions that necessitate rigorous R&D efforts, further compounding the financial commitment required. This financial barrier serves as a deterrent to many aspiring entrants, as the upfront costs can be prohibitive.

Regulatory compliance and adherence to stringent quality standards add another layer of complexity. The field of membrane filtration is intrinsically linked to public health and environmental considerations, necessitating rigorous oversight. New entrants must navigate a labyrinth of regulations and standards to ensure the safety and efficacy of their products. This compliance burden translates to additional time, effort, and costs.

Established companies in the membrane filtration arena hold a distinct advantage. They possess not only a history of successful product development but also proprietary technologies that have undergone refinement over time. These technologies are often protected by patents and intellectual property rights, making it challenging for newcomers to replicate or surpass them. The competitive degree by incumbents further raises the bar for new entrants seeking differentiation.

Furthermore, the membrane filtration market is characterized by a high degree of specialization and expertise. Established players have accumulated industry-specific knowledge, customer relationships, and distribution networks that contribute to their dominance. This accumulation of intangible assets bolsters the competitive position of existing companies and acts as a deterrent for new entrants striving to establish themselves.

Hence, the threat of new entrants is moderate.

6.12.2 THREAT OF SUBSTITUTES

In the membrane filtration market, the threat of substitutes remains relatively low. This is attributed to the unique advantages that membrane filtration brings to the table, particularly its efficiency, precision, and versatility across a spectrum of applications, including water treatment, pharmaceuticals, food & beverages, and beyond.

One of the key reasons that substitutes pose a limited threat is the exceptional performance that membrane filtration offers. This technology excels in removing even the tiniest contaminants, particles, and impurities from various liquid streams. Its ability to provide consistent and reliable results, coupled with its adaptability to diverse industries, sets it apart from potential alternatives.

While alternative technologies such as distillation and conventional filtration methods exist, they often fall short in comparison to the effectiveness and efficiency of membrane filtration. Distillation, while effective in certain scenarios, can be energy-intensive and less precise, making it less suitable for applications where precision and efficiency are paramount. Conventional filtration, on the other hand, may struggle with capturing ultra-small particles and achieving the level of purity that membrane filtration can deliver.

Moreover, membrane filtration's versatility plays a pivotal role in mitigating the threat of substitutes. It finds applications not only in treating water for consumption and industrial processes but also in ensuring product quality in pharmaceuticals, enhancing the shelf life of food and beverages, and even recovering valuable components from various streams. This breadth of applications makes it a comprehensive solution that substitutes would struggle to replicate.

Hence, the threat of substitutes is low.

6.12.3 BARGAINING POWER OF BUYERS

Buyers in this market, including food & beverage manufacturers, laboratories, and government agencies, possess a reasonable level of negotiating power when it comes to procurement decisions. The bargaining power of buyers holds substantial influence, particularly in industries like food and beverages, dairy, wineries, and breweries. These sectors have grown increasingly conscious of water quality, environmental sustainability, and stringent regulatory requirements. Therefore, buyers in these industries are keen on procuring filtration solutions that not only deliver high-quality results but also align with their sustainability goals and compliance mandates.

Buyers' bargaining power is amplified by their emphasis on quality and cost-effectiveness. The need for pure and contaminant-free water in food and beverage production, dairy processing, winemaking, and brewing drives buyers to demand superior filtration solutions that meet their specific product standards. However, buyers are also conscious of their budget constraints and seek cost-effective solutions that deliver value without compromising on quality.

The high demand for membrane filtration technologies, given their efficiency in delivering clean water and superior filtration performance, provides a certain advantage to suppliers. Yet, buyers wield significant bargaining power due to the availability of alternative filtration methods. These alternatives, ranging from traditional filtration processes to emerging technologies, offer buyers viable choices to consider.

Hence, the bargaining power of buyers is moderate.

6.12.4 BARGAINING POWER OF SUPPLIERS

In the dynamic landscape of the membrane filtration market, the role of suppliers in providing raw materials and components cannot be underestimated. Suppliers play a vital role in influencing the manufacturing process and ultimately impacting the competitiveness and profitability of companies in this sector.

The bargaining power of suppliers in this sector is considered moderate, as there are several factors influencing their negotiating strength. The market's moderate impact is attributed to the availability of multiple suppliers offering a range of raw materials and components. Manufacturers have the flexibility to choose from various sources, reducing the dependency on any single supplier. This diverse supplier base ensures a degree of competition among them, leading to competitive pricing and favorable terms for the manufacturers.

However, the quality of raw materials is directly linked to the performance of final membrane products. Suppliers offering consistent, high-quality materials hold greater sway as manufacturers depend on these inputs to meet quality standards and customer expectations. Threats of forward integration also enhance supplier power, as those capable of producing their own membranes have less incentive to offer favorable terms. Additionally, the costs incurred by manufacturers to switch suppliers can strengthen bargaining power, including both financial expenses and potential disruptions.

Supplier dependence is a crucial factor. Manufacturers heavily reliant on specific suppliers for critical materials are more likely to comply with supplier demands to ensure uninterrupted supply. The competitive landscape of the membrane filtration market also matters. In a highly competitive environment with numerous suppliers, manufacturers have more options, potentially reducing the bargaining power of any single supplier.

Nonetheless, the moderate impact is tempered by the continuous efforts of manufacturers to diversify their supplier base and establish strategic partnerships. By maintaining strong relationships with multiple suppliers and exploring alternative sources, manufacturers can mitigate the potential risks associated with overreliance on any one supplier. To maintain a competitive edge in the market, manufacturers often engage in collaborative partnerships with their suppliers, promoting long-term relationships that foster mutual growth and innovation. This approach further reduces supplier power and enables manufacturers to negotiate more favorable terms.

Hence, the bargaining power of suppliers is moderate.

6.12.5 INTENSITY OF COMPETITIVE RIVALRY

Existing competition: Numerous established companies compete for market share, resulting in an environment marked by intense rivalry and a constant drive for innovation and differentiation. These companies engage in fierce competition to capture market share, driving continuous innovation and differentiation in their product offerings. In this dynamic market, competition revolves around factors such as product quality, technological advancements, regulatory compliance, and customer service. Companies strive to develop cutting-edge testing equipment and supplies that deliver accurate and reliable results, crucial for ensuring food safety. Differentiation through technological innovation, such as the integration of automation, advanced analytics, and user-friendly interfaces, plays a vital role in gaining a competitive edge.

Established brands in the membrane filtration market have cultivated strong customer loyalty and trust through years of consistent product performance and adherence to stringent regulatory requirements. These companies benefit from their well-recognized names, extensive distribution networks, and established customer relationships, which can act as barriers to entry for new market players.

Pricing strategies also play a significant role in competitive rivalry. Companies strive to strike a balance between competitive pricing and maintaining profitability. In price-sensitive markets, this aspect can drive intense competition and necessitate effective cost-management strategies.

Moreover, the ability to provide customized filtration solutions tailored to specific customer requirements is a distinguishing factor. Companies that offer comprehensive solutions and services that cater to unique industry demands gain an advantage in this competitive space. The membrane filtration market's growth potential influences the nature of competitive rivalry. With increasing global demand for clean food & beverages products, stringent environmental regulations, and expanding applications across industries, the overall market provides ample room for multiple competitors to coexist. This coexistence is facilitated by collaborative efforts, such as partnerships and technology-sharing agreements, to address complex challenges that benefit the industry.

Hence, the intensity of competitive rivalry is high.

6.13 CASE STUDY ANALYSIS

6.13.1 SNYDER'S NFS MEMBRANES USED FOR WHEY CONCENTRATION & DE-ASHING

Challenge	Whey, a byproduct of cheese production, contains valuable components such as proteins and lactose but also undesirable minerals that need to be removed for further processing. Traditional methods for whey concentration and de-ashing often involve thermal processes, which can result in nutrient loss and increased energy consumption.
Solution Offered	Snyder's NFX and NFS membranes were tested in 2,540 spiral wound element modules. Acid whey powder (8wt%) was used as the incoming feed. Elements were tested at 490 psi with a feed flow rate of 2 gpm at 25 °C (77 °F) and permeate flux and calcium rejection were measured from 1× to 3× volumetric concentration factor (VCF). Calcium concentration was determined using the USEPA burette titration method with Hach CalVer calcium indicators.
Result	NFS membrane has an advantage over NFX in de-ashing capabilities in a feed stream comprised of acid whey powder. Though the permeating flux reached similar values by the end of the run, there was a slight difference in the overall flux decay. NFS exhibited a flux decay of approximately 73%, compared to NFX, which exhibited a flux decay of nearly 85%. There was also a comparable TOC rejection for both membrane types. There was a significant difference in calcium rejection performance between NFX and NFS at each concentration factor, which is beneficial in the production of higher-quality lactose. Overall, these results indicate that the NFS membrane has the potential to be used for whey concentration, decalcification, and de-ashing applications.

Source: Company Websites and MarketsandMarkets Analysis

6.13.2 LAGUNITAS BREWING COMPANY'S HIGH-STRENGTH BREWERY WASTEWATER TREATED TO HIGH MBR AND RO STANDARDS FOR REUSE

Challenge	<p>Beer production uses a large volume of water, with an average water-to-beer ratio of 4:1. About 25% of the water goes into the final product. At the same time, non-product contact activities, such as cleaning, cooling, and packing, consume the remaining majority of the volume. Beer manufacturing produces a large amount of organic waste, including proteins, fats, fibers, carbs, yeast, hops residues, ethanol, and suspended solids. Wastewater with a high organic content may overload municipal treatment facilities, preventing towns from receiving the effluent or only receiving it at a high surcharge. Breweries will be forced to transport effluents to larger treatment facilities under such circumstances or, in the worst-case scenario, scale back operations.</p>
Solution Offered	<p>In Petaluma, California, Lagunitas Brewing Company is one brewery that has overcome these challenges. Lagunitas used reverse osmosis (RO) and membrane bioreactor (MBR) technology from Toray to incorporate reuse into the wastewater treatment system. By removing 99% of contaminants, Toray's flat sheet MBR module sends the filtrate to an RO for polishing to exceptionally high standards and expanding the potential for reusing recycled water in the brewing process. The long-lasting and low-fouling characteristics of Toray's MBR and RO membranes allow them to function dependably in wastewater conditions for longer membrane life spans, cleaning range, and lower overall costs. UV disinfection of the RO permeate eliminates all leftover bacteria as the last step.</p>
Result	<p>Lagunitas used an advanced membrane treatment method to accomplish the following:</p> <ul style="list-style-type: none"> ▪ Reduction of water-to-beer ratio from 4:1 to 2.5:1 ▪ About 70% reduction in the volume of wastewater ▪ Approximately 40% reduction in water usage

Source: Company Websites and MarketsandMarkets Analysis

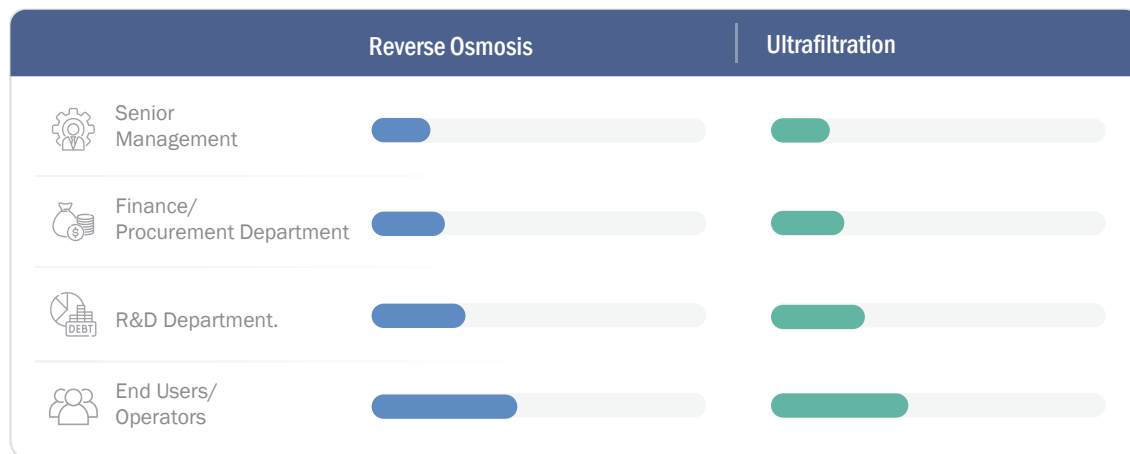
6.14 KEY STAKEHOLDERS AND BUYING CRITERIA

6.14.1 KEY STAKEHOLDERS IN BUYING PROCESS

The figure and table below give a holistic summary of the involvement of different stakeholders in the buying process for membrane filtration technology in the market.

End users serve as the linchpin in the buying criteria process for membrane filtration systems, offering invaluable perspectives and practical insights that shape the selection of the right system. Their role begins with identifying the need for membrane filtration within their specific application, followed by defining critical system requirements, such as flow rates and compatibility. Research and Development (R&D) departments play a pivotal role in the buying criteria for membrane filtration systems. Their involvement is essential in ensuring that the selected system aligns with the organization's long-term goals, technical requirements, and innovation strategies. Senior management plays a crucial role in establishing and influencing the buying criteria for membrane filtration systems within an organization. Their responsibilities go beyond the immediate technical aspects of the purchase and encompass strategic, financial, and organizational considerations. Senior management typically sets the overarching objectives that guide the selection process, including cost-efficiency, sustainability, and alignment with the company's mission and values.

FIGURE 28 INFLUENCE OF STAKEHOLDERS ON BUYING PROCESS FOR MEMBRANE FILTRATION, BY TYPE



Source: Secondary Research, Primary Interviews, Industry Journals, Related Research Publications, Press Releases, and MarketsandMarkets Analysis

TABLE 14 INFLUENCE OF STAKEHOLDERS ON BUYING PROCESS FOR MEMBRANE FILTRATION, BY TYPE

Stakeholder	Reverse Osmosis	Ultrafiltration
Senior Management	15%	15%
Finance/Procurement Department	20%	20%
R&D Department	25%	25%
End Users/Operators	40%	40%

Source: Secondary Research, Primary Interviews, Industry Journals, Related Research Publications, Press Releases, and MarketsandMarkets Analysis

6.14.2 BUYING CRITERIA

This section identifies the key criteria for selecting suppliers or vendors and their weight for the types of membrane filtration.

In the dynamic membrane filtration market, purchasing decisions hinge on several crucial factors. Buyers must carefully assess the technological advancements available, ensuring that they align with their specific requirements for efficiency and effectiveness. Brand reputation holds significant sway, indicating reliability and quality in critical applications. Pricing considerations, while important, must be balanced with long-term operational costs. Adherence to regulatory standards is non-negotiable, and dependable service and support are paramount to minimize downtime. Moreover, the strength of the relationship with the supplier/vendor is pivotal, fostering collaboration, customization, and a deep understanding of unique needs. In this intricate ecosystem, a holistic approach to these buying criteria is essential for success and sustainability in the membrane filtration market.

TABLE 15 KEY CRITERIA FOR SELECTING SUPPLIER/VENDOR, BY TYPE

Buying Criteria	Reverse Osmosis	Ultrafiltration
Technology	5	5
Pricing	3	2
Brand	4	4
Regulatory Compliance	5	5
Service	3	3
Relationship with Suppliers/Vendors	3	3

Note: Respondents rated each criterion on a scale of one (least important) to five (critical).

FIGURE 29 KEY CRITERIA FOR SELECTING SUPPLIER/VENDOR, BY TYPE

Source: Secondary Research, Primary Interviews, Industry Journals, Related Research Publications, Press Releases, and MarketsandMarkets Analysis

7 MEMBRANE FILTRATION MARKET, BY APPLICATION

KEY FINDINGS

- The dairy products segment dominated the global membrane filtration market, with a value of USD 2,371.3 million in 2022. Increasing global demand for dairy products is one of the major factors driving the membrane filtration market for dairy products.
- The drinks & concentrates segment is projected to grow at a higher CAGR of 7.9% during the forecast period. Growing utilization of nanofiltration membranes in the food & beverage industry is anticipated to drive growth in this segment.
- The wine & beer market is projected to reach USD 2,271.8 million by 2028. The rise in the consumption of wine and beer in the world drives the growth.
- The increasing use of membrane filtration in the dairy & food industry for pasteurization, sterilization, and concentration processes creates a huge demand for membrane filtration technologies.
- The membrane filtration market for drinks & concentrates is projected to reach USD 2,988.2 million by 2028. This is mainly due to the growing demand for fruit & carbonated drinks.

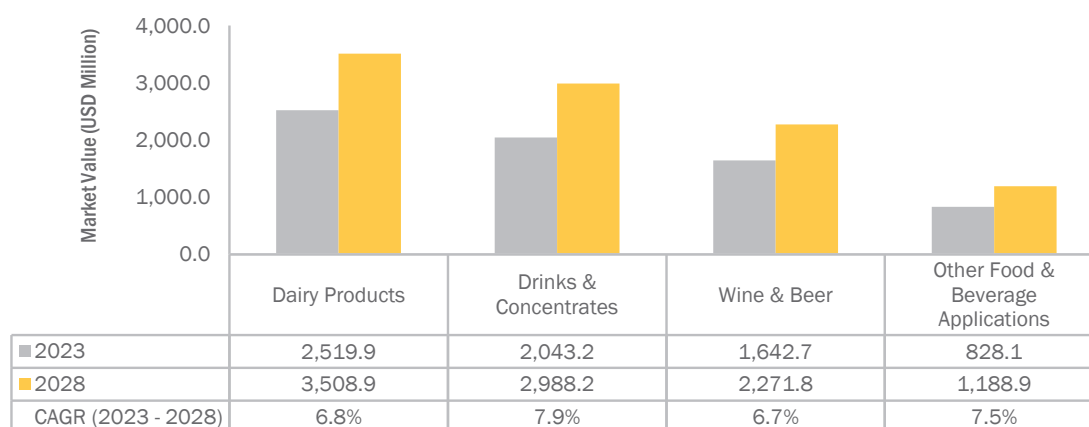
7.1 INTRODUCTION

Based on application, the membrane filtration market is categorized into dairy products, drinks & concentrates, wine & beer, and other food & beverage applications. The dairy products segment dominated the global membrane filtration market and is projected to continue to dominate the market during the review period.

The drinks & concentrates segment is projected to grow at a higher CAGR of 7.9% from 2023 to 2028 due to the increased use of membrane filtration in a wide range of food & beverage applications.

Veolia (US), Sartorius AG (Germany), Merck KGaA (Germany), Synder Filtration, Inc. (US), and Koch Separation Solutions (US) are some manufacturers offering membrane filtration products and services for the food & beverage industry.

FIGURE 30 DAIRY PRODUCTS SEGMENT TO DOMINATE MARKET DURING FORECAST PERIOD



Source: Company Press Releases, Annual Reports, Expert Interviews, and MarketsandMarkets Analysis

TABLE 16 MEMBRANE FILTRATION MARKET, BY APPLICATION, 2018–2022 (USD MILLION)

Application	2018	2019	2020	2021	2022	CAGR (2018–2022)
Dairy Products	1,889.6	1,995.6	2,110.6	2,235.5	2,371.3	5.8%
Drinks & Concentrates	1,454.6	1,552.7	1,659.8	1,776.6	1,904.2	7.0%
Wine & Beer	1,236.2	1,305.1	1,379.7	1,460.6	1,548.2	5.8%
Other Food & Beverage Applications	602.1	639.9	681.1	725.9	774.7	6.5%
Total	5,182.4	5,493.4	5,831.2	6,198.6	6,598.4	6.2%

Source: Related Journals, Annual Reports, Press Releases, Company Publications, Company Websites, Expert Interviews, and MarketsandMarkets Analysis

TABLE 17 MEMBRANE FILTRATION MARKET, BY APPLICATION, 2023–2028 (USD MILLION)

Application	2023	2024	2025	2026	2027	2028	CAGR (2023-2028)
Dairy Products	2,519.9	2,682.6	2,861.1	3,057.0	3,272.2	3,508.9	6.8%
Drinks & Concentrates	2,043.2	2,196.5	2,365.6	2,552.5	2,759.2	2,988.2	7.9%
Wine & Beer	1,642.7	1,746.2	1,859.7	1,984.3	2,121.2	2,271.8	6.7%
Other Food & Beverage Applications	828.1	886.9	951.7	1,023.1	1,101.8	1,188.9	7.5%
Total	7,033.9	7,512.2	8,038.1	8,616.8	9,254.4	9,957.8	7.2%

Source: Related Journals, Annual Reports, Press Releases, Company Publications, Company Websites, Expert Interviews, and MarketsandMarkets Analysis

7.2 DAIRY PRODUCTS

The dairy products segment is further divided into liquid milk and other dairy products. Membrane filtration technologies are increasingly being used to remove bacteria, microorganisms, particulates, and natural organic material from milk, which can change the color, taste, and odor of milk. For this, various types of technologies are used, including microfiltration (MF), ultrafiltration (UF), reverse osmosis (RO), and nanofiltration (NF). Microfiltration membranes have the largest pore sizes; they are typically used to filter out large particles and various microorganisms from milk.

Membrane filtration is a cornerstone of the dairy industry, serving as a vital technology for separating and concentrating various components of milk and dairy products. By employing semipermeable membranes with specific pore sizes, this process selectively allows certain molecules or particles to pass through while retaining others. Microfiltration, ultrafiltration, nanofiltration, and reverse osmosis are the key membrane filtration techniques used in dairy processing. These techniques find applications ranging from milk clarification, protein isolation, lactose reduction, and mineral removal to whey processing. Membrane filtration offers a plethora of benefits, including improved product quality, extended shelf life, reduced energy consumption, and enhanced sustainability. It has revolutionized dairy production by providing the flexibility needed to meet diverse consumer demands while minimizing environmental impact and waste, making it an essential tool in the modern dairy processing plant.

Microfiltration (MF) employs membranes with relatively larger pore sizes, typically falling within the range of 0.1 to 10 micrometers. This method is widely utilized to eliminate larger particles such as bacteria, somatic cells, and certain fat globules from milk, thereby enhancing its microbial quality and extending its shelf life.

Ultrafiltration (UF) employs membranes with smaller pores, typically measuring between 0.001 and 0.1 micrometers. Its primary purpose is to separate smaller constituents such as proteins, lactose, and minerals from milk, leading to the creation of concentrated dairy products such as milk protein concentrates and whey protein concentrates.

Nanofiltration (NF) involves membranes with even smaller pore sizes, typically falling within the range of 0.001 to 0.01 micrometers. NF is applied to selectively eliminate specific ions and tiny molecules, including certain salts and lactose, from milk and whey. This process facilitates the production of dairy products with reduced lactose content and demineralized characteristics.

Reverse Osmosis (RO) utilizes membranes with the smallest pore sizes, usually less than 0.001 micrometers. RO is employed to concentrate liquid dairy products by extracting water, resulting in products like condensed milk or milk with reduced water content.

TABLE 18 DAIRY PRODUCTS: MEMBRANE FILTRATION MARKET, BY SUBAPPLICATION, 2018–2022 (USD MILLION)

Subapplication	2018	2019	2020	2021	2022	CAGR (2018–2022)
Liquid Milk	1,241.4	1,313.8	1,392.0	1,476.7	1,568.4	6.0%
Other Dairy Products	648.1	681.8	718.6	758.9	802.9	5.5%
Total	1,889.6	1,995.6	2,110.6	2,235.5	2,371.3	5.8%

Source: Related Journals, Annual Reports, Press Releases, Company Publications, Company Websites, Expert Interviews, and MarketsandMarkets Analysis

TABLE 19 DAIRY PRODUCTS: MEMBRANE FILTRATION MARKET, BY SUBAPPLICATION, 2023–2028 (USD MILLION)

Subapplication	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Liquid Milk	1,668.8	1,778.8	1,899.4	2,031.8	2,177.3	2,337.4	7.0%
Other Dairy Products	851.1	903.8	961.7	1,025.2	1,094.9	1,171.5	6.6%
Total	2,519.9	2,682.6	2,861.1	3,057.0	3,272.2	3,508.9	6.8%

Source: Related Journals, Annual Reports, Press Releases, Company Publications, Company Websites, Expert Interviews, and MarketsandMarkets Analysis

TABLE 20 DAIRY PRODUCTS: MEMBRANE FILTRATION MARKET, BY REGION, 2018–2022 (USD MILLION)

Region	2018	2019	2020	2021	2022	CAGR (2018–2022)
North America	497.4	520.9	546.3	573.7	603.3	4.9%
Europe	406.0	422.0	439.2	457.7	477.5	4.1%
Asia Pacific	692.8	738.5	788.6	843.5	903.6	6.9%
South America	69.7	73.5	77.6	82.0	86.8	5.6%
RoW	223.7	240.6	258.9	278.6	300.0	7.6%
Total	1,889.6	1,995.6	2,110.6	2,235.5	2,371.3	5.8%

Source: Related Journals, Annual Reports, Press Releases, Company Publications, Company Websites, Expert Interviews, and MarketsandMarkets Analysis

TABLE 21 DAIRY PRODUCTS: MEMBRANE FILTRATION MARKET, BY REGION, 2023–2028 (USD MILLION)

Region	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
North America	635.1	669.9	707.8	749.3	794.7	844.3	5.9%
Europe	498.0	520.3	544.5	570.9	599.5	630.7	4.8%
Asia Pacific	971.0	1,045.0	1,126.2	1,215.6	1,314.1	1,422.6	7.9%
South America	93.2	100.2	107.9	116.5	125.9	136.4	7.9%
RoW	322.5	347.3	374.6	404.8	438.1	474.9	8.0%
Total	2,519.9	2,682.6	2,861.1	3,057.0	3,272.2	3,508.9	6.8%

Source: Related Journals, Annual Reports, Press Releases, Company Publications, Company Websites, Expert Interviews, and MarketsandMarkets Analysis

TABLE 22 DAIRY PRODUCTS: MEMBRANE FILTRATION MARKET, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	1,127.4	1,196.3	1,271.8	1,354.5	1,445.4	6.4%
Ultrafiltration (UF)	469.8	493.3	518.0	543.9	571.4	5.0%
Microfiltration (MF)	159.5	167.4	176.0	185.4	196.1	5.3%
Nanofiltration (NF)	132.9	138.7	144.8	151.8	158.4	4.5%
Total	1,889.6	1,995.6	2,110.6	2,235.5	2,371.3	5.8%

Source: Related Research Publications, Associations Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 23 DAIRY PRODUCTS: MEMBRANE FILTRATION MARKET, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	1,543.2	1,650.6	1,768.6	1,898.4	2,041.4	2,199.0	7.3%
Ultrafiltration (UF)	606.3	644.5	686.3	732.1	782.4	837.5	6.7%
Microfiltration (MF)	203.5	211.4	219.9	229.1	239.0	249.6	4.2%
Nanofiltration (NF)	166.9	176.2	186.3	197.3	209.5	222.7	5.9%
Total	2,519.9	2,682.6	2,861.1	3,057.0	3,272.2	3,508.9	6.8%

Source: Related Research Publications, Associations Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

7.2.1 LIQUID MILK

7.2.1.1 Growing consumer interest in broad spectrum of liquid milk offerings to fuel market expansion

The widespread adoption of membrane filtration technology has brought about significant changes in the liquid milk industry, leading to its application in various areas. Membrane filtration is employed to clarify and concentrate milk, effectively removing impurities and increasing the milk's solid content. It plays a crucial role in separating milk components; enabling the isolation of proteins, fats, and lactose, and facilitating the production of specialized milk products like fat-free milk or lactose-free milk. Moreover, it contributes to the microbiological safety of milk by eliminating harmful microbes and pathogens, ensuring milk's safety for consumers. Membrane filtering assists in standardization and homogenization, simplifying the production of consistent milk products.

The increasing use of membrane filtration technology in the liquid milk industry can be attributed to various factors. Primarily, there is a heightened focus on ensuring the quality of milk products as consumers increasingly seek high-quality options with longer shelf lives. Membrane filtration plays a crucial role in achieving this by effectively eliminating impurities and harmful microorganisms. Furthermore, there is a growing trend towards meeting specific nutritional requirements, and membrane filtration enables the isolation and customization of milk components to create specialized products. Additionally, the demand for a diverse range of products, including lactose-free milk and high-protein milk, has spurred the adoption of membrane filtration. Concerns about sustainability and the necessity of complying with strict food safety regulations have also contributed to its growing popularity. This technology is seen as a more environmentally friendly and efficient solution, aligning with sustainability objectives and ensuring adherence to rigorous food safety standards.

TABLE 24 LIQUID MILK: MEMBRANE FILTRATION MARKET, BY SUBAPPLICATION, 2018–2022 (USD MILLION)

Subapplication	2018	2019	2020	2021	2022	CAGR (2018–2022)
Milk Concentration	654.2	696.0	740.7	788.8	840.5	6.5%
Milk Protein Fractionation	430.8	452.7	476.7	503.0	531.6	5.4%
Milk Pre-Concentration	91.9	97.5	103.6	110.3	117.7	6.4%
Water Recovery	64.6	67.6	70.9	74.5	78.5	5.0%
Total	1,241.4	1,313.8	1,392.0	1,476.7	1,568.4	6.0%

Source: Related Journals, Annual Reports, Press Releases, Company Publications, Company Websites, Expert Interviews, and MarketsandMarkets Analysis

TABLE 25 LIQUID MILK: MEMBRANE FILTRATION MARKET, BY SUBAPPLICATION, 2023–2028 (USD MILLION)

Subapplication	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Milk Concentration	897.1	959.2	1,027.1	1,101.8	1,183.8	1,274.0	7.3%
Milk Protein Fractionation	563.0	597.3	635.0	676.3	721.6	771.3	6.5%
Milk Pre-Concentration	125.9	134.8	144.6	155.5	167.5	180.7	7.5%
Water Recovery	82.8	87.5	92.7	98.3	104.5	111.3	6.1%
Total	1,668.8	1,778.8	1,899.4	2,031.8	2,177.3	2,337.4	7.0%

Source: Related Journals, Annual Reports, Press Releases, Company Publications, Company Websites, Expert Interviews, and MarketsandMarkets Analysis

TABLE 26 LIQUID MILK: MEMBRANE FILTRATION MARKET, BY REGION, 2018–2022 (USD MILLION)

Region	2018	2019	2020	2021	2022	CAGR (2018–2022)
North America	343.2	360.7	379.6	399.8	421.5	5.3%
Europe	258.6	270.1	282.3	295.3	309.1	4.6%
Asia Pacific	448.8	476.7	507.3	540.9	577.8	6.5%
South America	46.1	48.8	51.7	54.8	58.2	6.0%
RoW	144.7	157.5	171.1	185.9	201.8	8.7%
Total	1,241.4	1,313.8	1,392.0	1,476.7	1,568.4	6.0%

Source: Related Journals, Annual Reports, Press Releases, Company Publications, Company Websites, Expert Interviews, and MarketsandMarkets Analysis

TABLE 27 LIQUID MILK: MEMBRANE FILTRATION MARKET, BY REGION, 2023–2028 (USD MILLION)

Region	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
North America	444.8	470.2	498.0	528.4	561.6	598.0	6.1%
Europe	323.0	338.1	354.5	372.3	391.6	412.6	5.0%
Asia Pacific	618.6	666.2	718.6	776.2	839.8	910.0	8.0%
South America	62.6	67.4	72.7	78.5	85.0	92.2	8.1%
RoW	219.8	236.9	255.7	276.4	299.3	324.6	8.1%
Total	1,668.8	1,778.8	1,899.4	2,031.8	2,177.3	2,337.4	7.0%

Source: Related Journals, Annual Reports, Press Releases, Company Publications, Company Websites, Expert Interviews, and MarketsandMarkets Analysis

7.2.1.2 Milk protein fractionation

7.2.1.2.1 Surging consumer demand for protein-packed products to boost growth

Milk protein fractionation using membrane filtration is becoming increasingly popular in the liquid milk sector. Several causes have contributed to this spike in popularity. Quality assurance is becoming increasingly important, as customers expect high-quality milk products with long shelf life. Membrane filtration is critical in attaining this goal because it efficiently removes contaminants and pathogens from milk, assuring product safety and preserving required quality standards.

The increasing demand for membrane filtration is also driven by the necessity to meet specific nutritional requirements. This technology allows for precise separation and modification of milk constituents like proteins, fats, and lactose. This customization aligns with market trends, facilitating the creation of specialized milk products such as lactose-free milk and high-protein variations, catering to a diverse range of consumer preferences.

Membrane separations can be recognized as a valid choice for conventional techniques or as a novel food processing technique since it is considered green technology. There is a widespread implementation of membrane techniques in several fields, including the dairy industry. Fractionation techniques such as membrane filtration are the best possible way to use milk components for human nutrition since it has many advantages, such as reduced energy consumption, fewer processing steps, more efficient separation, enhanced final product quality, and being environmentally friendly. It is essential to understand the effects of membrane processing conditions on the separation and fractionation of casein and whey proteins from milk for developing innovative processes to obtain highly functional whey proteins. Whey and milk components have a sustainable market future since they have a wide range of application areas in the food industry as additives in bakery, dairy products, meats, and beverages. However, their usage area is limited because the functionality of these products is not consistent in the food industry.

For this reason, there has been significant commercial interest in the production of milk and individual whey proteins with recognizable functional and nutritional properties. Recent improvements in membrane processing provide new exciting and economically convenient opportunities to obtain high-quality products with low energy consumption and low cost, meant for both functional and nutritional use. Therefore, membrane filtration technology should concentrate more on these new opportunities to obtain milk proteins with desired healthy and functional levels.

The desire for a broader product portfolio has spurred the adoption of membrane filtration. It empowers producers to segregate milk proteins into pure fractions consisting of casein and whey protein, opening new economic opportunities. This ability to offer unique and appealing products enhances the appeal of this technology within the dairy industry.

The USDA in October 2022 forecasts India's SMP consumption in MY 2023 at 685,000 MT, up by 2 percent increase in comparison to the MY 2022 revised consumption estimates of 670,000 MT, and forecasts exports of SMP in MY 2023 at 60,000 MT, up by 11 percent from Post's revised estimate of 54,000 MT.

TABLE 28 MILK PROTEIN FRACTIONATION: MEMBRANE FILTRATION MARKET, BY REGION, 2018–2022 (USD MILLION)

Region	2018	2019	2020	2021	2022	CAGR (2018–2022)
North America	119.1	124.1	129.5	135.5	142.0	4.5%
Europe	87.9	90.6	93.6	96.9	100.5	3.4%
Asia Pacific	158.2	169.6	182.1	195.7	210.7	7.4%
South America	15.8	16.5	17.3	18.1	19.1	4.8%
RoW	49.8	51.9	54.2	56.7	59.4	4.5%
Total	430.8	452.7	476.7	503.0	531.6	5.4%

Source: Related Journals, Annual Reports, Press Releases, Company Publications, Company Websites, Expert Interviews, and MarketsandMarkets Analysis

TABLE 29 MILK PROTEIN FRACTIONATION: MEMBRANE FILTRATION MARKET, BY REGION, 2023–2028 (USD MILLION)

Region	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
North America	149.0	156.6	164.9	173.9	183.8	194.7	5.5%
Europe	103.9	107.7	111.8	116.2	121.1	126.4	4.0%
Asia Pacific	227.3	245.6	265.6	287.6	311.9	338.6	8.3%
South America	20.4	21.8	23.4	25.2	27.1	29.3	7.5%
RoW	62.4	65.7	69.3	73.3	77.6	82.3	5.7%
Total	563.0	597.3	635.0	676.3	721.6	771.3	6.5%

Source: Related Journals, Annual Reports, Press Releases, Company Publications, Company Websites, Expert Interviews, and MarketsandMarkets Analysis

7.2.1.3 Milk concentration

7.2.1.3.1 Need for preserving vital elements in milk to spur market expansion

Concentration through membrane filtration replaces the evaporation technique, which can be efficiently achieved by RO. In combination with UF, MF is mostly used in processing milk protein concentrates (MPC). 'High-concentration RO' is the latest method applied for the concentration of orange and apple juices, which uses a combination of two membranes. RO and NF are found to be cost-effective compared to evaporation in sugar juices.

Milk concentration, achieved through membrane filtration, has become a critical process in the dairy industry, driven by several key factors. First and foremost, there is an escalating emphasis on ensuring the quality and safety of milk products as consumers increasingly seek high-quality options with extended shelf lives. Membrane filtration plays a pivotal role in meeting this demand by efficiently removing impurities, contaminants, and harmful microorganisms from milk, thus ensuring product integrity and enhancing overall quality.

Efficiency is another driving force behind the adoption of membrane filtration in milk concentration. With specialized membranes, this technology effectively removes excess water from milk while preserving essential components like proteins, vitamins, and minerals. This not only streamlines production processes but also reduces energy consumption, making it an economically attractive choice for dairy producers.

TABLE 30 MILK CONCENTRATION: MEMBRANE FILTRATION MARKET, BY REGION, 2018–2022 (USD MILLION)

Region	2018	2019	2020	2021	2022	CAGR (2018–2022)
North America	191.8	203.0	214.8	227.5	240.9	5.9%
Europe	136.8	144.4	152.3	160.6	169.3	5.5%
Asia Pacific	225.9	237.4	250.2	264.3	279.7	5.5%
South America	23.9	25.5	27.3	29.2	31.3	7.0%
RoW	75.8	85.6	96.0	107.2	119.3	12.0%
Total	654.2	696.0	740.7	788.8	840.5	6.5%

Source: Related Journals, Annual Reports, Press Releases, Company Publications, Company Websites, Expert Interviews, and MarketsandMarkets Analysis

TABLE 31 MILK CONCENTRATION: MEMBRANE FILTRATION MARKET, BY REGION, 2023–2028 (USD MILLION)

Region	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
North America	255.3	271.0	288.1	306.9	327.4	349.9	6.5%
Europe	178.4	188.1	198.7	210.0	222.4	235.7	5.7%
Asia Pacific	296.8	318.3	341.9	367.9	396.6	428.3	7.6%
South America	33.8	36.5	39.5	42.8	46.5	50.6	8.4%
RoW	133.0	145.3	159.0	174.1	190.9	209.5	9.5%
Total	897.1	959.2	1,027.1	1,101.8	1,183.8	1,274.0	7.3%

Source: Related Journals, Annual Reports, Press Releases, Company Publications, Company Websites, Expert Interviews, and MarketsandMarkets Analysis

7.2.1.4 Milk pre-concentration

7.2.1.4.1 Growing need to extend shelf-life of milk powder to propel adoption of membrane filtration technologies for milk pre-concentration

The dairy industry's need for membrane filtration has been gradually increasing, notably in the context of milk pre-concentration. This increase can be ascribed to several reasons that are driving the need for milk pre-concentration. For starters, dairy processors are always under pressure to improve production efficiency while preserving product quality. They can efficiently achieve these goals by lowering the amount of liquid milk by pre-concentration. The economic and environmental advantages of decreased transportation costs associated with concentrated milk have made pre-concentration an appealing alternative. Furthermore, concentrated milk products have a longer shelf life, which is important for dairy farmers looking to broaden their distribution reach.

Various specialized applications have emerged within the field of milk pre-concentration. Dairy processing, encompassing the production of cheese, yogurt, and butter, relies significantly on milk pre-concentration to maintain product consistency and reduce the need for extensive on-site processing. Membrane filtration is particularly advantageous in the preparation of infant formula, where precise milk concentration is critical to ensure nutritional quality. The production of milk powder, a commonly used dairy ingredient, hinges on pre-concentration to remove water content, thereby extending shelf life and improving storage efficiency. The ability to tailor milk composition to meet consumer preferences in functional dairy products like high-protein or low-lactose milk has gained increasing importance, with membrane filtration serving as a crucial tool to achieve these objectives.

TABLE 32 MILK PRE-CONCENTRATION: MEMBRANE FILTRATION MARKET, BY REGION, 2018–2022 (USD MILLION)

Region	2018	2019	2020	2021	2022	CAGR (2018–2022)
North America	20.9	21.9	23.0	24.2	25.5	5.1%
Europe	17.8	18.6	19.4	20.2	21.2	4.4%
Asia Pacific	39.0	42.1	45.5	49.3	53.5	8.2%
South America	3.4	3.6	3.8	4.0	4.3	5.8%
RoW	10.7	11.3	11.9	12.5	13.3	5.5%
Total	91.9	97.5	103.6	110.3	117.7	6.4%

Source: Related Journals, Annual Reports, Press Releases, Company Publications, Company Websites, Expert Interviews, and MarketsandMarkets Analysis

TABLE 33 MILK PRE-CONCENTRATION: MEMBRANE FILTRATION MARKET, BY REGION, 2023–2028 (USD MILLION)

Region	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
North America	26.9	28.5	30.2	32.0	34.0	36.2	6.1%
Europe	22.1	23.1	24.3	25.5	26.8	28.2	5.0%
Asia Pacific	58.1	63.2	68.9	75.2	82.3	90.1	9.2%
South America	4.6	5.0	5.4	5.9	6.4	6.9	8.5%
RoW	14.1	15.0	15.9	16.9	18.0	19.2	6.4%
Total	125.9	134.8	144.6	155.5	167.5	180.7	7.5%

Source: Related Journals, Annual Reports, Press Releases, Company Publications, Company Websites, Expert Interviews, and MarketsandMarkets Analysis

7.2.1.5 Water recovery

7.2.1.5.1 Stringent environmental regulations to drive demand for membrane filtration for water recovery

Water recovery, a critical facet of responsible resource management, has gained immense importance in recent years as global concerns about water scarcity, environmental preservation, and population growth have intensified. Membrane filtration technology has emerged as a key player in facilitating water recovery across various application segments.

The increasing demand for membrane filtration in water recovery is driven by several factors, including stringent environmental regulations, the need to reduce water consumption, population growth, and continuous advancements in membrane technology. The dairy industry stands out as an exemplar where membrane filtration has made a substantial impact. In this industry, membrane filtration systems are used to treat and recycle wastewater, reduce water usage during cleaning processes, ensure effluent compliance, and support sustainability goals. As the world's water challenges persist and industries seek sustainable solutions, the demand for membrane filtration is poised to continue its growth trajectory, making it an indispensable technology in the realm of water recovery.

TABLE 34 WATER RECOVERY: MEMBRANE FILTRATION MARKET, BY REGION, 2018–2022 (USD MILLION)

Region	2018	2019	2020	2021	2022	CAGR (2018–2022)
North America	11.3	11.7	12.1	12.6	13.1	3.7%
Europe	16.0	16.5	16.9	17.5	18.0	3.0%
Asia Pacific	25.8	27.6	29.5	31.6	33.9	7.1%
South America	3.0	3.1	3.3	3.4	3.6	4.4%
RoW	8.4	8.7	9.1	9.4	9.9	4.1%
Total	64.6	67.6	70.9	74.5	78.5	5.0%

Source: Related Journals, Annual Reports, Press Releases, Company Publications, Company Websites, Expert Interviews, and MarketsandMarkets Analysis

TABLE 35 WATER RECOVERY: MEMBRANE FILTRATION MARKET, BY REGION, 2023–2028 (USD MILLION)

Region	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
North America	13.6	14.2	14.9	15.6	16.3	17.2	4.7%
Europe	18.6	19.2	19.8	20.5	21.3	22.2	3.6%
Asia Pacific	36.4	39.2	42.2	45.5	49.1	53.0	7.8%
South America	3.8	4.0	4.3	4.6	5.0	5.3	7.1%
RoW	10.4	10.9	11.5	12.1	12.8	13.6	5.6%
Total	82.8	87.5	92.7	98.3	104.5	111.3	6.1%

Source: Related Journals, Annual Reports, Press Releases, Company Publications, Company Websites, Expert Interviews, and MarketsandMarkets Analysis

7.2.2 OTHER DAIRY PRODUCTS

In other dairy products, the use of membrane filtration technology has revolutionized various application segments, including whey processing, milk and whey-based ingredients, and cheese production. This advanced filtration technique has significantly impacted the quality, efficiency, and sustainability of these dairy product processes.

TABLE 36 OTHER DAIRY PRODUCTS: MEMBRANE FILTRATION MARKET, BY SUBAPPLICATION, 2018–2022 (USD MILLION)

Subapplication	2018	2019	2020	2021	2022	CAGR (2018–2022)
Whey	293.6	309.9	327.7	347.2	368.6	5.9%
Milk & Whey-based Ingredients	86.2	89.9	94.0	98.4	103.2	4.6%
Cheese	268.3	282.0	297.0	313.3	331.1	5.4%
Total	648.1	681.8	718.6	758.9	802.9	5.5%

Source: Related Journals, Annual Reports, Press Releases, Company Publications, Company Websites, Expert Interviews, and MarketsandMarkets Analysis

TABLE 37 OTHER DAIRY PRODUCTS: MEMBRANE FILTRATION MARKET, BY SUBAPPLICATION, 2023–2028 (USD MILLION)

Subapplication	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Whey	391.9	417.6	445.7	476.6	510.6	548.0	6.9%
Milk & Whey-based Ingredients	108.5	114.2	120.5	127.3	134.9	143.1	5.7%
Cheese	350.7	372.1	395.5	421.2	449.4	480.5	6.5%
Total	851.1	903.8	961.7	1,025.2	1,094.9	1,171.5	6.6%

Source: Related Journals, Annual Reports, Press Releases, Company Publications, Company Websites, Expert Interviews, and MarketsandMarkets Analysis

TABLE 38 OTHER DAIRY PRODUCTS: MEMBRANE FILTRATION MARKET, BY REGION, 2018–2022 (USD MILLION)

Region	2018	2019	2020	2021	2022	CAGR (2018–2022)
North America	154.2	160.2	166.8	173.9	181.8	4.2%
Europe	147.4	151.9	156.9	162.4	168.4	3.4%
Asia Pacific	244.0	261.8	281.3	302.6	325.9	7.5%
South America	23.6	24.7	25.9	27.2	28.6	4.9%
RoW	79.0	83.2	87.7	92.7	98.2	5.6%
Total	648.1	681.8	718.6	758.9	802.9	5.5%

Source: Related Journals, Annual Reports, Press Releases, Company Publications, Company Websites, Expert Interviews, and MarketsandMarkets Analysis

TABLE 39 OTHER DAIRY PRODUCTS: MEMBRANE FILTRATION MARKET, BY REGION, 2023–2028 (USD MILLION)

Region	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
North America	190.3	199.6	209.8	220.9	233.1	246.4	5.3%
Europe	175.0	182.2	190.0	198.6	207.9	218.1	4.5%
Asia Pacific	352.4	378.7	407.6	439.4	474.2	512.6	7.8%
South America	30.6	32.8	35.3	37.9	40.9	44.2	7.6%
RoW	102.7	110.4	118.9	128.3	138.7	150.2	7.9%
Total	851.1	903.8	961.7	1,025.2	1,094.9	1,171.5	6.6%

Source: Related Journals, Annual Reports, Press Releases, Company Publications, Company Websites, Expert Interviews, and MarketsandMarkets Analysis

7.2.2.1 Whey

7.2.2.1.1 Rising global demand for whey protein to boost adoption of membrane filtration technologies

Whey, a byproduct of cheese and yogurt manufacture, was formerly thought to be waste. Whey, on the other hand, has become a lucrative resource with the invention of membrane filtration. Membrane filtration is used to separate whey components from the liquid, such as proteins and lactose, resulting in whey protein concentrate (WPC) and whey protein isolate (WPI). These high-quality protein supplements are used in sports nutrition, baby formula, and functional meals. Membrane filtering increases the value of whey while reducing waste and environmental effects.

Different types of membranes, such as polymers, ceramic membranes, and modification membranes, are used for various purposes, such as increasing permeation flux, reducing membrane fouling, and increasing the protein rejection rate, concentration, fractionation, and purification of whey protein. Membrane fouling factors during the whey protein ultrafiltration process, which included whey protein conformation, membrane filtration conditions, and the interaction between proteins and the membrane surface or pores, were also discussed and analyzed to reveal the membrane fouling mechanism.

TABLE 40 WHEY: MEMBRANE FILTRATION MARKET, BY REGION, 2018–2022 (USD MILLION)

Region	2018	2019	2020	2021	2022	CAGR (2018–2022)
North America	73.5	76.7	80.1	83.8	87.9	4.6%
Europe	65.9	68.1	70.6	73.3	76.3	3.7%
Asia Pacific	107.0	114.9	123.6	133.0	143.4	7.6%
South America	10.9	11.4	12.0	12.7	13.4	5.3%
RoW	36.2	38.7	41.4	44.4	47.6	7.0%
Total	293.6	309.9	327.7	347.2	368.6	5.9%

Source: Related Journals, Annual Reports, Press Releases, Company Publications, Company Websites, Expert Interviews, and MarketsandMarkets Analysis

TABLE 41 WHEY: MEMBRANE FILTRATION MARKET, BY REGION, 2023–2028 (USD MILLION)

Region	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
North America	92.4	97.2	102.5	108.3	114.6	121.5	5.6%
Europe	79.5	83.1	86.9	91.1	95.7	100.7	4.8%
Asia Pacific	156.6	168.4	181.4	195.6	211.3	228.5	7.8%
South America	14.4	15.4	16.6	18.0	19.4	21.0	7.9%
RoW	49.1	53.4	58.3	63.6	69.6	76.3	9.2%
Total	391.9	417.6	445.7	476.6	510.6	548.0	6.9%

Source: Related Journals, Annual Reports, Press Releases, Company Publications, Company Websites, Expert Interviews, and MarketsandMarkets Analysis

7.2.2.2 Milk and whey-based ingredients

7.2.2.2.1 Rising demand for nutritious food products to drive market

Whey-based ingredients have gained significant attention in the food & beverage industry due to their nutritional value and functional properties. Whey, a byproduct of cheese production, is rich in proteins, lactose, minerals, and vitamins. In recent years, the utilization of whey-based ingredients has expanded beyond traditional applications, leading to an increased demand for advanced processing techniques. Among these techniques, membrane filtration has emerged as a key player, revolutionizing the way whey-based ingredients are processed and utilized across various segments.

Whey proteins are vital components in the formulation of dairy products, such as yogurt, cheese, and ice cream. Membrane filtration enables the separation of valuable proteins from whey, resulting in improved product quality and functionality.

The sports nutrition and dietary supplement industries have witnessed a surge in demand for whey protein powders and isolates. Membrane filtration techniques provide a means to concentrate and purify whey proteins, meeting the high-quality standards required in these markets.

TABLE 42 MILK AND WHEY-BASED INGREDIENTS: MEMBRANE FILTRATION MARKET, BY REGION, 2018–2022 (USD MILLION)

Region	2018	2019	2020	2021	2022	CAGR (2018–2022)
North America	23.7	24.5	25.2	26.1	27.0	3.3%
Europe	18.4	18.8	19.3	19.8	20.3	2.5%
Asia Pacific	31.2	33.3	35.7	38.2	40.9	7.0%
South America	3.4	3.5	3.6	3.8	3.9	4.0%
RoW	9.5	9.8	10.2	10.5	11.0	3.7%
Total	86.2	89.9	94.0	98.4	103.2	4.6%

Source: Related Journals, Annual Reports, Press Releases, Company Publications, Company Websites, Expert Interviews, and MarketsandMarkets Analysis

TABLE 43 MILK AND WHEY-BASED INGREDIENTS: MEMBRANE FILTRATION MARKET, BY REGION, 2023–2028 (USD MILLION)

Region	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
North America	28.1	29.2	30.4	31.8	33.2	34.8	4.4%
Europe	20.9	21.6	22.3	23.2	24.0	25.0	3.6%
Asia Pacific	43.7	46.8	50.1	53.7	57.7	62.1	7.3%
South America	4.2	4.4	4.7	5.0	5.4	5.8	6.7%
RoW	11.6	12.2	12.9	13.7	14.5	15.5	6.0%
Total	108.5	114.2	120.5	127.3	134.9	143.1	5.7%

Source: Related Journals, Annual Reports, Press Releases, Company Publications, Company Websites, Expert Interviews, and MarketsandMarkets Analysis

7.2.2.3 Cheese

7.2.2.3.1 Surge in consumption of cheese to boost market growth

Membrane filtration plays a pivotal role in the cheese production process in several ways. It contributes to the production of a wide range of cheese types, from fresh to hard cheeses, by optimizing texture, flavor, and consistency. It enables the concentration of milk before cheese production, a vital step in improving yield and controlling cheese moisture content. Membrane filtration is instrumental in isolating essential proteins like casein, crucial for cheese structure and texture. It aids in controlling bacteria and microorganisms, enhancing product safety, and extending the shelf life of cheese. Notably, whey, a cheese byproduct, can be further processed to extract valuable proteins using membrane filtration, serving as a resource-efficient solution for nutritional supplements and other applications.

The surge in demand for high-quality cheese and whey-based ingredients, driven by consumer preferences for healthier and functional foods, has spurred the widespread adoption of membrane filtration in cheese production. This technology offers precise control over the cheese-making process, resulting in improved product consistency and reduced waste. Furthermore, its alignment with sustainability goals, by minimizing resource usage compared to traditional methods, is a significant factor driving its adoption. As cheese production continues to diversify and consumers seek innovative dairy products, the role of membrane filtration becomes increasingly critical in meeting these evolving demands.

According to the International Dairy Foods Association, September 2022, over the last 10 years, the average individual consumption of cheese in the US rose by 13%, while per capita butter consumption rose by 18%. Additionally, yogurt consumption per person has seen a 2% increase. Looking at the broader picture, data from the Economic Research Service (ERS) reveals a consistent upward trend in per capita dairy consumption across various products. In 2021 alone, there was a 4% increase compared to the previous five years, a 9% increase over the past 15 years, and an impressive 19% increase over the past three decades.

TABLE 44 CHEESE: MEMBRANE FILTRATION MARKET, BY REGION, 2018–2022 (USD MILLION)

Region	2018	2019	2020	2021	2022	CAGR (2018–2022)
North America	56.9	59.1	61.4	64.0	66.8	4.1%
Europe	63.1	65.0	67.0	69.3	71.8	3.3%
Asia Pacific	105.7	113.5	122.1	131.4	141.5	7.6%
South America	9.4	9.8	10.3	10.8	11.3	4.8%
RoW	33.2	34.6	36.2	37.8	39.6	4.5%
Total	268.3	282.0	297.0	313.3	331.1	5.4%

Source: Related Journals, Annual Reports, Press Releases, Company Publications, Company Websites, Expert Interviews, and MarketsandMarkets Analysis

TABLE 45 CHEESE: MEMBRANE FILTRATION MARKET, BY REGION, 2023–2028 (USD MILLION)

Region	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
North America	69.9	73.2	76.9	80.9	85.3	90.0	5.2%
Europe	74.5	77.5	80.8	84.3	88.2	92.5	4.4%
Asia Pacific	152.0	163.5	176.2	190.0	205.3	222.1	7.9%
South America	12.1	13.0	13.9	15.0	16.1	17.4	7.5%
RoW	42.1	44.8	47.8	51.0	54.6	58.5	6.8%
Total	350.7	372.1	395.5	421.2	449.4	480.5	6.5%

Source: Related Journals, Annual Reports, Press Releases, Company Publications, Company Websites, Expert Interviews, and MarketsandMarkets Analysis

7.3 DRINKS & CONCENTRATES

7.3.1 RISING DEMAND FOR CONVENIENCE FOOD ITEMS, DRINKS, AND JUICES TO DRIVE USE OF MEMBRANE FILTRATION

The food & beverage industry is very competitive and dynamic in nature; there is an increase in awareness regarding health among consumers as well as in demand for high-quality, safe, and nutritious products. Therefore, employing the right membrane filtration solutions to accomplish these goals is necessary. Microfiltration membranes are employed by food industries owing to their high barrier properties against bacteria and other pollutants. Membrane filtration is widely used in the food & beverage industry to concentrate or remove specific substances from the liquid streams.

Membrane filtration helps food & beverage manufacturers to concentrate, clarify, and purify various products, including bottled water, juice, and wine. Rising demand for convenience food items, including ready-to-eat snacks, healthy drinks such as juices, and bottled water, is expected to drive the microfiltration membranes market across the globe.

Membrane filtration has become indispensable in the production of beverages and concentrates, revolutionizing various aspects of this industry. The growing demand for membrane filtration in this sector is rooted in the need for stringent quality control, clarity, and microbial stability of products. This technology ensures the removal of impurities and microorganisms, enhancing product safety and extending shelf life. It enables precise concentration and fractionation of components, facilitating cost-effective transportation and storage.

Membrane filtration caters to evolving consumer preferences for healthier and allergen-free beverages by selectively removing allergenic proteins. Its energy efficiency, compliance with stringent regulations, and customization capabilities make it a preferred choice for beverage manufacturers. As the industry adapts to meet consumer demands for cleaner, safer, and more natural products, membrane filtration stands as a vital tool in shaping the future of drinks and concentrates.

TABLE 46 DRINKS & CONCENTRATES: MEMBRANE FILTRATION MARKET, BY REGION, 2018–2022 (USD MILLION)

Region	2018	2019	2020	2021	2022	CAGR (2018–2022)
North America	398.3	421.1	445.8	472.6	501.6	5.9%
Europe	247.1	261.4	276.9	293.7	311.8	6.0%
Asia Pacific	571.3	617.5	668.1	723.5	784.5	8.2%
South America	56.8	60.5	64.4	68.7	73.4	6.6%
RoW	181.0	192.3	204.6	218.1	232.9	6.5%
Total	1,454.6	1,552.7	1,659.8	1,776.6	1,904.2	7.0%

Source: Related Journals, Annual Reports, Press Releases, Company Publications, Company Websites, Expert Interviews, and MarketsandMarkets Analysis

TABLE 47 DRINKS & CONCENTRATES: MEMBRANE FILTRATION MARKET, BY REGION, 2023–2028 (USD MILLION)

Region	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
North America	533.2	567.9	605.9	647.8	693.7	744.4	6.9%
Europe	331.4	352.9	376.6	402.6	431.2	462.6	6.9%
Asia Pacific	852.6	928.1	1,011.8	1,104.8	1,208.3	1,323.6	9.2%
South America	78.7	84.4	90.7	97.7	105.4	114.0	7.7%
RoW	247.3	263.2	280.5	299.6	320.6	343.6	6.8%
Total	2,043.2	2,196.5	2,365.6	2,552.5	2,759.2	2,988.2	7.9%

Source: Related Journals, Annual Reports, Press Releases, Company Publications, Company Websites, Expert Interviews, and MarketsandMarkets Analysis

TABLE 48 DRINKS & CONCENTRATES: MEMBRANE FILTRATION MARKET, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	528.0	566.2	607.3	651.8	699.8	7.3%
Ultrafiltration (UF)	517.8	552.0	589.5	630.8	676.2	6.9%
Microfiltration (MF)	340.4	362.5	386.8	413.5	442.8	6.8%
Nanofiltration (NF)	68.4	72.1	76.1	80.5	85.3	5.7%
Total	1,454.6	1,552.7	1,659.8	1,776.6	1,904.2	7.0%

Source: Related Research Publications, Associations Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 49 DRINKS & CONCENTRATES: MEMBRANE FILTRATION MARKET, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	753.2	812.2	877.4	949.6	1,029.6	1,118.4	8.2%
Ultrafiltration (UF)	724.9	778.6	837.7	903.1	975.3	1,055.3	7.8%
Microfiltration (MF)	474.3	508.9	547.1	589.2	635.7	687.2	7.7%
Nanofiltration (NF)	90.8	96.8	103.4	110.6	118.6	127.3	7.0%
Total	2,043.2	2,196.5	2,365.6	2,552.5	2,759.2	2,988.2	7.9%

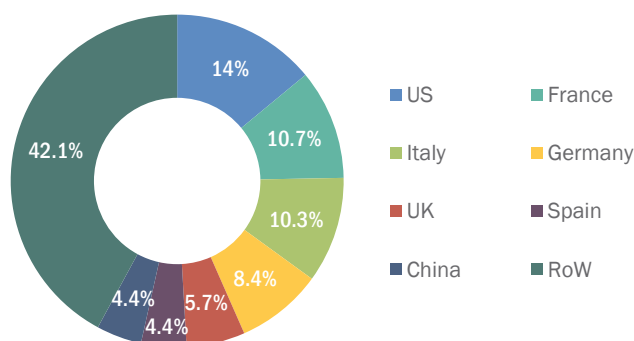
Source: Related Research Publications, Associations Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

7.4 WINE & BEER

7.4.1 CHANGING LIFESTYLES AND INCREASED CONSUMPTION OF BEVERAGES TO DRIVE MARKET

The increasing demand for membrane filtration in the wine & beer industry is driven by its pivotal role in ensuring product quality and consistency. This filtration method is essential for microbial stabilization, effectively removing or controlling microorganisms that can spoil these alcoholic beverages. Moreover, membrane filtration combines clarification, microbiological stabilization, and sterile filtration in a single continuous operation, reducing production costs and minimizing wine loss. The precise control it offers over filtration efficiency, regardless of flow rate and pressure differential, ensures consistent product quality in both wine and beer production. This technology is not limited to wine; it is also employed in beer production, further emphasizing its importance in maintaining product clarity and quality. As the wine and beer industries prioritize higher quality, efficiency, and consistent product characteristics, membrane filtration technologies continue to experience a surge in demand, contributing significantly to the overall improvement of production processes in these sectors.

FIGURE 31 GLOBAL WINE CONSUMPTION, BY COUNTRY, 2021



Source: The EU wine sector

TABLE 50 WINE & BEER: MEMBRANE FILTRATION MARKET, BY REGION, 2018–2022 (USD MILLION)

Region	2018	2019	2020	2021	2022	CAGR (2018–2022)
North America	338.2	354.9	372.9	392.4	413.5	5.2%
Europe	258.1	269.8	282.3	295.9	310.4	4.7%
Asia Pacific	522.6	556.9	594.1	634.6	678.6	6.7%
South America	28.1	29.7	31.4	33.2	35.2	5.7%
RoW	89.3	93.9	99.0	104.5	110.6	5.5%
Total	1,236.2	1,305.1	1,379.7	1,460.6	1,548.2	5.8%

Source: Related Journals, Annual Reports, Press Releases, Company Publications, Company Websites, Expert Interviews, and MarketsandMarkets Analysis

TABLE 51 WINE & BEER: MEMBRANE FILTRATION MARKET, BY REGION, 2023–2028 (USD MILLION)

Region	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
North America	436.3	461.1	488.3	518.1	550.8	586.6	6.1%
Europe	326.3	343.5	362.4	383.1	405.7	430.4	5.7%
Asia Pacific	726.5	779.1	837.0	900.7	970.9	1,048.4	7.6%
South America	37.4	39.8	42.5	45.4	48.6	52.2	6.9%
RoW	116.3	122.6	129.5	137.0	145.2	154.2	5.8%
Total	1,642.7	1,746.2	1,859.7	1,984.3	2,121.2	2,271.8	6.7%

Source: Related Journals, Annual Reports, Press Releases, Company Publications, Company Websites, Expert Interviews, and MarketsandMarkets Analysis

TABLE 52 WINE & BEER: MEMBRANE FILTRATION MARKET, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	175.5	183.3	191.7	200.9	210.9	4.7%
Ultrafiltration (UF)	436.4	462.1	490.3	521.2	555.1	6.2%
Microfiltration (MF)	583.5	617.0	652.9	691.4	732.6	5.9%
Nanofiltration (NF)	40.8	42.7	44.8	47.1	49.6	5.0%
Total	1,236.2	1,305.1	1,379.7	1,460.6	1,548.2	5.8%

Source: Related Research Publications, Associations Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 53 WINE & BEER: MEMBRANE FILTRATION MARKET, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	221.5	233.0	245.6	259.3	274.4	290.9	5.6%
Ultrafiltration (UF)	587.8	623.7	663.0	706.1	753.4	805.4	6.5%
Microfiltration (MF)	781.2	834.5	893.0	957.4	1,028.3	1,106.4	7.2%
Nanofiltration (NF)	52.2	55.0	58.1	61.4	65.1	69.2	5.8%
Total	1,642.7	1,746.2	1,859.7	1,984.3	2,121.2	2,271.8	6.7%

Source: Related Research Publications, Associations Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

7.5 OTHER FOOD & BEVERAGE APPLICATIONS

The other food & beverage applications include sugar, fish, and poultry products. Membrane filtration has become an essential technique in a variety of food and beverage industries, including sugar processing, seafood and fish production, and poultry processing. Its popularity arises from its capacity to assure the quality, safety, and uniformity of products in various industries. Membrane filtering improves purity by eliminating contaminants and color compounds, increases energy efficiency, and complies with severe environmental standards in sugar manufacturing. It aids food safety by eliminating hazardous germs, improving shelf life, and preserving product uniformity in fish and shellfish processing. In the poultry processing industry, membrane filtration assists in disease control, quality enhancement, and waste reduction, all of which are critical factors in assuring safe and sustainable chicken products. As the food and beverage sector prioritizes these elements, the need for membrane filtration in these applications is set to rise further, reaffirming its role as a cornerstone technology for modern food processing.

TABLE 54 OTHER FOOD & BEVERAGE APPLICATIONS: MEMBRANE FILTRATION MARKET, BY REGION, 2018–2022 (USD MILLION)

Region	2018	2019	2020	2021	2022	CAGR (2018–2022)
North America	101.7	107.2	113.1	119.6	126.5	5.6%
Europe	108.1	114.1	120.6	127.6	135.2	5.7%
Asia Pacific	215.5	232.0	249.8	269.4	290.6	7.8%
South America	41.7	44.2	46.9	49.9	53.1	6.3%
RoW	135.1	142.5	150.6	159.5	169.2	5.8%
Total	602.1	639.9	681.1	725.9	774.7	6.5%

Source: Related Journals, Annual Reports, Press Releases, Company Publications, Company Websites, Expert Interviews, and MarketsandMarkets Analysis

TABLE 55 OTHER FOOD & BEVERAGE APPLICATIONS: MEMBRANE FILTRATION MARKET, BY REGION, 2023–2028 (USD MILLION)

Region	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
North America	134.1	142.4	151.6	161.6	172.5	184.6	6.6%
Europe	143.4	152.4	162.4	173.2	185.2	198.3	6.7%
Asia Pacific	315.3	342.6	372.8	406.3	443.5	484.8	9.0%
South America	56.7	60.7	65.1	69.9	75.2	81.1	7.4%
RoW	178.5	188.7	199.8	212.0	225.4	240.0	6.1%
Total	828.1	886.9	951.7	1,023.1	1,101.8	1,188.9	7.5%

Source: Related Journals, Annual Reports, Press Releases, Company Publications, Company Websites, Expert Interviews, and MarketsandMarkets Analysis

TABLE 56 OTHER FOOD & BEVERAGE APPLICATIONS: MEMBRANE FILTRATION MARKET, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	225.2	240.6	257.2	275.1	294.4	6.9%
Ultrafiltration (UF)	217.3	230.6	245.1	261.1	278.6	6.4%
Microfiltration (MF)	107.2	113.7	120.9	128.7	137.3	6.4%
Nanofiltration (NF)	52.4	55.0	57.9	61.0	64.4	5.3%
Total	602.1	639.9	681.1	725.9	774.7	6.5%

Source: Related Research Publications, Associations Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 57 OTHER FOOD & BEVERAGE APPLICATIONS: MEMBRANE FILTRATION MARKET, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	315.8	339.5	365.5	394.3	426.1	461.4	7.9%
Ultrafiltration (UF)	297.5	318.3	341.2	366.5	394.3	425.1	7.4%
Microfiltration (MF)	146.6	156.7	167.8	180.0	193.5	208.4	7.3%
Nanofiltration (NF)	68.3	72.5	77.1	82.2	87.8	94.0	6.6%
Total	828.1	886.9	951.7	1,023.1	1,101.8	1,188.9	7.5%

Source: Related Research Publications, Associations Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

8 MEMBRANE FILTRATION MARKET, BY MEMBRANE MATERIAL

KEY FINDINGS

- The polymeric segment dominated the global membrane filtration market in 2022. This market segment was valued at USD 5,953.7 million in 2022. The structural characteristic of polymeric membranes for mitigating production costs makes these membranes a popular choice for the food & beverage industry.
- The ceramic segment is projected to grow at a higher CAGR of 8.0% during the forecast period. Growth in this market segment can be attributed to the increasing use of ceramic membranes in the water processing industry due to their high chemical and physical stability, long lifespan, and effective separation.
- Polymeric membranes are commonly used in microfiltration and ultrafiltration processes. Microfiltration membranes have pore sizes in the range of 0.1 to 10 micrometers, which makes them ideal for removing larger particles and bacteria from liquids.
- Polymeric membrane systems are often more cost-effective than alternative separation techniques. They require lower maintenance and can operate continuously for extended periods, resulting in reduced downtime and increased productivity.
- Ceramic membranes are highly durable and have a longer operational lifespan compared to polymeric membranes. This longevity can reduce the frequency of membrane replacements and, consequently, maintenance costs.

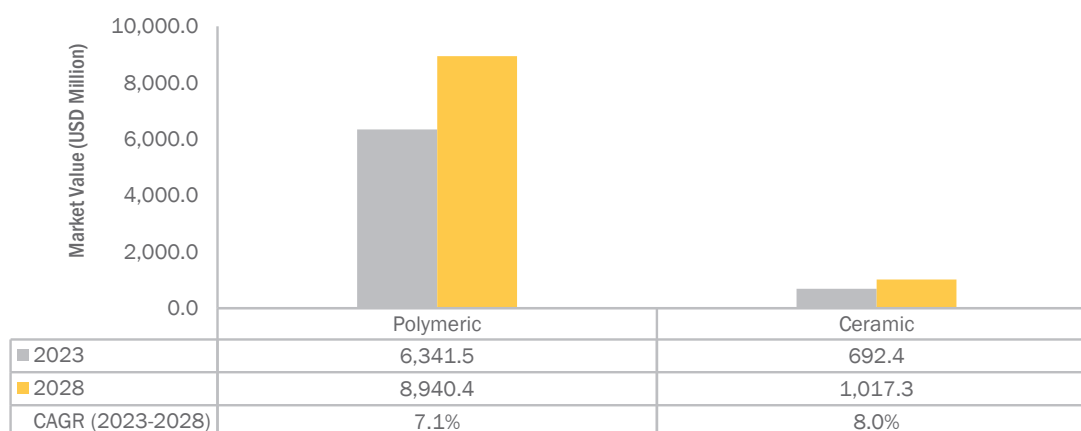
8.1 INTRODUCTION

The global membrane filtration market is segmented, based on membrane material, into polymeric and ceramic. The polymeric segment dominated the membrane filtration market, accounting for a share of 90.2% in 2022. This segment is also projected to grow at a significant CAGR of 7.1% from 2023 to 2028 due to its usage in a wide range of dairy and food and beverage applications.

Polymeric membranes are widely used because of their low cost and low energy needs compared to ceramic membranes. On the other hand, ceramic membranes are more resistant because of their physical properties, chemical stability, and hydrothermal environments.

The ceramic segment is projected to grow at a higher CAGR of 8.0% during the forecast period. Growth in this market is largely driven by the advantages of ceramic membranes, such as their long shelf-life, resistance to extreme temperature conditions, and chemical properties.

FIGURE 32 MEMBRANE FILTRATION MARKET, BY MEMBRANE MATERIAL, 2023 VS. 2028 (USD MILLION)



Source: Company Press Releases, Annual Reports, Expert Interviews, and MarketsandMarkets Analysis

TABLE 58 MEMBRANE FILTRATION MARKET, BY MEMBRANE MATERIAL, 2018–2022 (USD MILLION)

Membrane Material	2018	2019	2020	2021	2022	CAGR (2018–2022)
Polymeric	4,692.0	4,969.3	5,270.4	5,597.7	5,953.7	6.1%
Ceramic	490.5	524.1	560.8	600.9	644.7	7.1%
Total	5,182.4	5,493.4	5,831.2	6,198.6	6,598.4	6.2%

Source: Related Journals, Annual Reports, Press Releases, Company Publications, Company Websites, Expert Interviews, and MarketsandMarkets Analysis

TABLE 59 MEMBRANE FILTRATION MARKET, BY MEMBRANE MATERIAL, 2023–2028 (USD MILLION)

Membrane Material	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Polymeric	6,341.5	6,767.2	7,234.9	7,749.4	8,315.9	8,940.4	7.1%
Ceramic	692.4	745.0	803.1	867.4	938.5	1,017.3	8.0%
Total	7,033.9	7,512.2	8,038.1	8,616.8	9,254.4	9,957.8	7.2%

Source: Related Journals, Annual Reports, Press Releases, Company Publications, Company Websites, Expert Interviews, and MarketsandMarkets Analysis

8.2 POLYMERIC

8.2.1 INCREASING UTILIZATION OF POLYSULFONE MEMBRANES IN FOOD & BEVERAGE SECTOR TO FUEL MARKET GROWTH

Most membranes are made of solid polymers due to the wide range of barrier structures and properties of polymers. Polymeric membranes can be used to manufacture different membrane modules, such as spiral-wound, hollow fiber, and flat sheet (plate-and-frame) membranes. These membranes are made of organic materials. Polymeric membrane filtration is quite effective at removing pollutants, yet these membranes only have a few uses. Filtration can be improved by using nanocomposite membranes, which are created by mixing nanofillers with polymeric membrane matrices. In the past few years, polymer thin-film nanocomposite membranes have gained popularity for water purification owing to their thermal stability, hydrophilicity, selectivity, thermal resistance, and permeability.

Membranes produced from polymeric materials offer various advantages. For instance, spiral-wound polymeric membranes provide a high membrane area per element, which leads to smaller and less expensive plant designs. Cleaning polymeric membranes is a critical process as these membranes have a shorter lifespan than ceramic membranes. This is one of the key challenges for this segment in the coming years. However, a wide range of pore sizes available in these membranes allows them to be used in various applications, such as food & beverages, dairy products, and wine & beer.

Polymeric membranes have ushered in a revolution in the dairy and food & beverage industries, where precision and efficiency in filtration processes are paramount. In the dairy sector, polymeric membranes play a critical role in ensuring product safety and quality through effective microbial control, fractionation of milk components, and cost-efficient concentration and separation processes. Meanwhile, in the food & beverage industry, these membranes are instrumental in achieving product clarity and stability, maintaining sterility during production, preserving flavors and aromas, and meeting sustainability goals by treating wastewater.

TABLE 60 POLYMERIC: MEMBRANE FILTRATION MARKET, BY REGION, 2018–2022 (USD MILLION)

Region	2018	2019	2020	2021	2022	CAGR (2018–2022)
North America	1,189.9	1,249.9	1,314.6	1,384.5	1,459.8	5.2%
Europe	929.6	972.9	1,019.4	1,069.5	1,123.3	4.8%
Asia Pacific	1,818.4	1,945.0	2,083.3	2,234.5	2,400.2	7.2%
South America	179.7	190.2	201.6	213.9	227.3	6.1%
RoW	574.3	611.3	651.5	695.3	743.1	6.7%
Total	4,692.0	4,969.3	5,270.4	5,597.7	5,953.7	6.1%

Source: Related Journals, Annual Reports, Press Releases, Company Publications, Company Websites, Expert Interviews, and MarketsandMarkets Analysis

TABLE 61 POLYMERIC: MEMBRANE FILTRATION MARKET, BY REGION, 2023–2028 (USD MILLION)

Region	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
North America	1,541.2	1,630.1	1,727.4	1,834.0	1,950.8	2,078.9	6.2%
Europe	1,180.9	1,243.7	1,312.3	1,387.4	1,469.5	1,559.4	5.7%
Asia Pacific	2,585.8	2,790.1	3,015.5	3,264.3	3,539.3	3,843.7	8.3%
South America	243.3	260.9	280.3	301.6	325.3	351.4	7.6%
RoW	790.4	842.4	899.4	962.1	1,031.1	1,107.1	7.0%
Total	6,341.5	6,767.2	7,234.9	7,749.4	8,315.9	8,940.4	7.1%

Source: Related Journals, Annual Reports, Press Releases, Company Publications, Company Websites, Expert Interviews, and MarketsandMarkets Analysis

8.3 CERAMIC

8.3.1 DEMAND FOR MEMBRANES WITH DURABILITY, EXCEPTIONAL TEMPERATURE RESISTANCE, AND EASE OF MAINTENANCE TO DRIVE POPULARITY OF CERAMIC MEMBRANES

Ceramic membranes consist of inorganic materials and exhibit exceptional resistance to extreme temperatures and chemicals, which simplifies the cleaning process. Additionally, they boast longer operational lifespans compared to polymeric membranes. These unique qualities, including remarkable chemical and physical stability, extended lifespans, and efficient separation capabilities, primarily find their application in the food processing sector. Moreover, ceramic membranes are extensively utilized in the food and beverage industry for various purposes, including juice and beer clarification, product dewatering, sterilization of milk and whey, juice concentration, and whey desalination.

Ceramic membranes offer various advantages, such as high abrasion resistance, fluxes, durability, and bacteria resistance. Due to this, the ceramic membranes market segment is expected to provide lucrative growth opportunities in the coming years. However, the high cost of raw materials and the need for high sintering temperatures make ceramic membranes expensive and uneconomical. Therefore, several researchers are attempting to develop ceramic membranes from different substitutes or use low-cost raw materials such as alumina, silica, zirconia, and titania. In addition to this, naturally available clays, such as ball clay, dolomite, kaolin clay, bentonite clay, and other earth minerals (including phosphate, magnesite, perlite, and natural pozzolan), are increasingly being used to lower the cost of membranes.

However, certain disadvantages associated with ceramic membranes, such as high weight, considerable operation cost, and limited range of pore sizes, may hinder the growth of this segment during the review period.

TABLE 62 CERAMIC: MEMBRANE FILTRATION MARKET, BY REGION, 2018–2022 (USD MILLION)

Region	2018	2019	2020	2021	2022	CAGR (2018–2022)
North America	145.6	154.2	163.6	173.9	185.2	6.2%
Europe	89.7	94.4	99.6	105.3	111.5	5.6%
Asia Pacific	183.8	199.9	217.4	236.4	257.1	8.8%
South America	16.7	17.7	18.8	19.9	21.2	6.2%
RoW	54.7	58.0	61.5	65.4	69.6	6.2%
Total	490.5	524.1	560.8	600.9	644.7	7.1%

Source: Related Journals, Annual Reports, Press Releases, Company Publications, Company Websites, Expert Interviews, and MarketsandMarkets Analysis

TABLE 63 CERAMIC: MEMBRANE FILTRATION MARKET, BY REGION, 2023–2028 (USD MILLION)

Region	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
North America	197.6	211.2	226.2	242.7	260.9	281.0	7.3%
Europe	118.2	125.6	133.6	142.4	152.1	162.7	6.6%
Asia Pacific	279.7	304.6	332.4	363.2	397.5	435.7	9.3%
South America	22.7	24.2	25.9	27.8	29.9	32.2	7.3%
RoW	74.3	79.4	85.0	91.3	98.1	105.6	7.3%
Total	692.4	745.0	803.1	867.4	938.5	1,017.3	8.0%

Source: Related Journals, Annual Reports, Press Releases, Company Publications, Company Websites, Expert Interviews, and MarketsandMarkets Analysis

9 MEMBRANE FILTRATION MARKET, BY MODULE DESIGN

KEY FINDINGS

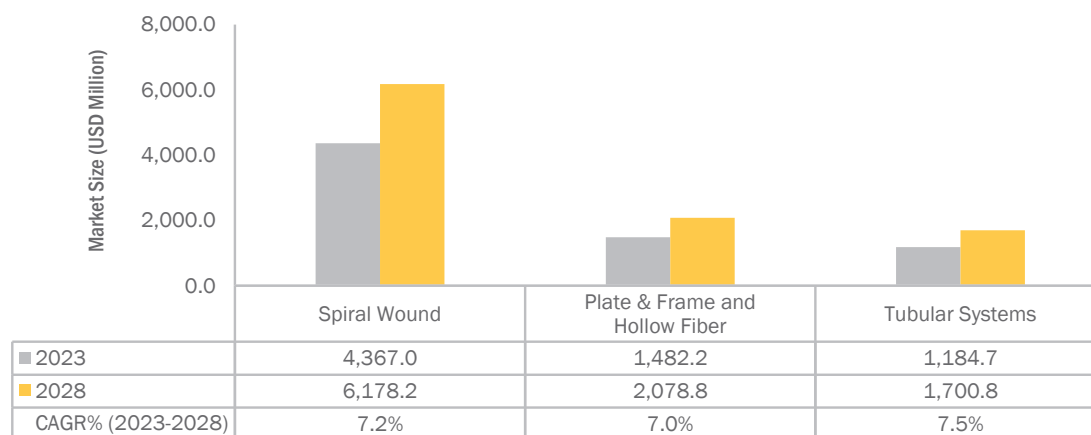
- The spiral wound segment dominated the global membrane filtration market in 2022. This market was valued at USD 4,097.1 million in 2022. Growing dairy applications drive the growth of this segment.
- The spiral wound segment is projected to grow at a CAGR of 7.2% during the forecast period. In the dairy industry, it aids dairy producers in minimizing the overall production cost, which further increases the demand for this segment.
- The tubular systems segment was valued at USD 1,108.3 million in 2022. In dairy applications, they are utilized to reduce bacteria in milk whey, whey protein concentrates, and brine.
- The tubular systems segment is projected to grow at the highest CAGR of 7.5% during the forecast period. This is mainly because of its increasing demand from the dairy and wine industries. They are used to reduce bacteria in milk, whey, whey protein concentrates, and brine in dairy applications. They are also used for wine filtration in the wine industry.
- The plate & frame and hollow fiber segment is projected to grow at a CAGR of 7.0% during the forecast period.

9.1 INTRODUCTION

Based on module design, the global membrane filtration market is segmented into spiral wound systems, tubular systems, and plate & frame and hollow fiber systems.

The spiral wound segment dominated the membrane filtration market, with a share of 62.1% in 2022. This segment is projected to grow at a CAGR of 7.2% during the forecast period. The ease of use and efficiency offered by spiral wound systems, as well as their applications in several industries, such as dairy, beverage, and water processing, are expected to drive growth in this market in the coming years. The tubular systems segment is projected to grow at the highest CAGR of 7.5% during the forecast period.

FIGURE 33 SPIRAL WOUND SEGMENT TO DOMINATE MARKET DURING FORECAST PERIOD



Source: Company Press Releases, Annual Reports, Expert Interviews, and MarketsandMarkets Analysis

TABLE 64 MEMBRANE FILTRATION MARKET, BY MODULE DESIGN, 2018–2022 (USD MILLION)

Module Design	2018	2019	2020	2021	2022	CAGR (2018–2022)
Spiral Wound	3,221.3	3,413.6	3,622.6	3,849.8	4,097.1	6.2%
Tubular Systems	859.2	913.8	973.2	1,037.8	1,108.3	6.6%
Plate & Frame and Hollow Fiber	1,101.9	1,165.9	1,235.5	1,310.9	1,393.0	6.0%
Total	5,182.4	5,493.4	5,831.2	6,198.6	6,598.4	6.2%

Source: Related Journals, Annual Reports, Press Releases, Company Publications, Company Websites, Expert Interviews, and MarketsandMarkets Analysis

TABLE 65 MEMBRANE FILTRATION MARKET, BY MODULE DESIGN, 2023–2028 (USD MILLION)

Module Design	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Spiral Wound	4,367.0	4,663.4	4,989.1	5,347.7	5,742.6	6,178.2	7.2%
Tubular Systems	1,184.7	1,268.9	1,361.5	1,463.6	1,576.3	1,700.8	7.5%
Plate & Frame and Hollow Fiber	1,482.2	1,580.0	1,687.4	1,805.6	1,935.6	2,078.8	7.0%
Total	7,033.9	7,512.2	8,038.1	8,616.8	9,254.4	9,957.8	7.2%

Source: Related Journals, Annual Reports, Press Releases, Company Publications, Company Websites, Expert Interviews, and MarketsandMarkets Analysis

9.2 SPIRAL WOUND

9.2.1 EXTENSIVE UTILIZATION OF SPIRAL WOUND MEMBRANES IN FOOD & BEVERAGE INDUSTRY TO DRIVE MARKET

Spiral wound modules are a critical component of membrane filtration systems used across various industries, including water treatment, dairy, food, and beverage production, and more. These modules play a pivotal role in separating particles, impurities, and contaminants from liquids. This makes them an indispensable part of the modern filtration landscape.

Spiral wound modules consist of a permeate collection tube, feed spacer, and multiple layers of flat sheet or hollow fiber membranes wound together in a spiral configuration. This design maximizes surface area while minimizing the footprint, making spiral wound modules highly efficient for various filtration processes.

Spiral wound modules are commonly used for removing dissolved solids from solutions, particularly in nanofiltration and reverse osmosis processes. These modules come in various configurations, featuring different spacers, membrane types, lengths, and diameters, making them versatile for multiple applications. They find applications in processing bottled water, dairy, and beverage industries.

In juice concentration processes, spiral wound modules are highly efficient and are widely employed for concentrating sugarcane, orange, and synthetic juices. In the dairy sector, they are utilized for tasks such as whey and cheese concentration. Leading market players, such as Koch Membrane Systems, offer a wide range of effective spiral membrane modules tailored for the dairy industry, helping dairy producers reduce production costs while ensuring high-quality dairy products.

Manufacturers are developing goods that combine membrane technology. For example, DuPont Water Solutions (DWS), situated in the US, developed the DuPont TapTec LC HF-4040 Reverse Osmosis (RO) membrane filter in November 2021. This membrane filter is inexpensive, small, and efficient, with user-friendly features, high flow rates, and dependability. DuPont makes its membrane components employing a spiral coiled process and a polyamide thin-film composite.

TABLE 66 SPIRAL WOUND: MEMBRANE FILTRATION MARKET, BY REGION, 2018–2022 (USD MILLION)

Region	2018	2019	2020	2021	2022	CAGR (2018–2022)
North America	843.3	885.6	931.3	980.6	1,034.0	5.2%
Europe	622.9	652.1	683.5	717.4	753.9	4.9%
Asia Pacific	1,217.0	1,303.9	1,398.8	1,502.6	1,616.2	7.4%
South America	124.6	131.8	139.7	148.3	157.6	6.1%
RoW	413.5	440.2	469.2	500.9	535.5	6.7%
Total	3,221.3	3,413.6	3,622.6	3,849.8	4,097.1	6.2%

Source: Related Journals, Annual Reports, Press Releases, Company Publications, Company Websites, Expert Interviews, and MarketsandMarkets Analysis

TABLE 67 SPIRAL WOUND: MEMBRANE FILTRATION MARKET, BY REGION, 2023–2028 (USD MILLION)

Region	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
North America	1,091.9	1,155.2	1,224.4	1,300.3	1,383.4	1,474.6	6.2%
Europe	792.6	835.0	881.2	931.8	987.1	1,047.7	5.7%
Asia Pacific	1,744.9	1,886.6	2,042.9	2,215.4	2,406.1	2,614.2	8.4%
South America	169.2	181.9	196.0	211.5	228.6	247.6	7.9%
RoW	568.4	604.7	644.7	688.7	737.4	794.1	6.9%
Total	4,367.0	4,663.4	4,989.1	5,347.7	5,742.6	6,178.2	7.2%

Source: Related Journals, Annual Reports, Press Releases, Company Publications, Company Websites, Expert Interviews, and MarketsandMarkets Analysis

9.3 TUBULAR SYSTEMS

9.3.1 GROWING IMPORTANCE OF TUBULAR SYSTEMS IN DAIRY AND WINE INDUSTRIES TO ENCOURAGE MARKET GROWTH

Tubular membrane modules are cylindrical structures with porous walls, commonly employed to treat feed streams containing high levels of dissolved solids, suspended solids, oil, and grease. They are particularly popular in water treatment applications due to their effectiveness in removing contaminants and producing high-quality processed water. This purified water can then undergo further treatment with a reverse osmosis system to produce high-quality fresh water, making it prevalent in the beverage industry. Besides water treatment, tubular membrane systems are also finding use in the dairy and wine industries. In dairy applications, they are utilized to reduce bacteria in milk whey, whey protein concentrates, and brine. In the wine industry, they are employed for wine filtration.

Koch Membrane Systems (KMS) introduced the Lees-COR line of tubular crossflow systems in May 2019, aimed at recovering premium wine and juice. These systems utilize crossflow membranes to create exceptionally high-quality wine and juices with excellent clarity. They offer an alternative to diatomaceous earth rotary vacuum drum filters, which can pose respiratory risks to employees and diminish the value of recovered juice and wine due to their filtration method. The Lees COR system, based on membrane technology, addresses these issues.

Furthermore, strategic decisions made by key industry players to diversify their product offerings in terms of module design are expected to drive growth in the membrane filtration market. For instance, in May 2018, Berghof Membrane Technology GmbH from the Netherlands collaborated with Denmark's Aquaporin A/S to commercialize tubular forward osmosis membrane technology. In March 2022, Dutch membrane applications specialist, Wation, joined forces with the team at Aquaporin and Berghof Wallin Systems to gather testimonials for their new product collectively designed Berghof Hyperflux and Aquaporin Inside food-ready Tubular Forward Osmosis (Food TFO) membranes for commercial production.

TABLE 68 TUBULAR SYSTEMS: MEMBRANE FILTRATION MARKET, BY REGION, 2018–2022 (USD MILLION)

Region	2018	2019	2020	2021	2022	CAGR (2018–2022)
North America	227.1	240.5	255.0	270.6	287.7	6.1%
Europe	191.2	201.0	211.6	223.0	235.3	5.3%
Asia Pacific	314.3	337.7	363.2	391.1	421.8	7.6%
South America	32.8	34.8	37.0	39.3	41.9	6.3%
RoW	93.8	99.9	106.5	113.7	121.6	6.7%
Total	859.2	913.8	973.2	1,037.8	1,108.3	6.6%

Source: Related Journals, Annual Reports, Press Releases, Company Publications, Company Websites, Expert Interviews, and MarketsandMarkets Analysis

TABLE 69 TUBULAR SYSTEMS: MEMBRANE FILTRATION MARKET, BY REGION, 2023–2028 (USD MILLION)

Region	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
North America	306.1	326.3	348.5	372.9	399.7	429.3	7.0%
Europe	248.8	263.4	279.5	297.1	316.4	337.6	6.3%
Asia Pacific	455.0	491.7	532.4	577.5	627.5	683.9	8.5%
South America	44.7	47.8	51.2	55.0	59.1	63.6	7.3%
RoW	130.2	139.6	149.9	161.2	173.6	186.4	7.4%
Total	1,184.7	1,268.9	1,361.5	1,463.6	1,576.3	1,700.8	7.5%

Source: Related Journals, Annual Reports, Press Releases, Company Publications, Company Websites, Expert Interviews, and MarketsandMarkets Analysis

9.4 PLATE & FRAME AND HOLLOW FIBER

9.4.1 EXTENSIVE USE OF HOLLOW FIBERS FOR ULTRAFILTRATION AND MICROFILTRATION OF MEMBRANE SYSTEMS IN BEVERAGE INDUSTRY TO BOOST GROWTH

Plate & frame modules contain membranes laid on top of a plate-like structure, which, in turn, is held together by a frame-like support. Since hollow fibers act like a sieve, substantially draining out pollutants, these membranes are efficient in both clear and highly turbid water types. Other pollutants do not impact their ability to prevent microbes in the water. Furthermore, differentiation in pH levels, temperatures, color, and salts will not hamper their efficacy.

This module offers various advantages, such as purification and easy separation of solids from water. The crossflow plates and frame systems allow the plate and frame to be rotated, reducing fouling. This design is very effective in terms of reducing the overall cost of the system. Hollow fiber modules comprise hollow fiber membranes and are generally manufactured for microfiltration and ultrafiltration membrane systems. They are widely used to sterilize water for several beverage products.

Hollow fiber membranes are typically utilized for MF and UF designs. However, the filters in ultrafiltration systems and hollow fiber membranes must be substituted more often than with reverse osmosis membranes, which may hamper the growth of the market to a certain extent.

TABLE 70 PLATE & FRAME AND HOLLOW FIBER: MEMBRANE FILTRATION MARKET, BY REGION, 2018–2022 (USD MILLION)

Region	2018	2019	2020	2021	2022	CAGR (2018–2022)
North America	265.1	278.0	292.0	307.0	323.3	5.1%
Europe	205.1	214.2	223.9	234.4	245.7	4.6%
Asia Pacific	470.9	503.3	538.7	577.2	619.4	7.1%
South America	39.0	41.2	43.6	46.2	49.0	5.9%
RoW	121.8	129.2	137.3	146.1	155.7	6.3%
Total	1,101.9	1,165.9	1,235.5	1,310.9	1,393.0	6.0%

Source: Related Journals, Annual Reports, Press Releases, Company Publications, Company Websites, Expert Interviews, and MarketsandMarkets Analysis

TABLE 71 PLATE & FRAME AND HOLLOW FIBER: MEMBRANE FILTRATION MARKET, BY REGION, 2023–2028 (USD MILLION)

Region	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
North America	340.8	359.9	380.7	403.6	428.6	456.0	6.0%
Europe	257.7	270.8	285.2	300.9	318.0	336.8	5.5%
Asia Pacific	665.6	716.4	772.6	834.6	903.2	981.4	8.1%
South America	52.1	55.4	59.0	63.1	67.5	72.3	6.8%
RoW	166.1	177.5	189.9	203.4	218.3	232.2	6.9%
Total	1,482.2	1,580.0	1,687.4	1,805.6	1,935.6	2,078.8	7.0%

Source: Related Journals, Annual Reports, Press Releases, Company Publications, Company Websites, Expert Interviews, and MarketsandMarkets Analysis

10 MEMBRANE FILTRATION MARKET, BY TYPE

KEY FINDINGS

- The reverse osmosis segment dominated the global membrane filtration market in 2022. This market was valued at USD 2,650.5 million in 2022. Enhancing food safety and minimizing product spoilage, which are critical concerns in the dairy industry, serve as key drivers for utilizing reverse osmosis (RO). RO can effectively remove bacteria and other microorganisms from milk and dairy products, thereby extending their shelf life.
- The reverse osmosis segment is projected to grow at the highest CAGR of 7.5% during the forecast period. Reverse osmosis plays a significant role in the food industry, where it is widely employed to concentrate egg whites, gelatin, and fruit juices, as well as to eliminate bacteria and brine from meat and alcohol from spirits during the manufacturing process. Additionally, the dairy, starch, and sugar sectors also make use of reverse osmosis technology.
- The ultrafiltration segment was the second-largest segment in the global membrane filtration market for food and beverage applications in 2022. This market is projected to reach USD 3,123.3 million by 2028. The growing applications of ultrafiltration in the dairy and beverage industries are expected to drive market growth in the coming years.
- The microfiltration segment is projected to reach USD 2251.7 million by 2028. Microfiltration membranes act as a critical driver in the food & beverage and wine industries. They contribute to product quality, shelf-life extension, innovation, efficiency, and sustainability. Their versatile applications have become indispensable tools for ensuring the production of high-quality and safe consumables.

10.1 INTRODUCTION

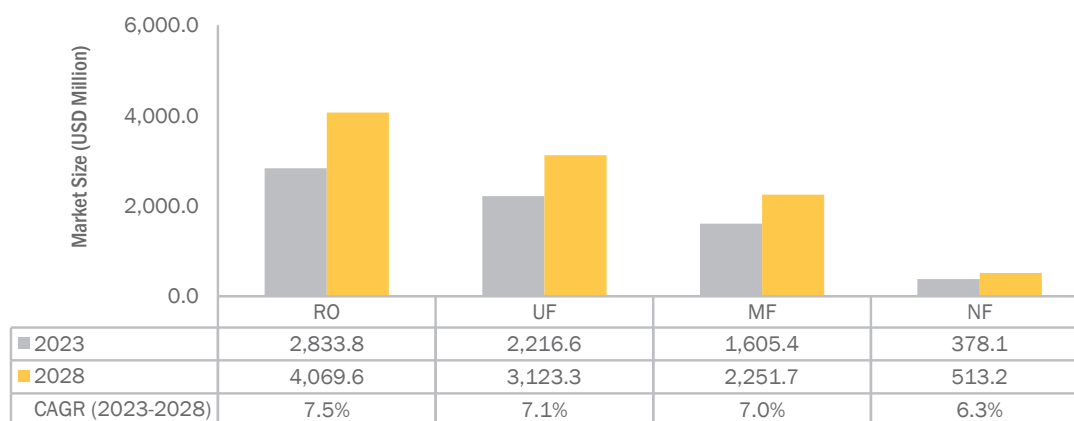
Membrane processes are extensively used in the dairy, wine & beer, fruit juice, and sugar industries. In the dairy industry, removal of bacteria and spores from skim milk (cold pasteurization), separation of casein micelles, separation, and fractionation of fat globules from whole milk, concentration and demineralization of whey and milk ultrafiltration permeate, fractionation of whey proteins, and desalination of whey membrane processes are realized by membrane processes. In the wine & beer industry, cross-flow of wines and beer clarification and stabilization of wines by electrodialysis are of common use. Fruit juice processing involves clarification, concentration, and deacidification. In the sugar industry, purification and demineralization are realized by membrane processes.

Based on the type of technology involved, the membrane filtration market is segmented into reverse osmosis (RO), ultrafiltration (UF), nanofiltration (NF), and microfiltration (MF). Reverse osmosis efficiently removes contaminants such as harmful bacteria and yeast from water, due to which it is mainly used in drinking water processing plants. UF and MF methods are used for milk pasteurization, whey concentration, and cheese purification. In beverage processing plants, UF is used to remove contaminants from water, and nanofiltration is used to partially reduce inorganic salt levels.

Industries such as food & beverage produce oily wastewater that contaminates water and soil and eventually harms the human body. Membrane technologies help clean oily wastewater. However, membrane fouling is a crucial problem associated with these membranes, resulting in a loss of productivity in the long run. This is one of the key challenges faced by manufacturers.

Alfa Laval (Sweden), Veolia (UK), and Synder Filtration, Inc. (US) are some manufacturers providing membrane filtration technologies, such as NF, UF, and MF, for customers operating in the food & beverage industry.

FIGURE 34 MEMBRANE FILTRATION MARKET, BY TYPE, 2023 VS. 2028



Source: Company Press Releases, Annual Reports, Expert Interviews, and MarketsandMarkets Analysis

TABLE 72 MEMBRANE FILTRATION MARKET, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	2,056.1	2,186.3	2,328.1	2,482.3	2,650.5	6.6%
Ultrafiltration (UF)	1,641.4	1,738.0	1,843.0	1,957.0	2,081.3	6.1%
Microfiltration (MF)	1,190.6	1,260.6	1,336.5	1,418.9	1,508.9	6.1%
Nanofiltration (NF)	294.4	308.4	323.6	340.3	357.7	5.0%
Total	5,182.4	5,493.4	5,831.2	6,198.6	6,598.4	6.2%

Source: Related Research Publications, Associations Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 73 MEMBRANE FILTRATION MARKET, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	2,833.8	3,035.3	3,257.2	3,501.7	3,771.5	4,069.6	7.5%
Ultrafiltration (UF)	2,216.6	2,365.1	2,528.3	2,707.8	2,905.4	3,123.3	7.1%
Microfiltration (MF)	1,605.4	1,711.4	1,827.8	1,955.7	2,096.5	2,251.7	7.0%
Nanofiltration (NF)	378.1	400.4	424.8	451.6	481.0	513.2	6.3%
Total	7,033.9	7,512.2	8,038.1	8,616.8	9,254.4	9,957.8	7.2%

Source: Related Research Publications, Associations Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

10.2 REVERSE OSMOSIS (RO)

10.2.1 GROWING POPULARITY OF PROCESSED FOOD PRODUCTS TO DRIVE USE OF RO TECHNOLOGY FOR WATER FILTRATION

Reverse osmosis offers high efficiency in terms of water purification; it can typically remove up to 99% of most mineral contaminants. In the food & beverage business, reverse osmosis is a frequently used water filtration method that uses pressure to force water across a semi-permeable membrane and eliminates the vast majority of impurities, including particles, tastes, colors, and odors. Traditional reverse osmosis systems are built in stages, each of which filters half of the wastewater from the stage before it.

RO has also gained traction in the beverage industry. Water is the most important ingredient in the beverage industry, due to which water filtration is a highly important process. Producers have to be very particular regarding the quality and sterility of the water being utilized. The water used in the beverage industry generally comes from municipal sources. This water is drinkable but contains elements of hardness or deposits of heavy metals that are usually from the pipes that transport the water; such elements in the water may affect the taste of the water and, thereby, the taste of the beverages. To prevent this, RO is used in beverage-producing plants.

Reverse osmosis is used extensively in the food sector in the manufacturing process of concentrations of egg whites, gelatin, and fruit juices; in the removal of bacteria and brine from meat; and in alcohol from spirits. RO is also used in the dairy, starch, and sugar sectors.

TABLE 74 REVERSE OSMOSIS: MEMBRANE FILTRATION MARKET, BY REGION, 2018–2022 (USD MILLION)

Region	2018	2019	2020	2021	2022	CAGR (2018–2022)
North America	505.7	532.7	561.9	593.5	627.7	5.5%
Europe	388.0	407.7	428.8	451.6	476.2	5.3%
Asia Pacific	824.1	886.6	955.3	1,030.7	1,113.7	7.8%
South America	76.6	81.3	86.4	92.1	98.2	6.4%
RoW	261.6	278.0	295.6	314.5	334.8	6.4%
Total	2,056.1	2,186.3	2,328.1	2,482.3	2,650.5	6.6%

Source: Related Research Publications, Associations Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 75 REVERSE OSMOSIS: MEMBRANE FILTRATION MARKET, BY REGION, 2023–2028 (USD MILLION)

Region	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
North America	664.8	705.4	749.9	798.6	852.2	916.6	6.6%
Europe	503.5	533.2	565.8	601.4	640.5	683.3	6.3%
Asia Pacific	1,203.5	1,302.7	1,412.6	1,534.2	1,669.1	1,812.5	8.5%
South America	107.2	117.2	128.3	140.7	154.4	170.4	9.7%
RoW	354.8	376.7	400.6	426.8	455.4	486.7	6.5%
Total	2,833.8	3,035.3	3,257.2	3,501.7	3,771.5	4,069.6	7.5%

Source: Related Research Publications, Associations Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

10.3 ULTRAFILTRATION (UF)

10.3.1 GROWING USE OF ULTRAFILTRATION IN TREATING DAIRY PRODUCTS TO DRIVE MARKET

Ultrafiltration (UF) is a pressure-driven membrane-based process that separates bacteria, viruses, suspended solids, and other microorganisms. The pore size of the ultrafiltration membrane varies between 0.1 and 0.001 microns. This membrane produces liquids with very high purity and low silt density. The ultrafiltration method offers several advantages over conventional clarification and disinfection processes. For instance, the ultrafiltration method does not need chemicals such as coagulants, flocculants, and disinfectants. It maintains consistency in the quality of the treated water in terms of particle and microbial removal, and it is characterized by simple automation that makes it very convenient to use.

UF membranes are mainly used in applications where all colloidal particles containing pathogenic organisms must be removed. It removes high-molecular-weight substances and organic & inorganic polymeric molecules. Organics and ions with low molecular weights, such as sodium, calcium, magnesium chloride, and sulfate, are not removed by UF membranes. UF membranes come in various configurations, such as plate and frame, spiral wound, and tubular. For high purity, spiral-wound and capillary configurations are commonly used. The selection of the configuration depends on the type and concentration of colloidal material. Since UF membranes are equipped with enhanced properties in

removing suspended matter and bacteria, they are widely used to prepare drinking water or processed water.

UF membranes are also witnessing increased demand from the dairy and food & beverage industries. In the dairy industry, ultrafiltration is used for a broad range of applications, such as fresh cheese production; protein standardization of cheese, milk, and skimmed milk powders; protein concentration; and decalcification of permeates as well as reduced-lactose milk. In July 2022, US-based sports nutrition beverage brand, GoodSport, launched a new sports drink formulated using ultrafiltered milk. GoodSport uses electrolytes, vitamins, and carbohydrates in milk to make a clear, light beverage by upcycling ultrafiltered deproteinized milk, commonly referred to as milk permeate.

UF also finds applications in wine and other beverage industries. It is used to filter water to remove organic contaminants. It is also used to improve wine concentrations, remove the color from heavy press juice fractions, and remove bitter tannins from red varieties. The growing use of UF membranes in the wine, dairy, and water processing industries is projected to drive the growth of this segment during the review period.

Tetra Pack (Switzerland), DuPont (US), Samco Technologies, Inc. (US), Alfa Laval (Sweden), Koch Membrane Systems (US), and Toray Membrane USA (US) are some manufacturers of ultrafiltration membranes for customers in the food & beverage and dairy industries.

TABLE 76 ULTRAFILTRATION: MEMBRANE FILTRATION MARKET, BY REGION, 2018–2022 (USD MILLION)

Region	2018	2019	2020	2021	2022	CAGR (2018–2022)
North America	428.0	449.5	472.8	497.9	525.0	5.2%
Europe	309.9	323.9	339.1	355.3	372.9	4.7%
Asia Pacific	618.7	662.2	709.6	761.1	817.6	7.2%
South America	59.4	62.8	66.5	70.5	74.9	5.9%
RoW	225.3	239.5	255.1	272.2	291.0	6.6%
Total	1,641.4	1,738.0	1,843.0	1,957.0	2,081.3	6.1%

Source: Related Research Publications, Associations Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 77 ULTRAFILTRATION: MEMBRANE FILTRATION MARKET, BY REGION, 2023–2028 (USD MILLION)

Region	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
North America	554.4	586.5	621.7	660.3	702.5	748.9	6.2%
Europe	391.1	411.1	432.9	456.7	482.7	511.2	5.5%
Asia Pacific	882.1	953.1	1,031.5	1,118.1	1,213.8	1,319.8	8.4%
South America	79.0	83.6	88.6	94.1	100.2	106.8	6.2%
RoW	309.9	330.7	353.5	378.6	406.2	436.7	7.1%
Total	2,216.6	2,365.1	2,528.3	2,707.8	2,905.4	3,123.3	7.1%

Source: Related Research Publications, Associations Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

10.4 MICROFILTRATION (MF)

10.4.1 RISING ADOPTION OF MICROFILTRATION IN TREATING BEVERAGES TO PROPEL GROWTH

Microfiltration (MF) uses porous membranes with an average pore size between 0.1 and 10 microns. It separates particles and components dissolved in fluids. Microfilters can be made with organic materials such as polymer-based membranes and inorganic materials such as ceramic or stainless steel. MF removes the undesired microorganisms, dead cells, and physical contaminants from the brine and other beverages without altering the product's chemical composition. MF is a low-pressure-driven membrane filtration process widely used in the dairy industry. Some common applications are bacteria reduction, fat removal in milk and whey, and standardization of protein and casein.

MF is also used for the cold sterilization of beverages; clearing fruit juices, wines, and beers; and producing whey protein isolates. In the water processing industry, it is used to separate bacteria from water and as a pretreatment of water for nanofiltration and reverse osmosis.

Companies are developing different microfiltration membranes with a wide range of food & beverage applications. In September 2019, Australian-Singaporean water and wastewater treatment company, De.mem, launched a microfiltration membrane (MF) specifically crafted for food & beverage applications. The newly developed membrane is a hollow fiber membrane with a comparatively bigger pore size and greater flux, permitting a better throughput of liquids. This technology enhances De.mem's current ultrafiltration and hollow fiber nanofiltration technologies.

In addition to this, research and development activities on different membranes are also fueling the market growth. For instance, US researchers at the National Academy of Engineering are utilizing bacteria to develop membranes. Researchers at Princeton University, US, are developing membranes from wood that can resolve the energy consumption issue associated with desalination.

TABLE 78 MICROFILTRATION: MEMBRANE FILTRATION MARKET, BY REGION, 2018–2022 (USD MILLION)

Region	2018	2019	2020	2021	2022	CAGR (2018–2022)
North America	340.8	358.4	377.4	397.9	420.2	5.4%
Europe	268.6	281.3	294.9	309.6	325.5	4.9%
Asia Pacific	465.2	498.8	535.4	575.3	619.3	7.4%
South America	48.9	51.8	54.9	58.3	62.0	6.1%
RoW	67.1	70.4	73.9	77.7	81.9	5.1%
Total	1,190.6	1,260.6	1,336.5	1,418.9	1,508.9	6.1%

Source: Related Research Publications, Associations Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 79 **MICROFILTRATION: MEMBRANE FILTRATION MARKET, BY REGION, 2023–2028 (USD MILLION)**

Region	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
North America	444.1	470.3	499.0	530.4	564.9	597.1	6.1%
Europe	342.1	360.2	380.0	401.7	425.4	451.3	5.7%
Asia Pacific	667.8	721.1	780.0	845.0	916.8	1,002.8	8.5%
South America	65.6	69.4	73.7	78.3	83.4	88.1	6.1%
RoW	85.9	90.3	95.1	100.3	106.0	112.3	5.5%
Total	1,605.4	1,711.4	1,827.8	1,955.7	2,096.5	2,251.7	7.0%

Source: Related Research Publications, Associations Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

10.5 NANOFILTRATION (NF)

10.5.1 ABILITY OF NANOFILTRATION TECHNOLOGY TO REMOVE LOW-MOLECULAR COMPONENTS FROM LIQUID TO DRIVE ITS USE

Nanofiltration separates a wide range of inorganic and organic substances from a solution. The transmembrane pressure applied in this technology is considerably lower than that of reverse osmosis (RO) but is still significantly higher than that of ultrafiltration. Nanofiltration has a unique ability to separate and fractionate organic species with relatively low molecular weights. It is thus largely used in the treatment of fresh and processed water. Nanofiltration membranes are produced in plate and frame forms, spiral wound, tubular, capillary, and hollow fiber formats. Advancements in NF technology have extended its usage in very high- or low-pH environments that strengthen its scope in a wide range of water and food applications.

In the food industry, nanofiltration is used for numerous applications. It is used in the concentration of whey and permeates from other whey treatments; the processing of sugar, dextrose syrup, and sugar juice concentrations; brine demineralization; degumming of solutions in edible oil processing; cheese production; and in alternative sweeteners. NF is used for higher concentrations of fruit juices as less different osmotic pressures across the membrane than RO are applied. The unique fractionation and filtration offered by NF due to size exclusion make it very effective in dairy applications such as ice creams and yogurts. Nanofiltration helps enhance the taste of these products due to non-heat concentrations and less ash content.

Nanofiltration is mainly projected to be driven by its growing use in the dairy industry. Nanofiltration of whey and permeates aids in reducing the mineral content (sodium and potassium chlorides). Demineralization of whey and whey powder and the production of high-quality lactose-free milk products are some of the important functions offered by NF for the dairy industry.

Shinshu University's Global Aqua Innovation Centre produces lactose-free milk by incorporating graphene oxide-based nanofiltration membranes. This is expected to be an alternative for lactose-intolerant people, thereby boosting the membrane filtration market growth in the coming years.

As opposed to traditional boiling reduction techniques for thick maple syrup, nanofiltration can be applied in maple syrup concentrations to lower costs and processing times. It is also a trustworthy method of enhancing overall production by concentrating plant hormones like gibberellins. Gibberellins are plant hormones utilized to support plant growth and other growing procedures.

TABLE 80 NANOFILTRATION: MEMBRANE FILTRATION MARKET, BY REGION, 2018–2022 (USD MILLION)

Region	2018	2019	2020	2021	2022	CAGR (2018–2022)
North America	61.0	63.5	66.1	69.0	72.1	4.3%
Europe	52.8	54.5	56.3	58.2	60.3	3.4%
Asia Pacific	94.2	97.2	100.3	103.8	106.8	3.2%
South America	11.5	12.0	12.4	13.0	13.5	4.1%
RoW	75.0	81.3	88.4	96.3	105.0	8.8%
Total	294.4	308.4	323.6	340.3	357.7	5.0%

Source: Related Research Publications, Associations Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 81 NANOFILTRATION: MEMBRANE FILTRATION MARKET, BY REGION, 2023–2028 (USD MILLION)

Region	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
North America	75.5	79.1	83.0	87.4	92.1	97.2	5.2%
Europe	62.4	64.7	67.2	70.0	73.0	76.2	4.1%
Asia Pacific	112.1	117.7	123.8	130.2	137.1	144.4	5.2%
South America	14.1	14.8	15.6	16.4	17.3	18.2	5.2%
RoW	114.1	124.1	135.3	147.7	161.6	177.1	9.2%
Total	378.1	400.4	424.8	451.6	481.0	513.2	6.3%

Source: Related Research Publications, Associations Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

11 MEMBRANE FILTRATION MARKET, BY REGION

KEY FINDINGS

- The US accounted for the largest North American membrane filtration market in 2022. This market segment was valued at USD 1,501.7 million in 2022. The strong maple syrup industry, coupled with the growing demand for functional food & beverages, drives the growth in the North American market.
- Asia Pacific was the largest membrane filtration market, valued at USD 2,657.3 million in 2022. The growing demand for nutritious and healthy dairy products is driving the region's membrane filtration demand.
- The Indian market is projected to grow at the highest CAGR of 9.1% from 2023 to 2028. The food & beverage industry is expanding rapidly in India, driven by changing consumer preferences and increasing urbanization. Membrane filtration is critical in ensuring the quality and safety of products, such as dairy, fruit juices, soft drinks, and bottled water.
- Technological advancements in the dairy industry across regions are expected to drive the demand for ultrafiltration technologies in the global membrane filtration market.

11.1 INTRODUCTION

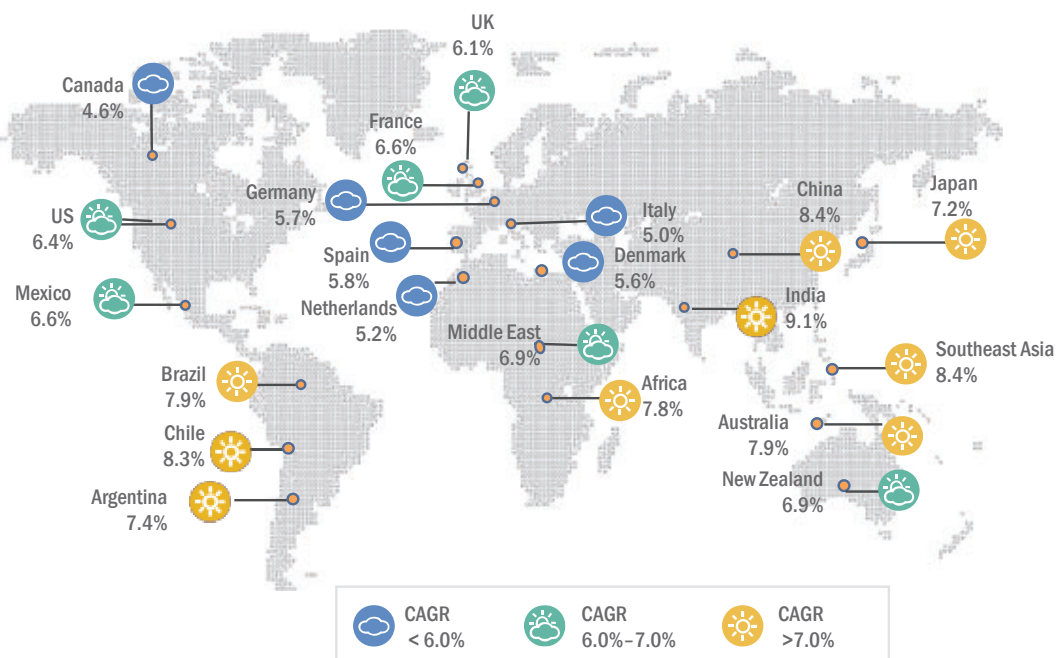
The membrane filtration market for food & beverage applications is mainly driven by factors such as the growth of the dairy industry, regulations imposed by governments favoring membrane filtration, increasing demand for high-value products, and the several advantages offered by membrane filtration. Membrane filtration is mainly used in the food & beverage industry to remove microorganisms and enable food safety during food processing. Other important functions include eliminating harmful microorganisms and enhancing product texture, flavor, taste, quality, and shelf life. The market is expected to grow robustly in the coming years due to the increasing demand for functional food and nutraceutical products. Globally, membrane filtration is widely used during the production of nutraceuticals for functions such as effective lipid-based nutraceutical separation, recovery of lipid components, fractionation, and recovery of bioactive components. Membrane filtration also reduces overall energy consumption and is therefore expected to witness substantial growth in the coming years as food & beverage manufacturers across the globe are opting for technologically advanced equipment that would help their profit margins while adding value to their product lines.

The geographic segmentation considered in this chapter is as follows:

- North America (US, Canada, and Mexico)
- Europe (Spain, Italy, Germany, UK, France, Netherlands, Denmark, and Rest of Europe)
- Asia Pacific (China, Southeast Asia, India, Japan, Australia, and Rest of Asia Pacific)
- South America (Brazil, Chile, Argentina, and Rest of South America)
- ROW (Middle East & Africa)

As of 2022, the Asia Pacific and North American regions accounted for a combined share of 65.2% of the overall membrane filtration market. The Asia Pacific market is expected to be the largest and fastest-growing market during the forecast period. The Middle East & Africa market is also expected to grow significantly from 2023 to 2028.

FIGURE 35 INDIA TO RECORD HIGHEST GROWTH RATE DURING FORECAST PERIOD



Source: Company Press Releases, Investor Presentations, Food Journals, Expert Interviews, and MarketsandMarkets Analysis

TABLE 82 MEMBRANE FILTRATION MARKET, BY REGION, 2018–2022 (USD MILLION)

Region	2018	2019	2020	2021	2022	CAGR (2018–2022)
North America	1,335.5	1,404.1	1,478.2	1,558.3	1,645.0	5.3%
Europe	1,019.3	1,067.3	1,119.1	1,174.8	1,234.9	4.9%
Asia Pacific	2,002.2	2,144.8	2,300.6	2,470.9	2,657.3	7.3%
Middle East & Africa	196.4	207.9	220.3	233.9	248.6	6.1%
South America	629.1	669.3	713.0	760.7	812.7	6.6%
Total	5,182.4	5,493.4	5,831.2	6,198.6	6,598.4	6.2%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 83 MEMBRANE FILTRATION MARKET, BY REGION, 2023–2028 (USD MILLION)

Region	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
North America	1,738.7	1,841.3	1,953.6	2,076.7	2,211.7	2,359.9	6.3%
Europe	1,299.1	1,369.2	1,445.9	1,529.8	1,621.6	1,722.1	5.8%
Asia Pacific	2,865.4	3,094.8	3,347.8	3,627.5	3,936.8	4,279.4	8.4%
Middle East & Africa	266.0	285.1	306.2	329.5	355.2	383.6	7.6%
South America	864.7	921.8	984.5	1,053.4	1,129.2	1,212.8	7.0%
Total	7,033.9	7,512.2	8,038.1	8,616.8	9,254.4	9,957.8	7.2%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

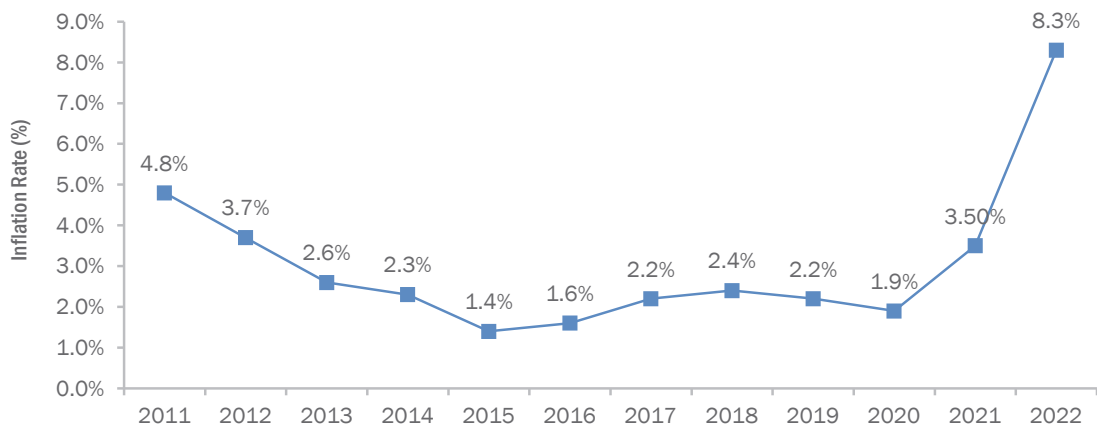
11.2 RECESSION INDICATORS

In simple terms, two consecutive quarters of negative gross domestic product (GDP) is termed a recession period. A recession is a significant, widespread, and prolonged downturn in economic activity. Major recession indicators include inflation, GDP growth, domestic demand, unemployment rate, supply chain disruption, and other factors.

The COVID-19 pandemic has hit the global economy hard for the past three years. And even as the global economy struggled to recover from the COVID-19 impact, the Russia-Ukraine war became one more factor in the setback of the economy. Due to globalization, every country's economy is interconnected, and any conflict between nations impacts the entire world. Warning signs such as high inflation, drastic rate hikes, and the Russia-Ukraine war are indicating a severe recession in 2023.

FIGURE 36 RECESSION INDICATORS

Inflation: Inflation can be defined as the general increase in the prices of goods and services in an economy. It can lead to declining purchasing power over time. Increasing prices of filtered food products can affect consumer behaviour, where consumers might shift to cheaper alternatives and reduce the demand for filtered products. This can further decline the membrane filtration market.

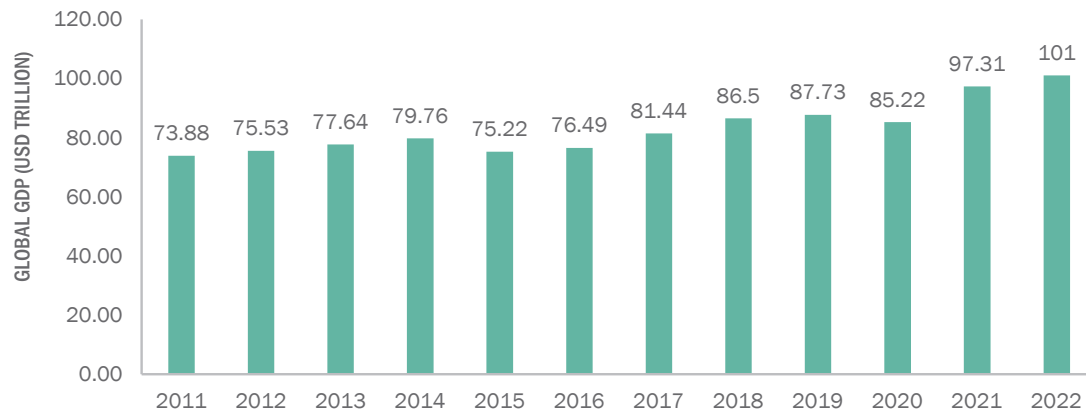
FIGURE 37 GLOBAL INFLATION RATE, 2011-2022

Source: World Bank

- GDP Growth:** Gross domestic product is the total monetary or market value of all the finished goods and services produced within a country's borders in a specific time. During the recession, the real GDP falls as economic activity declines. Negative real GDP indicates a sharp drop in productivity.
 - Global economic activity is experiencing a slowdown as there is higher-than-ever inflation.
 - Global growth is forecast to decrease from 6.0 percent in 2021 to 3.2 percent in 2022 and 2.7 percent in 2023.
 - According to the International Monetary Fund, this is the weakest growth profile since 2001, except for the global financial crisis and the acute phase of the COVID-19 pandemic. Gross domestic product (GDP) is estimated to have fallen by 0.6% in September 2022, after a fall of 0.1% in August 2022, driven by a fall in the services sector. Inflation rose to 9.9% in September, reflecting further component increases.

- Food price inflation also rose to 11.8%, as high input costs made food production more expensive.
- Employment continued to increase even though GDP contracted. Although real personal disposable income also declined in 2022, much of the decline was a result of the end of the COVID-19 relief stimulus, and personal income excluding payments continued to rise.

FIGURE 38 GLOBAL GDP, 2011–2022 (USD TRILLION)



Source: World Bank

- **Domestic Demand:** Final domestic demand is the sum of final consumption, investment, and stock building expenditures by the private and general government sectors in real terms. During the economic crisis, consumption smoothing at various levels defines consumers' behavior. Consumers are unwilling to pay more for products that can be alternated with cheaper ones, thereby redefining "necessity" and "luxury goods." Consumers prioritize buying necessities, so the demand for filtered food products could decline. If consumers choose less expensive alternatives or cut back on non-essential purchases, the market for membrane filtration may fall. The recession leads to economic challenges and uncertainty, resulting in some businesses and consumers cutting back on non-essential expenses, including membrane filtration services. This leads to a temporary decline in demand for membrane filtration, especially in industries that were severely affected by the recession, such as hospitality and food service.
- **Unemployment:** It refers to a situation where a person actively searches for employment but is unable to find work. High rate of unemployment is a sign of economic distress. During the Great Recession of 2007-2010, household food spending declined by 7%, mostly because of high unemployment. Per the United States Department of Agriculture (USDA), this was one of the largest inflation-adjusted declines in food spending that accompanied a recession since 1984.
- **Supply Chain Disruption:** Supply bottlenecks are gradually easing, though their lagged impact still contributes to inflation. The impact of pent-up demand, while weakening, still drives up prices in the services sector. The depreciation of the Euro has added to the build-up of inflationary pressures.
 - While food demand patterns have normalized since the pandemic, supply issues remain due to labour shortages, climate, and trade disruptions. Food manufacturers will look to strike a balance between quick fixes and structural solutions to increase resilience.
 - Economic headwinds could ease the pressure but also cast uncertainty on investments. Consumption to both private and public sectors is likely to take a hit, resulting in major reductions, which affected every sector of the economy, even the food sector.

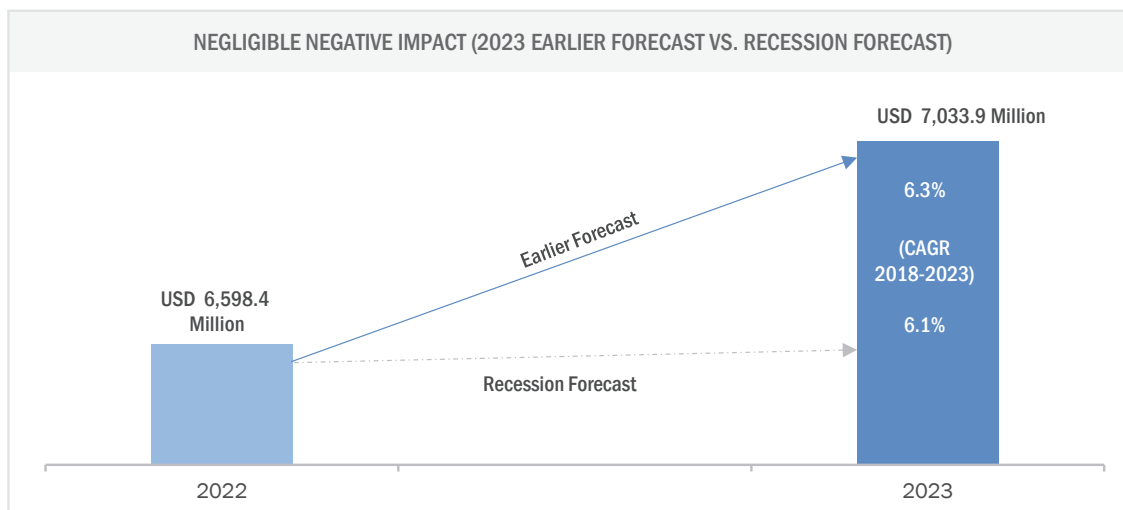
FIGURE 39 IMPACT OF RECESSION INDICATORS ON MEMBRANE FILTRATION MARKET

Recession Indicator	Factor	2022	2023	2025	2028
Inflation	Price of raw material	●	●	●	●
	Price of filtered products	●	●	●	●
GDP Growth	Increased consumption of quality products	●	●	●	●
	Technological advancements	●	●	●	●
Unemployment	Increased cost of production	●	●	●	●
	Decreased revenue of companies	●	●	●	●
Domestic Demand	Increased demand of nutritious, healthy food	●	●	●	●
	Growing interest in quality-assured food products	●	●	●	●
Supply Chain Disruptions	High supply chain costs	●	●	●	●
	Export and import of quality and hygienic food products	●	●	●	●

IMPACT LEVEL ● HIGH ● MEDIUM ● LOW

Source: Secondary Research, Primary Interviews, Industry Journals, Related Research Publications, Press Releases, and MarketsandMarkets Analysis

FIGURE 40 GLOBAL MEMBRANE FILTRATION MARKET: EARLIER FORECAST VS. RECESSION FORECAST



Since there was a difference of just 0.2% in the CAGR (2019-2023) of the global membrane filtration market post-recession, the level of impact considered for this study is a negligible negative impact. However, it will vary according to the individual market.



Source: Secondary Research, Primary Interviews, Industry Journals, Related Research Publications, Press Releases, and MarketsandMarkets Analysis

- The recent recession will have a negligible negative impact on the membrane filtration market. Factors that will majorly impact the market include supply chain disruptions, shortage of labourers, and inflation. However, factors such as GDP growth and domestic demand will have a very low impact or no impact on the membrane filtration market.
- Inflation will result in high prices of quality and hygienic products and other key raw materials used in manufacturing products. Also, increased prices of these raw materials and supply chain disruption due to the Russia-Ukraine war will impact their global exports and imports.

Hence, the membrane filtration market will have a negligible negative impact.

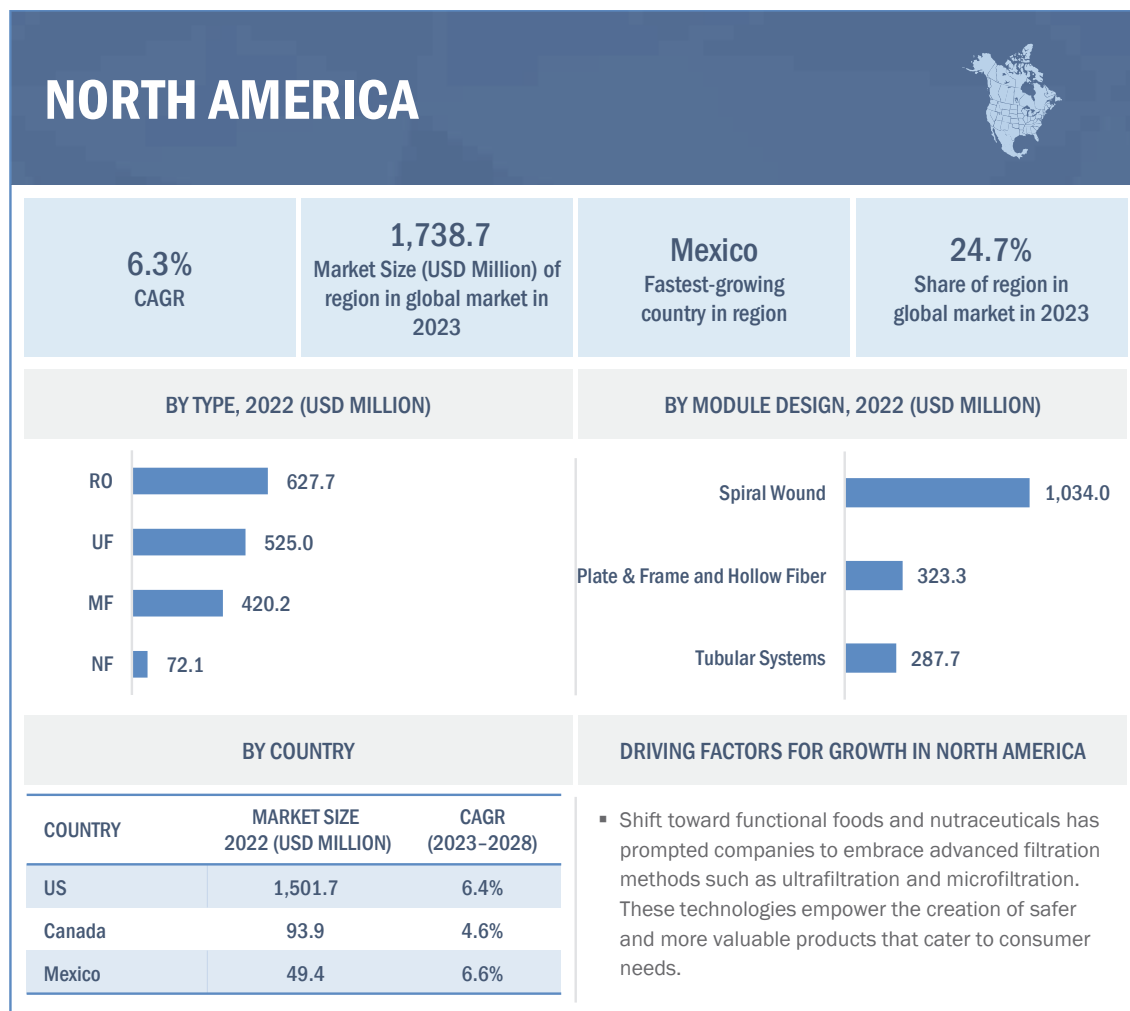
11.3 NORTH AMERICA

This market is expected to be mainly driven by the increasing use of membrane filtration equipment by food and beverage manufacturers, particularly dairy and functional food manufacturers.

The North America account for 24.9% of the market share in 2022. Consumers' growing preference in North America toward healthy and nutritious food products is expected to drive the demand for quality and functional food products. This, in turn, will drive the demand for membrane filtration technologies, such as ultrafiltration, nanofiltration, and microfiltration. These technologies are effective in terms of removing bacteria and enhancing the overall quality of food products.

Government support to promote membrane filtration for water purification applications also drives market growth. Safety and security certificates issued by government agencies to incorporate membrane technologies in various food & beverage, and dairy applications are a strong indicator of growth in the market. In February 2019, US-based PolyCera, Inc., a company that creates and produces innovative membrane technology solutions, received FDA approval for its Hydro flat sheet membrane. This approval allows PolyCera to incorporate its Hydro flat sheet membrane in different food processing applications, such as fat and casein removal, dairy processing, and whey concentration.

In March 2016, a US-based company, Synder Filtration, received Kosher and Halal certifications for sanitary membranes. Since the company is often required to fulfill cultural requirements, these certifications are crucial for dairy and food & beverage producers who utilize membrane filtration in their processing techniques.

FIGURE 41 NORTH AMERICA: MEMBRANE FILTRATION MARKET SNAPSHOT

Source: Company Press Releases, Investor Presentations, Food Journals, Expert Interviews, and MarketsandMarkets Analysis

11.3.1 NORTH AMERICA: RECESSION IMPACT ANALYSIS

Major North American countries, such as the US and Canada, are a part of NATO (North Atlantic Treaty Organization) and, as a result, are significantly experiencing war-based inflation due to disrupted supply chains and the surging US dollar. Macro effects on these powerful economies are subsequently driving the recession worldwide. This rise in inflation, surging prices, and disruption in demand & supply are impacting the membrane filtration market globally, including in North America. Reduced consumer spending can lead to decreased sales and revenue for food manufacturers, distributors, and retailers. This can impact their ability to invest in membrane filtration in food and beverages. Some businesses may be inclined to cut costs, which can include reducing or postponing filtration efforts to alleviate financial strains.

The US Food and Drug Administration (FDA) plays a critical role in regulating food and beverages filtration to ensure the safety and quality of food products available to consumers in the United States. The FDA's food and beverages membrane filtration regulations are designed to prevent foodborne illnesses, protect public health, and maintain consumer confidence in the food supply. These regulations encompass various aspects, including Hazard Analysis and Critical Control Points (HACCP) plans, Good Manufacturing Practices (GMPs), food labeling requirements, and the evaluation and approval of food additives and color additives. The FDA conducts routine sampling and testing of food products to assess compliance with safety and quality standards, including testing for contaminants, pathogens, and undeclared allergens.

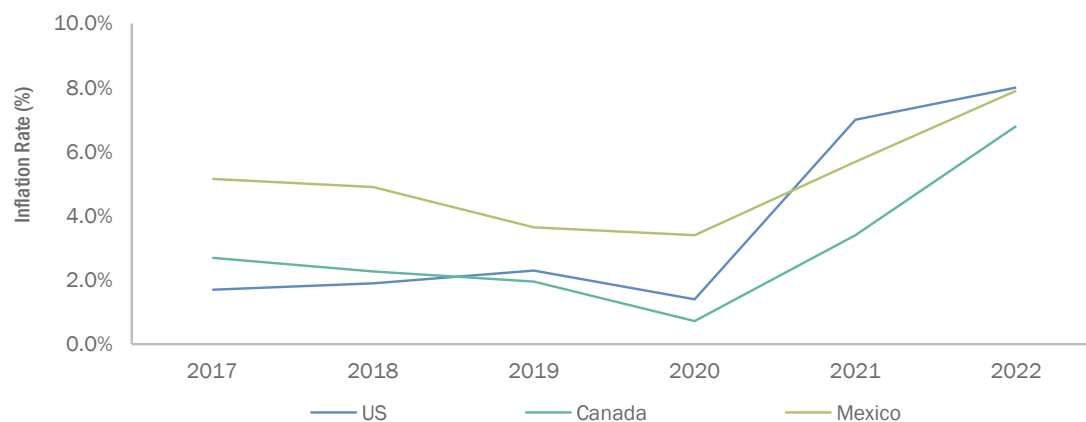
Import controls are also in place to ensure that foreign food products entering the US meet the same safety standards as domestically produced foods. In cases of foodborne illness outbreaks, the FDA collaborates with state and local health authorities to investigate the source of contamination and take appropriate regulatory actions. By enforcing these stringent standards, the FDA ensures that the food consumed by Americans is safe, wholesome, and accurately labeled, thereby safeguarding public health, and maintaining the integrity of the nation's food supply chain.

Therefore, with major disruptions in production, transportation, and many membrane filtration producers in the region, the market for membrane filtration in North America is a little volatile and vulnerable to changes, such as the ongoing recession. The following are some of the major indicators of the recession that have had an impact on the region's membrane filtration market and related markets.

North America: Indicators Impacting the Membrane Filtration Market

- Domestic Demand:** The US has witnessed a significant surge in the demand for hygienic and healthy food, largely driven by an increased focus on health awareness among its population. As people become more informed about various health conditions, preventive measures, and treatment options, they are actively preferring hygienic and filtered food products to address their health needs. The lockdown imposed due to COVID-19 resulted in high demand for membrane filtration.
- Inflation:** According to an article published in BBC News in June 2022, inflation in the US in May hit 8.6%, one of the highest rates in the world. According to the US Labor Department, the annual inflation rate for the US was 7.7%, which ended in October 2022. This inflation is driven by high consumer demand in the country due to its pre-pandemic monetary policy coupled with COVID-19 and Russia-Ukraine war-based supply chain disruptions. Thus, the rise in inflation is subsequently pushing the prices for all commodities, and their membrane filtration and separations.

FIGURE 42 NORTH AMERICA: INFLATION RATES, BY KEY COUNTRY, 2017–2022

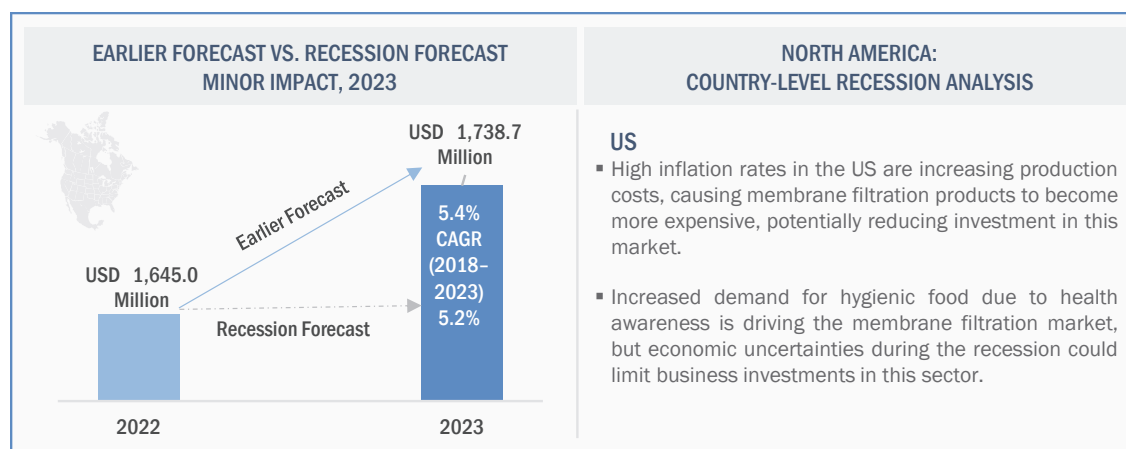


Source: World Bank

According to a survey conducted by the Food Economics Division of the USDA, most Americans lead busy lifestyles. With greater time constraints from work, childcare, and commuting, individuals turn towards safe and convenient foods. The North American membrane filtration market is projected to grow significantly due to the consumer lookout for minimally safe and convenience foods with extended storage lives. This increased demand has heightened the need for appropriate food safety measures, thus fueling the uptake of the membrane filtration market.

The membrane filtration market is susceptible to volatility due to major impacts on transportation and production during times of recession. However, the increasing emphasis on health awareness and the rising demand for robust food safety measures act as significant mitigating factors, rendering the impact of the recession on the membrane filtration market negligible.

FIGURE 43 NORTH AMERICAN MEMBRANE FILTRATION MARKET: EARLIER FORECAST VS. RECESSION FORECAST



Source: World Bank, Secondary Research, Primary Interviews, Industry Journals, Related Research Publications, Press Releases, and MarketsandMarkets Analysis

TABLE 84 NORTH AMERICA: MEMBRANE FILTRATION MARKET, BY COUNTRY, 2018–2022 (USD MILLION)

Country	2018	2019	2020	2021	2022	CAGR (2018–2022)
US	1,214.7	1,278.3	1,347.0	1,421.3	1,501.7	5.4%
Canada	81.2	84.0	87.1	90.4	93.9	3.7%
Mexico	39.6	41.8	44.1	46.7	49.4	5.7%
Total	1,335.5	1,404.1	1,478.2	1,558.3	1,645.0	5.3%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 85 NORTH AMERICA: MEMBRANE FILTRATION MARKET, BY COUNTRY, 2023–2028 (USD MILLION)

Country	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
US	1,588.7	1,684.0	1,788.2	1,902.5	2,027.9	2,165.5	6.4%
Canada	97.6	101.7	106.2	111.1	116.4	122.3	4.6%
Mexico	52.4	55.6	59.2	63.1	67.4	72.1	6.6%
Total	1,738.7	1,841.3	1,953.6	2,076.7	2,211.7	2,359.9	6.3%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 86 NORTH AMERICA: MEMBRANE FILTRATION MARKET, BY MODULE DESIGN, 2018–2022 (USD MILLION)

Module Design	2018	2019	2020	2021	2022	CAGR (2018–2022)
Spiral Wound	843.3	885.62	931.29	980.64	1,033.98	5.2%
Tubular Systems	227.1	240.48	254.95	270.65	287.68	6.1%
Plate & Frame and Hollow Fiber	265.1	278.00	291.96	307.03	323.31	5.1%
Total	1,335.5	1,404.1	1,478.2	1,558.3	1,645.0	5.3%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 87 NORTH AMERICA: MEMBRANE FILTRATION MARKET, BY MODULE DESIGN, 2023–2028 (USD MILLION)

Module Design	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Spiral Wound	1,091.9	1,155.2	1,224.4	1,300.3	1,383.4	1,474.6	6.2%
Tubular Systems	306.1	326.3	348.5	372.9	399.7	429.3	7.0%
Plate & Frame and Hollow Fiber	340.8	359.9	380.7	403.6	428.6	456.0	6.0%
Total	1,738.7	1,841.3	1,953.6	2,076.7	2,211.7	2,359.9	6.3%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 88 NORTH AMERICA: MEMBRANE FILTRATION MARKET, BY MEMBRANE MATERIAL, 2018–2022 (USD MILLION)

Membrane Material	2018	2019	2020	2021	2022	CAGR (2018–2022)
Polymeric	1,189.9	1,249.9	1,314.6	1,384.5	1,459.8	5.2%
Ceramic	145.6	154.2	163.6	173.9	185.2	6.2%
Total	1,335.5	1,404.1	1,478.2	1,558.3	1,645.0	5.3%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 89 NORTH AMERICA: MEMBRANE FILTRATION MARKET, BY MEMBRANE MATERIAL, 2023–2028 (USD MILLION)

Membrane Material	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Polymeric	1,541.2	1,630.1	1,727.4	1,834.0	1,950.8	2,078.9	6.2%
Ceramic	197.6	211.2	226.2	242.7	260.9	281.0	7.3%
Total	1,738.7	1,841.3	1,953.6	2,076.7	2,211.7	2,359.9	6.3%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 90 NORTH AMERICA: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2018–2022 (USD MILLION)

Application	2018	2019	2020	2021	2022	CAGR (2018–2022)
Dairy Products	497.4	520.9	546.3	573.7	603.3	4.9%
Drinks & Concentrates	398.3	421.1	445.8	472.6	501.6	5.9%
Wine & Beer	338.2	354.9	372.9	392.4	413.5	5.2%
Other Food & Beverage Applications	101.7	107.2	113.1	119.6	126.5	5.6%
Total	1,335.5	1,404.1	1,478.2	1,558.3	1,645.0	5.3%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 91 NORTH AMERICA: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2023–2028 (USD MILLION)

Application	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Dairy Products	635.1	669.9	707.8	749.3	794.7	844.3	5.9%
Drinks & Concentrates	533.2	567.9	605.9	647.8	693.7	744.4	6.9%
Wine & Beer	436.3	461.1	488.3	518.1	550.8	586.6	6.1%
Other Food & Beverage Applications	134.1	142.4	151.6	161.6	172.5	184.6	6.6%
Total	1,738.7	1,841.3	1,953.6	2,076.7	2,211.7	2,359.9	6.3%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 92 NORTH AMERICA: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY SUBAPPLICATION, 2018–2022 (USD MILLION)

Subapplication	2018	2019	2020	2021	2022	CAGR (2018–2022)
Liquid Milk	343.2	360.7	379.6	399.8	421.5	5.3%
Other Dairy Products	154.2	160.2	166.8	173.9	181.8	4.2%
Total	497.4	520.9	546.3	573.7	603.3	4.9%

Source: Related Journals, Annual Reports, Press Releases, Company Publications, Company Websites, Expert Interviews, and MarketsandMarkets Analysis

TABLE 93 NORTH AMERICA: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY SUBAPPLICATION, 2023–2028 (USD MILLION)

Subapplication	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Liquid Milk	444.8	470.2	498.0	528.4	561.6	598.0	6.1%
Other Dairy Products	190.3	199.6	209.8	220.9	233.1	246.4	5.3%
Total	635.1	669.9	707.8	749.3	794.7	844.3	5.9%

Source: Related Journals, Annual Reports, Press Releases, Company Publications, Company Websites, Expert Interviews, and MarketsandMarkets Analysis

TABLE 94 NORTH AMERICA: MEMBRANE FILTRATION MARKET FOR LIQUID MILK, BY SUBAPPLICATION, 2018–2022 (USD MILLION)

Subapplication	2018	2019	2020	2021	2022	CAGR (2018–2022)
Milk Concentration	191.8	203.0	214.8	227.5	240.9	5.9%
Milk Protein Fractionation	119.1	124.1	129.5	135.5	142.0	5.9%
Milk Pre-Concentration	20.9	21.9	23.0	24.2	25.5	5.1%
Water Recovery	11.3	11.7	12.1	12.6	13.1	3.7%
Total	343.2	360.7	379.6	399.8	421.5	5.3%

Source: Related Journals, Annual Reports, Press Releases, Company Publications, Company Websites, Expert Interviews, and MarketsandMarkets Analysis

TABLE 95 NORTH AMERICA: MEMBRANE FILTRATION MARKET FOR LIQUID MILK, BY SUBAPPLICATION, 2023–2028 (USD MILLION)

Subapplication	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Milk Concentration	255.3	271.0	288.1	306.9	327.4	349.9	6.5%
Milk Protein Fractionation	149.0	156.6	164.9	173.9	183.8	194.7	5.5%
Milk Pre-Concentration	26.9	28.5	30.2	32.0	34.0	36.2	6.1%
Water Recovery	13.6	14.2	14.9	15.6	16.3	17.2	4.7%
Total	444.8	470.2	498.0	528.4	561.6	598.0	6.1%

Source: Related Journals, Annual Reports, Press Releases, Company Publications, Company Websites, Expert Interviews, and MarketsandMarkets Analysis

TABLE 96 NORTH AMERICA: MEMBRANE FILTRATION MARKET FOR OTHER DAIRY PRODUCTS, BY SUBAPPLICATION, 2018–2022 (USD MILLION)

Subapplication	2018	2019	2020	2021	2022	CAGR (2018–2022)
Whey	73.5	76.7	80.1	83.8	87.9	4.6%
Milk & Whey Based Ingredients	23.7	24.5	25.2	26.1	27.0	3.3%
Cheese	56.9	59.1	61.4	64.0	66.8	4.1%
Total	154.2	160.2	166.8	173.9	181.8	4.2%

Source: Related Journals, Annual Reports, Press Releases, Company Publications, Company Websites, Expert Interviews, and MarketsandMarkets Analysis

TABLE 97 NORTH AMERICA: MEMBRANE FILTRATION MARKET FOR OTHER DAIRY PRODUCTS, BY SUBAPPLICATION, 2023–2028 (USD MILLION)

Subapplication	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Whey	92.4	97.2	102.5	108.3	114.6	121.5	5.6%
Milk & Whey Based Ingredients	28.1	29.2	30.4	31.8	33.2	34.8	4.4%
Cheese	69.9	73.2	76.9	80.9	85.3	90.0	5.2%
Total	190.3	199.6	209.8	220.9	233.1	246.4	5.3%

Source: Related Journals, Annual Reports, Press Releases, Company Publications, Company Websites, Expert Interviews, and MarketsandMarkets Analysis

TABLE 98 NORTH AMERICA: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	265.4	278.5	292.9	308.6	325.7	5.3%
Ultrafiltration (UF)	131.8	137.8	144.1	150.6	157.4	4.5%
Microfiltration (MF)	72.7	76.0	79.7	83.6	88.0	4.9%
Nanofiltration (NF)	27.5	28.6	29.7	30.9	32.2	4.0%
Total	497.4	520.9	546.3	573.7	603.3	4.9%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 99 NORTH AMERICA: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	344.2	364.5	386.6	410.8	437.4	472.1	6.5%
Ultrafiltration (UF)	165.2	173.6	182.8	192.8	203.8	215.7	5.5%
Microfiltration (MF)	92.2	96.9	101.9	107.4	113.5	114.4	4.4%
Nanofiltration (NF)	33.5	34.9	36.5	38.2	40.1	42.1	4.7%
Total	635.1	669.9	707.8	749.3	794.7	844.3	5.9%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 100 NORTH AMERICA: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	150.9	160.1	169.8	180.2	191.3	6.1%
Ultrafiltration (UF)	130.6	137.8	145.7	154.3	163.7	5.8%
Microfiltration (MF)	103.9	109.9	116.4	123.5	131.2	6.0%
Nanofiltration (NF)	12.7	13.3	14.0	14.7	15.4	4.9%
Total	398.3	421.1	445.8	472.6	501.6	5.9%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 101 NORTH AMERICA: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	203.9	217.8	233.1	249.9	268.4	288.8	7.2%
Ultrafiltration (UF)	173.8	184.9	197.2	210.6	225.3	241.5	6.8%
Microfiltration (MF)	139.2	148.0	157.6	168.2	179.8	192.6	6.7%
Nanofiltration (NF)	16.2	17.1	18.1	19.1	20.3	21.5	5.8%
Total	533.2	567.9	605.9	647.8	693.7	744.4	6.9%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 102 NORTH AMERICA: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	51.4	53.9	56.6	59.5	62.7	5.1%
Ultrafiltration (UF)	128.8	135.3	142.3	150.0	158.4	5.3%
Microfiltration (MF)	146.1	153.4	161.3	169.6	178.4	5.1%
Nanofiltration (NF)	11.8	12.3	12.8	13.4	14.0	4.2%
Total	338.2	354.9	372.9	392.4	413.5	5.2%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 103 NORTH AMERICA: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	66.0	69.7	73.6	78.0	82.7	88.0	5.9%
Ultrafiltration (UF)	167.0	176.3	186.5	197.7	210.0	223.4	6.0%
Microfiltration (MF)	188.7	199.9	212.2	225.6	240.4	256.6	6.3%
Nanofiltration (NF)	14.6	15.2	16.0	16.8	17.6	18.6	5.0%
Total	436.3	461.1	488.3	518.1	550.8	586.6	6.1%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 104 NORTH AMERICA: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	38.0	40.3	42.7	45.2	48.0	6.0%
Ultrafiltration (UF)	36.7	38.6	40.7	43.0	45.5	5.5%
Microfiltration (MF)	18.1	19.1	20.1	21.3	22.5	5.6%
Nanofiltration (NF)	8.8	9.2	9.6	10.1	10.6	4.6%
Total	101.7	107.2	113.1	119.6	126.5	5.6%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 105 NORTH AMERICA: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	50.6	53.4	56.5	59.9	63.7	67.8	6.0%
Ultrafiltration (UF)	48.4	51.7	55.2	59.2	63.5	68.2	7.1%
Microfiltration (MF)	23.9	25.5	27.3	29.2	31.3	33.6	7.0%
Nanofiltration (NF)	11.2	11.8	12.5	13.3	14.1	15.0	6.1%
Total	134.1	142.4	151.6	161.6	172.5	184.6	6.6%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

11.3.2 US

11.3.2.1 Growing popularity of dairy products to propel demand for membrane filtration solutions

The US market has experienced rapid growth recently due to increased consumption of functional foods, beverages, nutraceuticals, and processed dairy items. This heightened demand for such products is spurring the need for advanced filtration methods like membrane filtration, which enhances the quality, texture, and taste of foods.

The expansion of the membrane filtration market in the US is also influenced by consumers' growing preference for healthy and nutritious food options. This shift towards functional foods and nutraceuticals is driving companies to adopt sophisticated filtration techniques like ultrafiltration and microfiltration. These technologies enable the production of safer and more valuable products for consumers.

The US membrane filtration market is also expected to be driven by the increasing use of membrane filtration technologies in the dairy industry. The dairy industry is witnessing rapid growth in the US. According to the OECD, the total cheese production in the US in 2022 was 6239.91 tonnes, and in 2021 was 6207.32 tonnes. This means the demand for cheese is continuously increasing. Therefore, the demand for membrane filtration technologies will also increase in the coming years.

The growing beverage industry is also one of the driving factors responsible for the growth of the North American membrane filtration market. North American consumers are more likely to prefer packaged food and beverage products, forcing manufacturers to use filtered water in producing these beverages. In the past few years, US-based beverage giants such as PepsiCo and Coca-Cola have been utilizing filtered water using RO to produce soft drinks, which has eventually strengthened the growth of the reverse osmosis market in the US.

TABLE 106 US: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2018–2022 (USD MILLION)

Application	2018	2019	2020	2021	2022	CAGR (2018–2022)
Dairy Products	452.6	474.6	498.4	524.1	552.0	5.1%
Drinks & Concentrates	364.8	386.0	408.9	433.7	460.5	6.0%
Wine & Beer	304.7	320.0	336.6	354.4	373.7	5.2%
Other Food & Beverage Applications	92.6	97.7	103.2	109.1	115.5	5.7%
Total	1,214.7	1,278.3	1,347.0	1,421.3	1,501.7	5.4%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 107 US: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2023–2028 (USD MILLION)

Application	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Dairy Products	582.1	615.0	651.0	690.3	733.3	780.5	6.0%
Drinks & Concentrates	489.7	521.8	556.9	595.6	638.1	684.9	6.9%
Wine & Beer	394.4	417.1	441.9	469.1	498.8	531.5	6.1%
Other Food & Beverage Applications	122.4	130.1	138.4	147.6	157.7	168.7	6.6%
Total	1,588.7	1,684.0	1,788.2	1,902.5	2,027.9	2,165.5	6.4%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 108 US: MEMBRANE FILTRATION MARKET, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	458.5	483.4	510.3	539.5	571.1	5.6%
Ultrafiltration (UF)	391.7	411.8	433.4	456.8	482.1	5.3%
Microfiltration (MF)	309.3	325.6	343.2	362.2	382.8	5.5%
Nanofiltration (NF)	55.1	57.5	60.0	62.7	65.6	4.4%
Total	1,214.7	1,278.3	1,347.0	1,421.3	1,501.7	5.4%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 109 US: MEMBRANE FILTRATION MARKET, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	605.4	643.0	684.1	729.3	778.8	838.9	6.7%
Ultrafiltration (UF)	509.6	539.6	572.5	608.5	647.9	691.2	6.3%
Microfiltration (MF)	405.0	429.3	455.8	485.0	516.9	546.3	6.2%
Nanofiltration (NF)	68.7	72.1	75.8	79.8	84.2	89.1	5.3%
Total	1,588.7	1,684.0	1,788.2	1,902.5	2,027.9	2,165.5	6.4%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 110 US: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	242.3	254.3	267.4	281.8	297.5	5.3%
Ultrafiltration (UF)	131.1	137.7	144.6	151.9	159.7	5.1%
Microfiltration (MF)	53.8	56.3	59.0	61.9	65.2	4.9%
Nanofiltration (NF)	25.4	26.3	27.4	28.5	29.6	4.0%
Total	452.6	474.6	498.4	524.1	552.0	5.1%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 111 US: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	314.7	333.4	354.0	376.5	401.1	433.8	6.6%
Ultrafiltration (UF)	168.1	177.2	187.2	198.0	209.9	222.9	5.8%
Microfiltration (MF)	68.6	72.3	76.3	80.7	85.5	85.2	4.4%
Nanofiltration (NF)	30.8	32.1	33.6	35.1	36.8	38.6	4.6%
Total	582.1	615.0	651.0	690.3	733.3	780.5	6.0%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 112 US: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	138.3	147.4	157.2	167.7	178.9	6.6%
Ultrafiltration (UF)	119.7	126.0	132.9	140.5	148.8	5.6%
Microfiltration (MF)	95.2	100.4	106.0	112.1	118.8	5.7%
Nanofiltration (NF)	11.7	12.2	12.7	13.4	14.0	4.7%
Total	364.8	386.0	408.9	433.7	460.5	6.0%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 113 US: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	190.8	204.0	218.5	234.4	251.9	271.2	7.3%
Ultrafiltration (UF)	158.0	168.1	179.2	191.4	204.8	219.6	6.8%
Microfiltration (MF)	126.1	134.0	142.8	152.3	162.8	174.4	6.7%
Nanofiltration (NF)	14.8	15.6	16.5	17.4	18.5	19.7	5.9%
Total	489.7	521.8	556.9	595.6	638.1	684.9	6.9%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 114 US: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	43.3	45.0	46.8	48.8	51.0	4.2%
Ultrafiltration (UF)	107.6	112.9	118.8	125.2	132.2	5.3%
Microfiltration (MF)	143.8	151.6	159.9	168.7	178.2	5.5%
Nanofiltration (NF)	10.1	10.5	11.1	11.6	12.3	5.1%
Total	304.7	320.0	336.6	354.4	373.7	5.2%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 115 US: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	53.3	55.8	58.5	61.5	64.8	68.4	5.1%
Ultrafiltration (UF)	139.6	147.7	156.6	166.3	177.0	188.6	6.2%
Microfiltration (MF)	188.5	199.9	212.3	225.9	240.7	257.1	6.4%
Nanofiltration (NF)	12.9	13.7	14.5	15.4	16.3	17.4	6.1%
Total	394.4	417.1	441.9	469.1	498.8	531.5	6.1%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 116 US: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	34.6	36.7	38.9	41.3	43.8	6.0%
Ultrafiltration (UF)	33.4	35.2	37.1	39.2	41.4	5.5%
Microfiltration (MF)	16.5	17.4	18.4	19.4	20.6	5.7%
Nanofiltration (NF)	8.1	8.4	8.8	9.2	9.7	4.7%
Total	92.6	97.7	103.2	109.1	115.5	5.7%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 117 US: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	46.6	49.7	53.1	56.9	61.0	65.6	7.1%
Ultrafiltration (UF)	43.9	46.6	49.5	52.7	56.2	60.1	6.5%
Microfiltration (MF)	21.8	23.1	24.5	26.1	27.8	29.7	6.4%
Nanofiltration (NF)	10.2	10.7	11.3	11.9	12.6	13.4	5.6%
Total	122.4	130.1	138.4	147.6	157.7	168.7	6.6%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

11.3.3 CANADA

11.3.3.1 Growing demand for functional food products and wine to drive market

The Canadian government mainly focuses on the quality of dairy products produced. According to Agriculture and Agri-Food Canada, the Canadian government imposes strict quality standards on dairy farms and processing plants. Therefore, it is important for dairy product manufacturers to maintain the highest quality standards during the manufacturing process. To obtain dairy products of optimum quality, Canadian dairy manufacturers adopt membrane filtration technologies for the purification, filtration, and enhancement of dairy products, which is expected to drive this market in the coming years. Dairy production in Canada is rapidly growing year after year. According to OECD 2022, the milk production in Canada is 10,815.87 tonnes, and in 2021 is 10,774.44 tonnes. This shows the rise in the demand for dairy products in Canada in the upcoming years.

Furthermore, the growth in the demand for functional food is also expected to drive the demand for membrane filtration in Canada in the coming years. A shift in trend has been seen in Canadian consumers' food selection patterns. Consumers are increasingly including functional ingredients products in their regular diets. Agriculture and Agri-Food Canada states that "growing consumer interest, combined with a greater understanding of food-health relationships, rising healthcare costs, and an aging population, are factors driving the market for functional foods and natural health products." Therefore, to meet the demand for these products, functional food manufacturers are increasingly adopting membrane filtration technologies such as ultrafiltration and microfiltration.

According to StatCan 2022, liquor authorities and other retail outlets sold USD 26.1 billion worth of alcoholic beverages in the fiscal year ending March 31, 2022, up 2.4% from a year earlier. The increase in sales of alcoholic beverages was driven by inflation, which rose 2.8% for alcoholic beverages purchased from stores from March 2021 to March 2022. This gives rise to increased demand for the membrane filtration market.

According to a report published by the Crops and Horticulture and Division Agriculture and Agri-Food Canada in August 2021, "the Canadian maple syrup industry accounts for approximately 75% of the world's maple syrup production, with 92% of the Canadian production originating from Quebec, 4% from New Brunswick, 3% from Ontario, and 1% from Nova Scotia." Furthermore, as per Synder Filtration, maple syrup is often processed using membrane technologies to lower the evaporation needed to attain a "66%+ sugar concentration. This way, maple syrup manufacturers can save substantial amounts.

In June 2022, Canada-based H2O Innovation acquired US-based Evaporator Co., Inc, a leading player in manufacturing, developing, and selling maple farming equipment and products. H2O is engaged in manufacturing equipment required for the maple syrup industry and markets them to maple syrup producers in Canada and the US. This acquisition will strengthen H2O's position in the maple syrup industry and the membrane filtration market.

TABLE 118 CANADA: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2018–2022 (USD MILLION)

Application	2018	2019	2020	2021	2022	CAGR (2018–2022)
Dairy Products	30.4	31.4	32.5	33.5	34.7	3.4%
Drinks & Concentrates	22.5	23.4	24.4	25.4	26.6	4.3%
Wine & Beer	22.7	23.5	24.2	25.1	26.1	3.5%
Other Food & Beverage Applications	5.6	5.8	6.0	6.3	6.6	4.0%
Total	81.2	84.0	87.1	90.4	93.9	3.7%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 119 CANADA: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2023–2028 (USD MILLION)

Application	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Dairy Products	35.8	37.0	38.4	39.9	41.5	43.3	3.9%
Drinks & Concentrates	27.9	29.3	30.8	32.5	34.3	36.3	5.4%
Wine & Beer	27.1	28.3	29.5	30.9	32.3	34.0	4.6%
Other Food & Beverage Applications	6.8	7.2	7.5	7.9	8.3	8.8	5.1%
Total	97.6	101.7	106.2	111.1	116.4	122.3	4.6%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 120 CANADA: MEMBRANE FILTRATION MARKET, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	32.0	33.2	34.5	35.8	37.3	3.9%
Ultrafiltration (UF)	23.9	24.7	25.6	26.5	27.5	3.5%
Microfiltration (MF)	21.1	21.8	22.6	23.5	24.4	3.7%
Nanofiltration (NF)	4.2	4.3	4.4	4.5	4.7	2.9%
Total	81.2	84.0	87.1	90.4	93.9	3.7%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 121 CANADA: MEMBRANE FILTRATION MARKET, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	38.9	40.6	42.5	44.6	46.8	49.3	4.8%
Ultrafiltration (UF)	28.5	29.7	30.9	32.3	33.8	35.4	4.4%
Microfiltration (MF)	25.4	26.5	27.6	28.9	30.3	31.8	4.6%
Nanofiltration (NF)	4.8	5.0	5.2	5.4	5.6	5.8	3.8%
Total	97.6	101.7	106.2	111.1	116.4	122.3	4.6%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 122 CANADA: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	18.13	18.69	19.27	19.88	20.51	6.0%
Ultrafiltration (UF)	6.50	6.76	7.02	7.28	7.54	3.2%
Microfiltration (MF)	3.51	3.67	3.83	3.98	4.12	3.4%
Nanofiltration (NF)	2.21	2.28	2.34	2.41	2.48	2.3%
Total	30.35	31.39	32.45	33.54	34.65	4.3%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 123 CANADA: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	21.08	21.71	22.39	23.14	23.95	24.83	3.3%
Ultrafiltration (UF)	7.83	8.15	8.51	8.89	9.30	9.76	4.5%
Microfiltration (MF)	4.31	4.53	4.76	5.01	5.29	5.59	5.3%
Nanofiltration (NF)	2.56	2.65	2.74	2.84	2.95	3.08	3.8%
Total	35.79	37.04	38.40	39.88	41.49	43.25	3.9%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 124 CANADA: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	8.52	9.01	9.54	10.12	10.75	6.0%
Ultrafiltration (UF)	7.37	7.59	7.82	8.08	8.36	3.2%
Microfiltration (MF)	5.87	6.05	6.25	6.47	6.71	3.4%
Nanofiltration (NF)	0.72	0.73	0.75	0.77	0.79	2.3%
Total	22.48	23.38	24.36	25.43	26.60	4.3%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 125 CANADA: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	11.53	12.38	13.31	14.33	15.44	16.65	7.6%
Ultrafiltration (UF)	8.63	8.93	9.25	9.60	9.98	10.40	3.8%
Microfiltration (MF)	6.92	7.14	7.39	7.67	7.97	8.29	3.7%
Nanofiltration (NF)	0.81	0.82	0.85	0.87	0.90	0.92	2.8%
Total	27.88	29.28	30.80	32.46	34.28	36.27	5.4%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 126 CANADA: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	3.23	3.30	3.38	3.46	3.56	2.5%
Ultrafiltration (UF)	8.02	8.29	8.58	8.89	9.24	3.6%
Microfiltration (MF)	10.73	11.09	11.50	11.94	12.42	3.7%
Nanofiltration (NF)	0.75	0.77	0.80	0.83	0.86	3.4%
Total	22.73	23.45	24.25	25.12	26.08	3.5%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 127 CANADA: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	3.67	3.79	3.91	4.06	4.21	4.38	3.6%
Ultrafiltration (UF)	9.62	10.03	10.48	10.98	11.52	12.10	4.7%
Microfiltration (MF)	12.94	13.51	14.13	14.81	15.55	16.36	4.8%
Nanofiltration (NF)	0.89	0.93	0.97	1.01	1.06	1.12	4.6%
Total	27.12	28.26	29.50	30.86	32.34	33.96	4.6%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 128 CANADA: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	2.09	2.18	2.28	2.38	2.49	4.4%
Ultrafiltration (UF)	2.02	2.09	2.17	2.25	2.35	3.8%
Microfiltration (MF)	1.00	1.03	1.07	1.12	1.17	4.0%
Nanofiltration (NF)	0.49	0.50	0.51	0.53	0.55	3.0%
Total	5.60	5.81	6.03	6.28	6.55	4.0%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 129 CANADA: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGES APPLICATIONS, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	2.61	2.75	2.89	3.05	3.22	3.41	5.5%
Ultrafiltration (UF)	2.45	2.56	2.69	2.82	2.97	3.13	5.0%
Microfiltration (MF)	1.22	1.27	1.33	1.40	1.47	1.54	4.9%
Nanofiltration (NF)	0.57	0.59	0.61	0.64	0.66	0.69	4.1%
Total	6.85	7.17	7.52	7.90	8.32	8.78	5.1%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

11.3.4 MEXICO

11.3.4.1 Rapid growth in dairy industry to drive growth

The membrane filtration market in Mexico is influenced by the dairy industry and the constantly growing cheese and butter production. According to the USDA 2022, the production forecast for 2023 is 13.57 MMT, a two percent growth compared to 2022, driven by a growing herd, increased producer integration, and secured milk sales through large companies such as Lala and Alpura. Increased industrial use in 2023 is forecast to help drive up consumption to 13.58 MMT, a two percent increase compared to 2022. Imports and exports are forecast to rebound from lower trade in 2022. With this significant production of dairy products, the demand for membrane filtration is expected to increase for purification purposes, including removing pigment-producing micrococcus, pathogenic bacteria, yeast, and mold.

Exports of dairy products from the US are duty-free in Mexico because of NAFTA (North American Free Trade Agreement). When NAFTA was enacted in 1994, nearly USD 193 million worth of dairy exports were being exported from the US to Mexico.

Apart from the dairy industry, Mexico is one of the leading beer producers. Beer is not subjected to heat stress during reverse osmosis, which operates at filtration temperatures of roughly 10°C. The growing demand for beer is expected to support market growth in Mexico.

TABLE 130 MEXICO: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2018–2022 (USD MILLION)

Application	2018	2019	2020	2021	2022	CAGR (2018–2022)
Dairy Products	14.5	15.0	15.5	16.1	16.6	3.5%
Drinks & Concentrates	11.0	11.7	12.6	13.5	14.5	7.2%
Wine & Beer	10.7	11.4	12.1	12.9	13.8	6.4%
Other Food & Beverage Applications	3.4	3.7	3.9	4.2	4.5	6.9%
Total	39.6	41.8	44.1	46.7	49.4	5.7%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 131 MEXICO: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2023–2028 (USD MILLION)

Application	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Dairy Products	17.2	17.8	18.4	19.1	19.8	20.6	3.7%
Drinks & Concentrates	15.6	16.9	18.2	19.7	21.4	23.3	8.3%
Wine & Beer	14.7	15.8	16.9	18.2	19.6	21.1	7.5%
Other Food & Beverage Applications	4.8	5.2	5.6	6.1	6.6	7.1	8.0%
Total	52.4	55.6	59.2	63.1	67.4	72.1	6.6%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 132 MEXICO: MEMBRANE FILTRATION MARKET, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	15.3	16.2	17.1	18.1	19.2	5.9%
Ultrafiltration (UF)	12.4	13.0	13.7	14.5	15.4	5.6%
Microfiltration (MF)	10.3	10.9	11.5	12.2	12.9	5.8%
Nanofiltration (NF)	1.6	1.7	1.7	1.8	1.9	3.3%
Total	39.6	41.8	44.1	46.7	49.4	5.7%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 133 MEXICO: MEMBRANE FILTRATION MARKET, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	20.4	21.8	23.2	24.8	26.5	28.5	6.8%
Ultrafiltration (UF)	16.3	17.3	18.3	19.5	20.8	22.3	6.5%
Microfiltration (MF)	13.7	14.6	15.6	16.6	17.7	19.0	6.7%
Nanofiltration (NF)	1.9	2.0	2.1	2.2	2.3	2.4	4.1%
Total	52.4	55.6	59.2	63.1	67.4	72.1	6.6%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 134 MEXICO: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	8.33	8.67	9.03	9.41	9.80	4.2%
Ultrafiltration (UF)	3.49	3.62	3.74	3.87	4.00	3.5%
Microfiltration (MF)	1.77	1.82	1.85	1.89	1.92	2.0%
Nanofiltration (NF)	0.88	0.89	0.90	0.91	0.92	1.1%
Total	14.47	14.99	15.52	16.07	16.63	3.5%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 135 MEXICO: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	10.17	10.56	10.97	11.41	11.88	12.37	4.0%
Ultrafiltration (UF)	4.14	4.29	4.45	4.63	4.81	5.01	3.9%
Microfiltration (MF)	1.96	2.01	2.06	2.11	2.16	2.22	2.5%
Nanofiltration (NF)	0.93	0.94	0.95	0.96	0.97	0.99	1.3%
Total	17.20	17.80	18.44	19.11	19.83	20.59	3.7%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 136 MEXICO: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	4.16	4.52	4.92	5.36	5.85	8.9%
Ultrafiltration (UF)	3.63	3.85	4.08	4.33	4.61	6.1%
Microfiltration (MF)	2.87	3.04	3.23	3.43	3.66	6.3%
Nanofiltration (NF)	0.32	0.33	0.35	0.37	0.39	5.2%
Total	10.98	11.74	12.57	13.49	14.50	7.2%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 137 MEXICO: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	6.44	7.10	7.83	8.65	9.57	10.59	10.5%
Ultrafiltration (UF)	4.89	5.20	5.55	5.93	6.34	6.80	6.8%
Microfiltration (MF)	3.88	4.12	4.38	4.67	4.99	5.34	6.6%
Nanofiltration (NF)	0.41	0.43	0.45	0.48	0.51	0.54	5.6%
Total	15.62	16.85	18.22	19.73	21.41	23.27	8.3%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 138 MEXICO: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	1.53	1.60	1.69	1.78	1.88	5.4%
Ultrafiltration (UF)	3.99	4.23	4.50	4.80	5.13	6.5%
Microfiltration (MF)	5.07	5.39	5.74	6.13	6.55	6.6%
Nanofiltration (NF)	0.16	0.17	0.18	0.19	0.21	6.3%
Total	10.74	11.40	12.12	12.90	13.77	6.4%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 139 MEXICO: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	2.00	2.12	2.25	2.40	2.57	2.75	6.6%
Ultrafiltration (UF)	5.49	5.88	6.32	6.80	7.33	7.91	7.6%
Microfiltration (MF)	7.02	7.53	8.09	8.71	9.40	10.16	7.7%
Nanofiltration (NF)	0.22	0.23	0.25	0.27	0.29	0.31	7.1%
Total	14.72	15.76	16.91	18.18	19.58	21.13	7.5%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 140 MEXICO: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGES APPLICATIONS, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	1.29	1.38	1.48	1.59	1.71	7.3%
Ultrafiltration (UF)	1.25	1.33	1.41	1.51	1.62	6.8%
Microfiltration (MF)	0.63	0.67	0.72	0.77	0.82	6.8%
Nanofiltration (NF)	0.28	0.30	0.31	0.33	0.35	5.7%
Total	3.45	3.68	3.93	4.20	4.50	6.9%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 141 MEXICO: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	1.84	1.99	2.15	2.33	2.53	2.75	8.3%
Ultrafiltration (UF)	1.74	1.87	2.02	2.18	2.36	2.56	8.0%
Microfiltration (MF)	0.88	0.95	1.02	1.10	1.18	1.28	7.8%
Nanofiltration (NF)	0.38	0.40	0.43	0.46	0.49	0.52	6.9%
Total	4.84	5.20	5.61	6.06	6.56	7.11	8.0%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

11.4 EUROPE

Europe is the third-largest regional segment in the global membrane filtration market. Growth in this market segment is mainly influenced by the growing demand for membrane filtration equipment from the dairy, functional food, and nutraceutical industries.

Spain is the largest membrane filtration market in Europe, followed by Italy. The increased use of membrane filtration technologies in functional food, dairy, and water purification has furthered growth in the market in Spain over the last decade. The growing demand for fortified food products, along with the rising awareness among Spanish consumers about the quality of food products and the ingredients included in them, is a key factor responsible for the increased application of these technologies in the food & beverage industry in the country.

France is projected to be the fastest-growing market in Europe. This is due to dairy manufacturers' increased use of membrane filtration technologies and the strict quality and food safety regulations imposed by government bodies.

11.4.1 EUROPE: RECESSION IMPACT ANALYSIS

Europe heavily bore the effect of recession as it is home to the ongoing Russian-Ukraine war. Countries in Europe are experiencing high inflation, growing unemployment rates, and soaring energy prices. The Russia-Ukraine war exacerbated the energy crisis in Europe, drove up inflation, tightened financial conditions, and hit business confidence. The European Commission, in 2022, reported that inflation would stay higher for longer, at 8.5% in 2022 and 6.1% in 2023. It also noted that employment growth would halt in 2023, reversing a trend that had brought the EU bloc's employment to record levels following the COVID-19 pandemic. In 2023, unemployment is expected to rise to 7.2% in the Eurozone and 6.5% in the EU.

Major European countries, such as Germany, the UK, France, Spain, Italy, and countries under the rest of Europe, are impacted by the ongoing Russia-Ukraine war and inflation. The food industry is experiencing the impact of the recession, and a service slump is being witnessed. This is expected to cause high food prices, inflation, and a significant spike in food spending. The food industry is also expected to be affected in this region. Hygienic and quality food consumption in Europe has been on the rise in recent years.

The demand for dairy products and functional foods in Europe has been steadily rising, which is particularly evident in Italy. Increasing awareness among Europeans regarding the significance of maintaining a healthy lifestyle and addressing nutritional deficiencies has played a key role. The demand for membrane-filtered food is increasing due to the fast-paced lifestyle and a growing focus on healthier dietary choices. In today's fast-paced world, consumers are increasingly seeking convenient and ready-to-eat food options

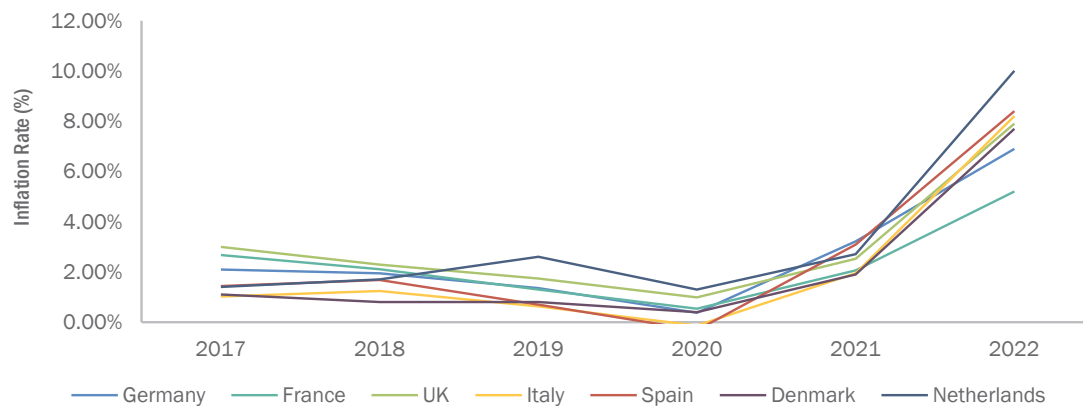
that align with their busy schedules. Furthermore, changing dietary patterns, including consuming processed foods, have resulted in an increased need for membrane filtration market.

Inflation: The EU executive commission slashed its prediction for economic growth for 2023 and predicted that the Eurozone's 19 member countries would enter recession during the winter of 2022 as peak inflation persisted for longer than planned and high fuel and heating costs eroded consumer purchasing power. According to the European Commission, food prices are expected to fall in 2023, with inflation remaining at 7% in the EU and 6.1% in the Eurozone, before falling to 3% in the EU and 2.6% in the Eurozone in 2024.

After mid-2021, the considerable increase in Eurozone food Inflation has been driven mainly by the rise in worldwide food commodity filtration and separations, which have increased since Russia invaded Ukraine. Thus, a rise in inflation subsequently pushes the prices upward for all commodities. High inflation in the US is strengthening the US dollar with respect to other currencies worldwide, affecting its raw materials exports.

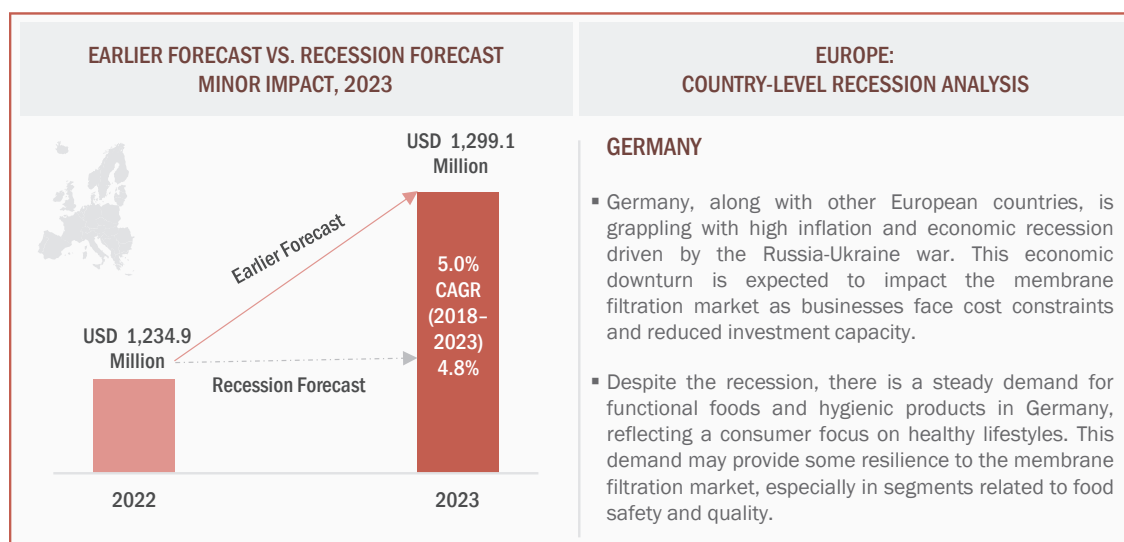
Therefore, the membrane filtration market is expected to be affected negatively by the recession. However, strong consumer demand for functional products in Europe and rising demand for food safety and testing are expected to help the industry sail through the ongoing recession in the region.

FIGURE 44 EUROPE: INFLATION RATES, BY KEY COUNTRY, 2017–2022



Source: World Bank

FIGURE 45 EUROPEAN MEMBRANE FILTRATION MARKET: EARLIER FORECAST VS. RECESSION FORECAST



Source: World Bank, Secondary Research, Primary Interviews, Industry Journals, Related Research Publications, Press Releases, and MarketsandMarkets Analysis

TABLE 142 EUROPE: MEMBRANE FILTRATION MARKET, BY COUNTRY, 2018-2022 (USD MILLION)

Country	2018	2019	2020	2021	2022	CAGR (2018-2022)
Spain	315.4	331.0	347.7	365.6	384.8	5.1%
Italy	164.3	170.7	177.6	185.1	193.0	4.1%
Germany	150.6	157.4	164.8	172.7	181.3	4.8%
UK	93.6	98.2	103.2	108.6	114.5	5.2%
France	86.2	90.9	96.0	101.6	107.5	5.7%
Netherlands	62.0	64.6	67.3	70.3	73.4	4.3%
Denmark	74.4	77.6	81.1	84.9	89.1	4.6%
Rest of Europe	72.8	76.8	81.2	86.0	91.3	5.8%
Total	1,019.3	1,067.3	1,119.1	1,174.8	1,234.9	4.9%

Source: Related Journals, Annual Reports, Press Releases, Company Publications, Company Websites, Expert Interviews, and MarketsandMarkets Analysis

TABLE 143 EUROPE: MEMBRANE FILTRATION MARKET, BY COUNTRY, 2023–2028 (USD MILLION)

Country	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Spain	404.8	426.7	450.6	476.9	505.6	537.0	5.8%
Italy	201.5	210.8	220.9	232.0	244.0	257.2	5.0%
Germany	190.5	200.6	211.6	223.7	236.9	251.4	5.7%
UK	120.8	127.7	135.2	143.4	152.5	162.4	6.1%
France	114.0	121.1	128.8	137.3	146.7	156.9	6.6%
Netherlands	76.8	80.5	84.5	88.9	93.7	99.0	5.2%
Denmark	93.6	98.6	104.0	109.7	116.0	122.8	5.6%
Rest of Europe	97.0	103.3	110.2	117.8	126.2	135.4	6.9%
Total	1,299.1	1,369.2	1,445.9	1,529.8	1,621.6	1,722.1	5.8%

Source: Related Journals, Annual Reports, Press Releases, Company Publications, Company Websites, Expert Interviews, and MarketsandMarkets Analysis

TABLE 144 EUROPE: MEMBRANE FILTRATION MARKET, BY MODULE DESIGN, 2018–2022 (USD MILLION)

Module Design	2018	2019	2020	2021	2022	CAGR (2018–2022)
Spiral Wound	622.9	652.10	683.54	717.39	753.87	4.9%
Tubular Systems	191.2	201.04	211.61	223.02	235.34	5.3%
Plate & Frame and Hollow Fiber	205.1	214.19	223.93	234.40	245.67	4.6%
Total	1,019.3	1,067.3	1,119.1	1,174.8	1,234.9	4.9%

Source: Related Journals, Annual Reports, Press Releases, Company Publications, Company Websites, Expert Interviews, and MarketsandMarkets Analysis

TABLE 145 EUROPE: MEMBRANE FILTRATION MARKET, BY MODULE DESIGN, 2023–2028 (USD MILLION)

Module Design	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Spiral Wound	792.6	835.0	881.2	931.8	987.1	1,047.7	5.7%
Tubular Systems	248.8	263.4	279.5	297.1	316.4	337.6	6.3%
Plate & Frame and Hollow Fiber	257.7	270.8	285.2	300.9	318.0	336.8	5.5%
Total	1,299.1	1,369.2	1,445.9	1,529.8	1,621.6	1,722.1	5.8%

Source: Related Journals, Annual Reports, Press Releases, Company Publications, Company Websites, Expert Interviews, and MarketsandMarkets Analysis

TABLE 146 EUROPE: MEMBRANE FILTRATION MARKET, BY MEMBRANE MATERIAL, 2018–2022 (USD MILLION)

Membrane Material	2018	2019	2020	2021	2022	CAGR (2018–2022)
Polymeric	929.6	972.9	1,019.4	1,069.5	1,123.3	4.8%
Ceramic	89.7	94.4	99.6	105.3	111.5	5.6%
Total	1,019.3	1,067.3	1,119.1	1,174.8	1,234.9	4.9%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 147 EUROPE: MEMBRANE FILTRATION MARKET, BY MEMBRANE MATERIAL, 2023–2028 (USD MILLION)

Membrane Material	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Polymeric	1,180.9	1,243.7	1,312.3	1,387.4	1,469.5	1,559.4	5.7%
Ceramic	118.2	125.6	133.6	142.4	152.1	162.7	6.6%
Total	1,299.1	1,369.2	1,445.9	1,529.8	1,621.6	1,722.1	5.8%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 148 EUROPE: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2018–2022 (USD MILLION)

Application	2018	2019	2020	2021	2022	CAGR (2018–2022)
Dairy	406.0	422.0	439.2	457.7	477.5	4.1%
Drinks & Concentrates	247.1	261.4	276.9	293.7	311.8	6.0%
Wine & Beer	258.1	269.8	282.3	295.9	310.4	4.7%
Other Food & Beverage Applications	108.1	114.1	120.6	127.6	135.2	5.7%
Total	1,019.3	1,067.3	1,119.1	1,174.8	1,234.9	4.9%

Source: Related Journals, Annual Reports, Press Releases, Company Publications, Company Websites, Expert Interviews, and MarketsandMarkets Analysis

TABLE 149 EUROPE: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2023–2028 (USD MILLION)

Application	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Dairy	498.0	520.3	544.5	570.9	599.5	630.7	4.8%
Drinks & Concentrates	331.4	352.9	376.6	402.6	431.2	462.6	6.9%
Wine & Beer	326.3	343.5	362.4	383.1	405.7	430.4	5.7%
Other Food & Beverage Applications	143.4	152.4	162.4	173.2	185.2	198.3	6.7%
Total	1,299.1	1,369.2	1,445.9	1,529.8	1,621.6	1,722.1	5.8%

Source: Related Journals, Annual Reports, Press Releases, Company Publications, Company Websites, Expert Interviews, and MarketsandMarkets Analysis

TABLE 150 EUROPE: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY SUBAPPLICATION, 2018–2022 (USD MILLION)

Subapplication	2018	2019	2020	2021	2022	CAGR (2018–2022)
Liquid Milk	258.6	270.1	282.3	295.3	309.1	4.6%
Other Dairy Products	147.4	151.9	156.9	162.4	168.4	3.4%
Total	406.0	422.0	439.2	457.7	477.5	4.1%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 151 EUROPE: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY SUBAPPLICATION, 2023–2028 (USD MILLION)

Subapplication	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Liquid Milk	323.0	338.1	354.5	372.3	391.6	412.6	5.0%
Other Dairy Products	175.0	182.2	190.0	198.6	207.9	218.1	4.5%
Total	498.0	520.3	544.5	570.9	599.5	630.7	4.8%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 152 EUROPE: MEMBRANE FILTRATION MARKET FOR LIQUID MILK, BY SUBAPPLICATION, 2018–2022 (USD MILLION)

Subapplication	2018	2019	2020	2021	2022	CAGR (2018–2022)
Milk Concentration	136.8	144.4	152.3	160.6	169.3	5.5%
Milk Protein Fractionation	87.9	90.6	93.6	96.9	100.5	3.4%
Milk Pre-Concentration	17.8	18.6	19.4	20.2	21.2	4.4%
Water Recovery	16.0	16.5	16.9	17.5	18.0	3.0%
Total	258.6	270.1	282.3	295.3	309.1	4.6%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 153 EUROPE: MEMBRANE FILTRATION MARKET FOR LIQUID MILK, BY SUBAPPLICATION, 2023–2028 (USD MILLION)

Subapplication	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Milk Concentration	178.4	188.1	198.7	210.0	222.4	235.7	5.7%
Milk Protein Fractionation	103.9	107.7	111.8	116.2	121.1	126.4	4.0%
Milk Pre-Concentration	22.1	23.1	24.3	25.5	26.8	28.2	5.0%
Water Recovery	18.6	19.2	19.8	20.5	21.3	22.2	3.6%
Total	323.0	338.1	354.5	372.3	391.6	412.6	5.0%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 154 EUROPE: MEMBRANE FILTRATION MARKET FOR OTHER DAIRY PRODUCTS, BY SUBAPPLICATION, 2018–2022 (USD MILLION)

Subapplication	2018	2019	2020	2021	2022	CAGR (2018–2022)
Whey	65.9	68.1	70.6	73.3	76.3	3.7%
Milk & Whey Based Ingredients	18.4	18.8	19.3	19.8	20.3	2.5%
Cheese	63.1	65.0	67.0	69.3	71.8	3.3%
Total	147.4	151.9	156.9	162.4	168.4	3.4%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 155 EUROPE: MEMBRANE FILTRATION MARKET FOR OTHER DAIRY PRODUCTS, BY SUBAPPLICATION, 2023–2028 (USD MILLION)

Subapplication	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Whey	79.5	83.1	86.9	91.1	95.7	100.7	4.8%
Milk & Whey Based Ingredients	20.9	21.6	22.3	23.2	24.0	25.0	3.6%
Cheese	74.5	77.5	80.8	84.3	88.2	92.5	4.4%
Total	175.0	182.2	190.0	198.6	207.9	218.1	4.5%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 156 EUROPE: MEMBRANE FILTRATION MARKET, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	388.0	407.7	428.8	451.6	476.2	5.3%
Ultrafiltration (UF)	309.88	323.9	339.1	355.3	372.9	4.7%
Microfiltration (MF)	268.58	281.3	294.9	309.6	325.5	4.9%
Nanofiltration (NF)	52.75	54.5	56.3	58.2	60.3	3.4%
Total	1,019.3	1,067.3	1,119.1	1,174.8	1,234.9	4.9%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 157 EUROPE: MEMBRANE FILTRATION MARKET, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	503.5	533.2	565.8	601.4	640.5	683.3	6.3%
Ultrafiltration (UF)	391.1	411.1	432.9	456.7	482.7	511.2	5.5%
Microfiltration (MF)	342.1	360.2	380.0	401.7	425.4	451.3	5.7%
Nanofiltration (NF)	62.4	64.7	67.2	70.0	73.0	76.2	4.1%
Total	1,299.1	1,369.2	1,445.9	1,529.8	1,621.6	1,722.1	5.8%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 158 EUROPE: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	228.0	238.5	249.7	261.7	274.6	4.8%
Ultrafiltration (UF)	87.4	89.7	92.1	94.6	97.4	2.7%
Microfiltration (MF)	66.8	69.6	72.7	76.1	79.7	4.5%
Nanofiltration (NF)	23.7	24.2	24.7	25.3	25.8	2.1%
Total	406.0	422.0	439.2	457.7	477.5	4.1%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 159 EUROPE: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	288.8	304.2	321.0	339.3	359.2	381.0	5.7%
Ultrafiltration (UF)	93.7	95.3	97.0	98.8	100.7	102.6	1.8%
Microfiltration (MF)	88.6	93.3	98.4	104.0	110.1	116.7	5.7%
Nanofiltration (NF)	26.9	27.5	28.1	28.8	29.5	30.3	2.4%
Total	498.0	520.3	544.5	570.9	599.5	630.7	4.8%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 160 EUROPE: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	84.5	89.6	95.1	101.2	107.9	6.3%
Ultrafiltration (UF)	89.2	94.4	100.0	105.8	112.0	5.9%
Microfiltration (MF)	62.3	65.8	69.7	74.0	78.6	6.0%
Nanofiltration (NF)	11.1	11.6	12.1	12.7	13.3	4.5%
Total	247.1	261.4	276.9	293.7	311.8	6.0%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 161 EUROPE: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	115.2	123.3	132.2	142.0	152.8	164.7	7.4%
Ultrafiltration (UF)	124.4	132.2	140.8	150.2	160.5	171.8	6.7%
Microfiltration (MF)	78.5	83.6	89.1	95.1	101.8	109.1	6.8%
Nanofiltration (NF)	13.2	13.9	14.6	15.3	16.1	17.1	5.2%
Total	331.4	352.9	376.6	402.6	431.2	462.6	6.9%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 162 EUROPE: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	35.1	36.6	38.3	40.2	42.2	4.7%
Ultrafiltration (UF)	94.2	98.7	103.7	109.1	114.9	5.1%
Microfiltration (MF)	120.3	125.5	131.1	136.9	143.1	4.4%
Nanofiltration (NF)	8.5	8.9	9.3	9.7	10.2	4.5%
Total	258.1	269.8	282.3	295.9	310.4	4.7%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 163 EUROPE: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	44.4	46.9	49.5	52.5	55.6	59.2	5.9%
Ultrafiltration (UF)	121.7	129.1	137.3	146.2	156.0	166.8	6.5%
Microfiltration (MF)	149.4	156.3	163.8	171.9	180.8	190.4	5.0%
Nanofiltration (NF)	10.7	11.2	11.9	12.5	13.3	14.1	5.7%
Total	326.3	343.5	362.4	383.1	405.7	430.4	5.7%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 164 EUROPE: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	40.4	43.0	45.6	48.5	51.5	6.2%
Ultrafiltration (UF)	39.0	41.1	43.4	45.8	48.5	5.6%
Microfiltration (MF)	19.2	20.3	21.4	22.7	24.0	5.7%
Nanofiltration (NF)	9.4	9.8	10.2	10.6	11.1	4.2%
Total	108.1	114.1	120.6	127.6	135.2	5.7%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 165 EUROPE: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	55.0	58.9	63.1	67.7	72.9	78.5	7.4%
Ultrafiltration (UF)	51.3	54.4	57.8	61.5	65.6	70.0	6.4%
Microfiltration (MF)	25.5	27.0	28.8	30.7	32.8	35.0	6.6%
Nanofiltration (NF)	11.6	12.1	12.7	13.3	14.0	14.8	5.0%
Total	143.4	152.4	162.4	173.2	185.2	198.3	6.7%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

11.4.2 SPAIN

11.4.2.1 Growing wine industry to drive membrane filtration market

The membrane filtration market in Spain, particularly in the dairy, food & beverages, and wine industries, has witnessed significant growth due to several factors. The demand for enhanced food quality and preservation has driven the adoption of membrane filtration technologies like reverse osmosis, ultrafiltration, microfiltration, and nano filtration. These technologies play a crucial role in refining dairy products, concentrates, wines, and beers by improving taste, texture, and quality. The market's expansion aligns with the global trend of adopting advanced filtration methods to cater to evolving consumer preferences for healthier and better-tasting products. With an increasing focus on sustainability and value addition, membrane filtration has become indispensable in Spain's food and beverage sectors, including wine production.

According to the International Organization of Vine and Wine 2022, Spain produced 35.7 mhl (millions of hectolitres) of wine in 2022, and consumption of wine in 2022 is 10.3 mhl. The growing wine industry drives the market of membrane filtration in Spain.

The growing dairy industry is one of the most prominent drivers of the membrane filtration market in Spain. Membrane filtration is widely used for whey concentration, cheese protection from harmful pathogens, and lactose-free milk production. In January 2018, US-based SPX Flow raised USD 60 million to develop a dairy ingredients plant in Galicia, Spain. By producing high-value dry dairy components, SPX Flow aims to design and offer a fully integrated system that maximizes returns on skimmed milk. The plant aims to process milk

using drying technologies and membrane solutions for milk fractionation. The new facility will also create milk protein powders for infant formulas, sports nutrition, and other dietary supplements.

TABLE 166 SPAIN: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2018–2022 (USD MILLION)

Application	2018	2019	2020	2021	2022	CAGR (2018–2022)
Dairy Products	131.4	136.5	142.2	148.6	155.7	4.3%
Drinks & Concentrates	68.5	72.8	77.3	82.1	87.0	6.2%
Wine & Beer	70.3	73.9	77.6	81.4	85.3	4.9%
Other Food & Beverage Applications	45.2	47.8	50.6	53.6	56.7	5.8%
Total	315.4	331.0	347.7	365.6	384.8	5.1%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 167 SPAIN: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2023–2028 (USD MILLION)

Application	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Dairy Products	162.4	169.6	177.5	186.3	195.8	206.2	4.9%
Drinks & Concentrates	92.6	98.6	105.2	112.5	120.5	129.2	6.9%
Wine & Beer	89.7	94.5	99.7	105.4	111.7	118.5	5.7%
Other Food & Beverage Applications	60.2	64.0	68.1	72.7	77.7	83.1	6.7%
Total	404.8	426.7	450.6	476.9	505.6	537.0	5.8%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 168 SPAIN: MEMBRANE FILTRATION MARKET, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	120.8	127.0	133.7	140.9	148.6	5.3%
Ultrafiltration (UF)	92.7	97.2	102.1	107.2	112.8	5.0%
Microfiltration (MF)	83.7	87.9	92.4	97.3	102.5	5.2%
Nanofiltration (NF)	18.2	18.9	19.5	20.2	21.0	3.6%
Total	315.4	331.0	347.7	365.6	384.8	5.1%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 169 SPAIN: MEMBRANE FILTRATION MARKET, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	157.5	167.3	177.9	189.8	202.8	217.0	6.6%
Ultrafiltration (UF)	118.0	123.8	130.1	136.9	144.4	152.6	5.3%
Microfiltration (MF)	107.6	113.2	119.3	126.0	133.3	141.2	5.6%
Nanofiltration (NF)	21.7	22.4	23.3	24.2	25.1	26.2	3.9%
Total	404.8	426.7	450.6	476.9	505.6	537.0	5.8%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 170 SPAIN: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	70.8	73.9	77.4	81.1	85.0	4.7%
Ultrafiltration (UF)	25.8	26.5	27.4	28.5	29.8	3.7%
Microfiltration (MF)	26.6	27.6	28.7	30.1	31.7	4.4%
Nanofiltration (NF)	8.2	8.4	8.7	8.9	9.1	2.8%
Total	131.4	136.5	142.2	148.6	155.7	4.3%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 171 SPAIN: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	89.8	95.0	100.6	107.0	113.9	121.5	6.2%
Ultrafiltration (UF)	30.4	31.2	32.1	33.1	34.2	35.5	3.1%
Microfiltration (MF)	32.8	33.9	35.0	36.2	37.4	38.6	3.3%
Nanofiltration (NF)	9.3	9.6	9.8	10.1	10.3	10.6	2.6%
Total	162.4	169.6	177.5	186.3	195.8	206.2	4.9%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 172 SPAIN: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	23.1	24.5	26.1	27.8	29.7	6.5%
Ultrafiltration (UF)	24.9	26.7	28.4	30.0	31.5	6.0%
Microfiltration (MF)	17.3	18.3	19.4	20.6	22.0	6.2%
Nanofiltration (NF)	3.2	3.4	3.5	3.7	3.9	4.7%
Total	68.5	72.8	77.3	82.1	87.0	6.2%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 173 SPAIN: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	31.7	33.9	36.4	39.1	42.0	45.3	7.4%
Ultrafiltration (UF)	33.5	35.6	37.9	40.5	43.3	46.3	6.7%
Microfiltration (MF)	23.3	24.8	26.4	28.2	30.2	32.4	6.8%
Nanofiltration (NF)	4.0	4.2	4.5	4.7	4.9	5.2	5.2%
Total	92.6	98.6	105.2	112.5	120.5	129.2	6.9%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 174 SPAIN: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	10.1	10.6	11.1	11.7	12.3	5.2%
Ultrafiltration (UF)	25.7	26.8	28.1	29.5	31.0	4.8%
Microfiltration (MF)	31.7	33.5	35.3	37.0	38.7	5.1%
Nanofiltration (NF)	2.9	3.0	3.1	3.2	3.3	3.4%
Total	70.3	73.9	77.6	81.4	85.3	4.9%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 175 SPAIN: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	13.0	13.8	14.6	15.5	16.5	17.6	6.2%
Ultrafiltration (UF)	32.5	34.1	35.8	37.5	39.3	41.3	4.9%
Microfiltration (MF)	40.8	43.1	45.7	48.6	51.9	55.5	6.3%
Nanofiltration (NF)	3.4	3.5	3.7	3.8	4.0	4.1	4.0%
Total	89.7	94.5	99.7	105.4	111.7	118.5	5.7%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 176 SPAIN: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	16.9	18.0	19.2	20.3	21.5	6.2%
Ultrafiltration (UF)	16.3	17.2	18.2	19.3	20.4	5.8%
Microfiltration (MF)	8.0	8.5	9.0	9.5	10.1	5.9%
Nanofiltration (NF)	3.9	4.1	4.3	4.5	4.7	4.4%
Total	45.2	47.8	50.6	53.6	56.7	5.8%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 177 SPAIN: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	23.0	24.6	26.3	28.2	30.3	32.7	7.3%
Ultrafiltration (UF)	21.6	22.9	24.4	25.9	27.6	29.5	6.4%
Microfiltration (MF)	10.7	11.4	12.1	12.9	13.8	14.8	6.6%
Nanofiltration (NF)	4.9	5.1	5.3	5.6	5.9	6.2	5.0%
Total	60.2	64.0	68.1	72.7	77.7	83.1	6.7%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

11.4.3 ITALY

11.4.3.1 Stringent food safety regulations to encourage use of membrane filtration technologies

Italy is one of Europe's largest food & beverage manufacturing markets and has strong food safety regulations. In the European Union, all products entering the food chain are required to meet relevant food safety standards and ensure rigorous checks are carried out in production units nationwide. Additionally, food & beverage products manufactured must go through a comprehensive purification process to avoid any risk to human health from contaminants such as bacteria. Therefore, food manufacturers have been utilizing membrane filtration technologies to remove bacteria, spores, dead cells, and impurities from these products.

Conventional evaporation was used by kiwi juice producers in Jiado Quimei, Xian Province, China, to concentrate their juice; however, the high temperatures required for evaporation caused the concentrate to turn from green to brown. The specialist Italian food processing company, Alberto Bertuzzi, proposed utilizing a membrane filtration system to address the issue of heat degradation and increase the market value of the finished product. To satisfy the demands of the juice producers, Bertuzzi selected B1 modular membrane technology as the main element in a customized membrane filtration system. These modules are perfect for the food & beverage industry, requiring high product quality and cost-effective fluid concentration.

The aging population and changing lifestyles in Italy also increase the demand for functional foods. Consumers here are relatively more health-conscious, and there is a strong demand for nutritious and healthy food. As a result, food, beverage, and functional food manufacturers are increasingly using membrane filtration technologies to meet quality expectations and regulations.

TABLE 178 ITALY: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2018–2022 (USD MILLION)

Application	2018	2019	2020	2021	2022	CAGR (2018–2022)
Dairy Products	64.4	66.6	68.8	71.1	73.5	3.4%
Drinks & Concentrates	40.7	42.7	44.9	47.3	49.9	5.2%
Wine & Beer	42.5	44.1	45.7	47.6	49.6	3.9%
Other Food & Beverage Applications	16.6	17.4	18.2	19.1	20.1	4.9%
Total	164.3	170.7	177.6	185.1	193.0	4.1%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 179 ITALY: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2023–2028 (USD MILLION)

Application	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Dairy Products	76.0	78.8	81.8	85.1	88.7	92.6	4.0%
Drinks & Concentrates	52.6	55.6	58.9	62.5	66.5	70.8	6.1%
Wine & Beer	51.7	54.0	56.6	59.3	62.4	65.7	4.9%
Other Food & Beverage Applications	21.2	22.3	23.6	25.0	26.5	28.2	5.9%
Total	201.5	210.8	220.9	232.0	244.0	257.2	5.0%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 180 ITALY: MEMBRANE FILTRATION MARKET, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	62.6	65.3	68.1	71.1	74.4	4.4%
Ultrafiltration (UF)	52.6	54.6	56.7	58.9	61.3	3.9%
Microfiltration (MF)	43.5	45.2	47.1	49.0	51.2	4.2%
Nanofiltration (NF)	5.5	5.6	5.8	6.0	6.2	2.9%
Total	164.3	170.7	177.6	185.1	193.0	4.1%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 181 ITALY: MEMBRANE FILTRATION MARKET, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	77.8	81.5	85.6	90.1	94.9	100.2	5.2%
Ultrafiltration (UF)	63.9	66.7	69.8	73.1	76.8	80.8	4.8%
Microfiltration (MF)	53.5	56.0	58.7	61.7	65.0	68.6	5.1%
Nanofiltration (NF)	6.4	6.6	6.8	7.1	7.4	7.7	3.8%
Total	201.5	210.8	220.9	232.0	244.0	257.2	5.0%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 182 ITALY: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	25.27	26.19	27.14	28.12	29.14	3.6%
Ultrafiltration (UF)	18.80	19.35	19.91	20.48	21.06	2.9%
Microfiltration (MF)	19.04	19.72	20.43	21.17	21.94	3.6%
Nanofiltration (NF)	1.28	1.30	1.32	1.33	1.34	1.1%
Total	64.39	66.56	68.79	71.10	73.48	3.4%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 183 ITALY: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	30.18	31.31	32.54	33.88	35.33	36.90	4.1%
Ultrafiltration (UF)	21.72	22.44	23.22	24.07	25.00	26.00	3.7%
Microfiltration (MF)	22.78	23.69	24.68	25.76	26.94	28.22	4.4%
Nanofiltration (NF)	1.35	1.37	1.39	1.42	1.44	1.47	1.6%
Total	76.03	78.81	81.84	85.13	88.70	92.58	4.0%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 184 ITALY: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	14.95	15.73	16.59	17.52	18.54	5.5%
Ultrafiltration (UF)	13.65	14.29	14.99	15.75	16.59	5.0%
Microfiltration (MF)	10.31	10.81	11.36	11.96	12.62	5.2%
Nanofiltration (NF)	1.83	1.90	1.98	2.06	2.14	4.0%
Total	40.74	42.73	44.91	47.29	49.89	5.2%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 185 ITALY: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	19.60	20.77	22.05	23.44	24.98	26.66	6.3%
Ultrafiltration (UF)	17.47	18.43	19.48	20.63	21.88	23.26	5.9%
Microfiltration (MF)	13.33	14.10	14.95	15.88	16.89	18.01	6.2%
Nanofiltration (NF)	2.24	2.34	2.45	2.57	2.70	2.84	4.9%
Total	52.64	55.64	58.92	62.51	66.45	70.77	6.1%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 186 ITALY: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	15.91	16.53	17.20	17.94	18.74	4.2%
Ultrafiltration (UF)	14.12	14.60	15.13	15.70	16.33	3.7%
Microfiltration (MF)	11.19	11.59	12.03	12.51	13.04	3.9%
Nanofiltration (NF)	1.32	1.35	1.39	1.42	1.47	2.7%
Total	42.54	44.07	45.75	47.58	49.58	3.9%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 187 ITALY: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	19.58	20.50	21.50	22.60	23.80	25.10	5.1%
Ultrafiltration (UF)	17.00	17.73	18.53	19.40	20.35	21.39	4.7%
Microfiltration (MF)	13.61	14.24	14.92	15.67	16.48	17.37	5.0%
Nanofiltration (NF)	1.51	1.56	1.62	1.68	1.74	1.81	3.7%
Total	51.71	54.04	56.58	59.35	62.37	65.68	4.9%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 188 ITALY: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	6.50	6.82	7.17	7.56	7.97	5.2%
Ultrafiltration (UF)	6.07	6.35	6.64	6.97	7.32	4.8%
Microfiltration (MF)	2.95	3.09	3.24	3.40	3.58	4.9%
Nanofiltration (NF)	1.06	1.09	1.13	1.17	1.21	3.4%
Total	16.59	17.35	18.19	19.10	20.09	4.9%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 189 ITALY: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	8.44	8.96	9.52	10.13	10.80	11.54	6.5%
Ultrafiltration (UF)	7.69	8.09	8.53	9.00	9.53	10.10	5.6%
Microfiltration (MF)	3.76	3.96	4.19	4.43	4.70	4.99	5.8%
Nanofiltration (NF)	1.26	1.31	1.36	1.41	1.48	1.54	4.2%
Total	21.15	22.32	23.59	24.98	26.50	28.17	5.9%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

11.4.4 GERMANY

11.4.4.1 Growing consumption of food products and beverages to drive growth

The membrane filtering industry in Germany has grown significantly in the dairy, food & beverage, and wine industries. This expansion is being driven by rising consumer demand for higher product quality, safety, and sustainability. Technologies such as reverse osmosis, ultrafiltration, microfiltration, and nanofiltration are widely used to improve dairy products, drinks, and wines. The German market is a leader in the worldwide filtration and separation equipment business. The country's emphasis on modern desalination technologies and its goal to increase the value of dairy and plant-based food products help to accelerate the use of membrane filtering technology.

The market in Germany is mainly driven by the constantly growing production of dairy products, such as cheese and whey powder. According to the United States Department of Agriculture (USDA), Germany is the largest market for food & beverages in the European Union. In 2021, the food processing industry generated a roughly USD 203 billion turnover, accounting for 5.8% of the country's GDP. The largest subsectors, by value, were meat (24%), dairy (15.5%), bakery (9.4%), confectionary and long-life bakery products (7.8%), and processed fruits and vegetables (6.3%).

Germany has consistently been the largest dairy producer in Europe for several years. Being one of the largest milk-producing countries, pasteurization of milk is carried out on a large scale in this country. The European Union imposes strict quality regulations regarding controlling harmful pathogens in food & dairy products. To meet these standards, dairy producers widely use membrane filtration technologies for several dairy applications, such as cheese raw material purification, milk pasteurization, whey concentration, etc.

Leading manufacturers of dairy products, such as Theo Müller, FrieslandCampina, Bayernland-Gruppe, and Nestlé, have a significant presence in Germany. Companies such as Nestlé and FrieslandCampina use reverse osmosis for optimal water usage. Additionally, research & development activities to promote membrane technologies are also anticipated to boost the market growth. In March 2017, FrieslandCampina released a research paper stating, "in the dairy industry, it is estimated that 75% of all ultrafiltration membranes are used to fractionate whey proteins."

Another important factor driving the demand for membrane filtration is the increased demand for functional foods in Germany. The aging population in this country also fuels the demand for functional food to overcome conditions, such as cholesterol and diabetes. Over the years, the demand for food & beverages with health-improving components has also grown in Germany. Consumers are increasingly opting for light, low-fat, and value-added food, juice, and beverage products, and these products can be

easily obtained by membrane filtration technologies such as nanofiltration and microfiltration. These technologies purify, enhance the taste, and increase the shelf life, and reduce the fat content of food & beverage products.

TABLE 190 GERMANY: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2018–2022 (USD MILLION)

Application	2018	2019	2020	2021	2022	CAGR (2018–2022)
Dairy Products	59.9	62.3	64.9	67.5	70.2	4.1%
Drinks & Concentrates	40.2	42.4	44.8	47.5	50.4	5.8%
Wine & Beer	44.3	46.2	48.2	50.5	53.0	4.6%
Other Food & Beverage Applications	6.2	6.5	6.9	7.2	7.7	5.6%
Total	150.6	157.4	164.8	172.7	181.3	4.8%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 191 GERMANY: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2023–2028 (USD MILLION)

Application	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Dairy Products	73.2	76.5	80.1	84.0	88.2	92.8	4.8%
Drinks & Concentrates	53.5	56.9	60.7	64.8	69.3	74.3	6.8%
Wine & Beer	55.6	58.5	61.7	65.1	68.9	73.1	5.6%
Other Food & Beverage Applications	8.1	8.6	9.2	9.8	10.5	11.2	6.6%
Total	190.5	200.6	211.6	223.7	236.9	251.4	5.7%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 192 GERMANY: MEMBRANE FILTRATION MARKET, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	56.8	59.6	62.6	65.8	69.3	5.1%
Ultrafiltration (UF)	46.1	48.1	50.3	52.7	55.2	4.6%
Microfiltration (MF)	39.2	40.9	42.9	44.9	47.1	4.7%
Nanofiltration (NF)	8.5	8.8	9.0	9.3	9.6	2.9%
Total	150.6	157.4	164.8	172.7	181.3	4.8%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 193 GERMANY: MEMBRANE FILTRATION MARKET, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	73.1	77.2	81.7	86.6	92.0	97.9	6.0%
Ultrafiltration (UF)	58.0	61.0	64.3	67.9	71.8	76.1	5.6%
Microfiltration (MF)	49.5	52.2	55.0	58.2	61.6	65.4	5.7%
Nanofiltration (NF)	9.9	10.2	10.6	11.0	11.4	11.9	3.8%
Total	190.5	200.6	211.6	223.7	236.9	251.4	5.7%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 194 GERMANY: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	33.58	35.19	36.89	38.71	40.64	4.9%
Ultrafiltration (UF)	13.92	14.33	14.76	15.18	15.60	2.9%
Microfiltration (MF)	7.77	8.07	8.38	8.69	8.99	3.7%
Nanofiltration (NF)	4.65	4.74	4.83	4.91	5.00	1.8%
Total	59.92	62.34	64.86	67.49	70.24	4.1%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 195 GERMANY: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	42.7	45.0	47.4	50.1	53.0	56.2	5.6%
Ultrafiltration (UF)	16.1	16.7	17.4	18.0	18.8	19.6	3.9%
Microfiltration (MF)	9.3	9.7	10.0	10.4	10.9	11.4	4.1%
Nanofiltration (NF)	5.1	5.2	5.3	5.4	5.5	5.6	2.0%
Total	73.2	76.5	80.1	84.0	88.2	92.8	4.8%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 196 GERMANY: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	14.59	15.45	16.39	17.42	18.55	6.2%
Ultrafiltration (UF)	14.31	15.08	15.93	16.85	17.86	5.7%
Microfiltration (MF)	9.41	9.91	10.45	11.05	11.70	5.6%
Nanofiltration (NF)	1.89	1.97	2.06	2.15	2.25	4.5%
Total	40.20	42.41	44.83	47.47	50.37	5.8%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 197 GERMANY: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	19.8	21.1	22.6	24.2	25.9	27.9	7.1%
Ultrafiltration (UF)	19.0	20.1	21.5	22.9	24.5	26.2	6.7%
Microfiltration (MF)	12.4	13.2	14.0	14.9	16.0	17.1	6.6%
Nanofiltration (NF)	2.4	2.5	2.6	2.8	3.0	3.2	5.9%
Total	53.5	56.9	60.7	64.8	69.3	74.3	6.8%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 198 GERMANY: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	6.29	6.49	6.71	6.95	7.21	3.5%
Ultrafiltration (UF)	15.63	16.36	17.16	18.04	18.99	5.0%
Microfiltration (MF)	20.89	21.81	22.81	23.90	25.09	4.7%
Nanofiltration (NF)	1.46	1.51	1.57	1.63	1.70	3.8%
Total	44.26	46.17	48.25	50.51	52.99	4.6%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 199 GERMANY: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	7.52	7.85	8.21	8.60	9.03	9.50	4.8%
Ultrafiltration (UF)	19.96	21.02	22.17	23.44	24.82	26.34	5.7%
Microfiltration (MF)	26.39	27.81	29.37	31.07	32.93	34.96	5.8%
Nanofiltration (NF)	1.77	1.85	1.94	2.04	2.14	2.26	5.0%
Total	55.64	58.53	61.69	65.15	68.92	73.06	5.6%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 200 GERMANY: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	2.31	2.44	2.59	2.74	2.92	6.0%
Ultrafiltration (UF)	2.23	2.34	2.47	2.61	2.76	5.5%
Microfiltration (MF)	1.10	1.16	1.22	1.29	1.36	5.5%
Nanofiltration (NF)	0.54	0.56	0.58	0.61	0.64	4.4%
Total	6.17	6.50	6.86	7.25	7.68	5.6%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 201 GERMANY: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	3.10	3.31	3.53	3.78	4.05	4.35	7.0%
Ultrafiltration (UF)	2.92	3.10	3.30	3.51	3.75	4.01	6.5%
Microfiltration (MF)	1.44	1.53	1.62	1.72	1.84	1.96	6.4%
Nanofiltration (NF)	0.67	0.71	0.74	0.79	0.83	0.88	5.7%
Total	8.14	8.64	9.19	9.80	10.47	11.20	6.6%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

11.4.5 UK

11.4.5.1 Rising consumption of drinks and concentrates to boost demand for membrane filtration technologies

The membrane filtration market in the UK is mainly driven by the growing demand for membrane filtration technologies from the dairy, drinks & concentrates, sugar, poultry, and fish processing industries.

The UK is one of the major providers of dairy products, particularly fresh pasteurized liquid milk and cheese. The UK significantly consumes and produces dairy products, and membrane filtration technologies such as microfiltration and ultrafiltration are prominently utilized for pasteurization of milk, protein standardization of cheese milk, cheese brine sanitation, and other purposes by dairy manufacturers here. There is a strong demand in the country for food products that improve the heart and digestive system and offer cognitive and brain health benefits. In October 2021, ITS, a UK-based flavor company, opened an ultra-high-temperature (UHT) plant in England. In this manufacturing unit, ITS tests flavors to ensure they can withstand crucial heat treatment. The UHT testing procedure ensures that flavors included in dairy and liquid products are captivating. To meet changing tastes and preferences, manufacturers are experimenting with flavors through different techniques, such as ultrafiltration and UHT testing, which can alter yogurt and milk.

Apart from this, the development of liquid-solid separation technologies for different applications such as concentration, purification, product recovery, and wastewater treatment is also expected to support growth in the membrane filtration market in the UK. In January 2019, US-based Koch Separation Solutions installed the UK's most extensive MBR system. KMS replaced the Woolston facility's old traditional activated sludge system with its PULSION MBR ultrafiltration membrane in collaboration with 4Delivery. This improved the quality of effluents by enhancing nutrient removal and achieved nearly 100% solid and bacteria removal.

TABLE 202 UK: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2018–2022 (USD MILLION)

Application	2018	2019	2020	2021	2022	CAGR (2018–2022)
Dairy Products	36.6	38.2	39.9	41.6	43.5	4.4%
Drinks & Concentrates	22.8	24.2	25.7	27.3	29.0	6.2%
Wine & Beer	23.9	25.0	26.2	27.5	29.0	5.0%
Other Food & Beverage Applications	10.3	10.9	11.5	12.2	13.0	6.0%
Total	93.6	98.2	103.2	108.6	114.5	5.2%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 203 UK: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2023–2028 (USD MILLION)

Application	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Dairy Products	45.4	47.6	49.9	52.5	55.3	58.3	5.1%
Drinks & Concentrates	31.0	33.1	35.4	37.9	40.7	43.8	7.2%
Wine & Beer	30.6	32.3	34.1	36.2	38.4	40.9	6.0%
Other Food & Beverage Applications	13.8	14.7	15.7	16.8	18.1	19.4	7.0%
Total	120.8	127.7	135.2	143.4	152.5	162.4	6.1%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 204 UK: MEMBRANE FILTRATION MARKET, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	35.2	37.1	39.1	41.3	43.7	5.5%
Ultrafiltration (UF)	28.7	30.1	31.6	33.2	35.0	5.1%
Microfiltration (MF)	24.3	25.5	26.8	28.1	29.6	5.1%
Nanofiltration (NF)	5.4	5.6	5.8	6.0	6.2	3.8%
Total	93.6	98.2	103.2	108.6	114.5	5.2%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 205 UK: MEMBRANE FILTRATION MARKET, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	46.3	49.1	52.3	55.7	59.5	63.6	6.6%
Ultrafiltration (UF)	36.8	38.9	41.2	43.6	46.3	49.3	6.0%
Microfiltration (MF)	31.2	32.9	34.7	36.7	38.9	41.3	5.8%
Nanofiltration (NF)	6.5	6.8	7.1	7.4	7.8	8.2	4.7%
Total	120.8	127.7	135.2	143.4	152.5	162.4	6.1%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 206 UK: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	20.19	21.22	22.32	23.49	24.74	5.2%
Ultrafiltration (UF)	8.28	8.57	8.86	9.14	9.44	3.3%
Microfiltration (MF)	5.44	5.65	5.86	6.07	6.28	3.6%
Nanofiltration (NF)	2.66	2.74	2.82	2.92	2.99	3.0%
Total	36.58	38.18	39.86	41.62	43.46	4.4%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 207 UK: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	26.1	27.7	29.3	31.1	33.1	35.3	6.2%
Ultrafiltration (UF)	9.8	10.2	10.7	11.2	11.7	12.3	4.6%
Microfiltration (MF)	6.4	6.5	6.6	6.7	6.9	7.0	1.9%
Nanofiltration (NF)	3.1	3.2	3.3	3.4	3.6	3.7	3.7%
Total	45.4	47.6	49.9	52.5	55.3	58.3	5.1%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 208 UK: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	7.81	8.29	8.82	9.40	10.04	6.5%
Ultrafiltration (UF)	8.24	8.72	9.24	9.82	10.44	6.1%
Microfiltration (MF)	5.75	6.09	6.46	6.87	7.32	6.2%
Nanofiltration (NF)	1.03	1.07	1.12	1.18	1.23	4.7%
Total	22.83	24.18	25.65	27.27	29.04	6.2%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 209 UK: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	10.76	11.54	12.41	13.36	14.42	15.59	7.7%
Ultrafiltration (UF)	11.11	11.84	12.64	13.53	14.49	15.56	7.0%
Microfiltration (MF)	7.79	8.32	8.89	9.52	10.22	10.98	7.1%
Nanofiltration (NF)	1.29	1.36	1.43	1.51	1.60	1.69	5.5%
Total	30.96	33.06	35.37	37.92	40.73	43.82	7.2%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 210 UK: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	3.39	3.51	3.64	3.79	3.95	3.9%
Ultrafiltration (UF)	8.42	8.85	9.32	9.83	10.39	5.4%
Microfiltration (MF)	11.26	11.80	12.39	13.03	13.73	5.1%
Nanofiltration (NF)	0.79	0.82	0.85	0.89	0.93	4.2%
Total	23.86	24.98	26.20	27.54	29.00	5.0%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 211 UK: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	4.12	4.30	4.51	4.73	4.97	5.23	4.9%
Ultrafiltration (UF)	10.93	11.52	12.17	12.88	13.65	14.49	5.8%
Microfiltration (MF)	14.54	15.43	16.41	17.48	18.65	19.93	6.5%
Nanofiltration (NF)	0.97	1.02	1.07	1.12	1.18	1.24	5.1%
Total	30.56	32.28	34.15	36.20	38.44	40.90	6.0%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 212 UK: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	3.85	4.08	4.34	4.63	4.94	6.4%
Ultrafiltration (UF)	3.72	3.92	4.15	4.40	4.67	5.9%
Microfiltration (MF)	1.83	1.93	2.05	2.17	2.30	5.9%
Nanofiltration (NF)	0.90	0.94	0.98	1.03	1.08	4.8%
Total	10.29	10.88	11.52	12.22	12.99	6.0%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 213 UK: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	5.3	5.6	6.0	6.5	7.0	7.5	7.4%
Ultrafiltration (UF)	5.0	5.3	5.6	6.0	6.5	6.9	6.9%
Microfiltration (MF)	2.4	2.6	2.8	3.0	3.2	3.4	6.8%
Nanofiltration (NF)	1.1	1.2	1.3	1.4	1.4	1.5	6.1%
Total	13.8	14.7	15.7	16.8	18.1	19.4	7.0%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

11.4.6 FRANCE

11.4.6.1 Rising demand to adopt membrane filtration technologies in cheese industry

The membrane filtration market in France has showcased significant growth, particularly within the food and beverages sector, including the dairy and wine industries. Membrane filtration technologies have gained prominence as pivotal tools for enhancing product quality, process efficiency, and sustainability across these sectors. The extensive use of membrane filtration technologies by dairy manufacturers is one of the key driving factors for the market in France. Dairy products are an important component of the consumer diet in France. According to French Agrifood Export data, “72% of all French people consume dairy products daily. The French consume an average of 26.7 kilograms of cheese per capita per year, which makes them the second-largest cheese-consuming country in Europe. Also, dairy products are the second largest agrifood industry after meat.” High dairy consumption and the growing demand for value-added and quality dairy products are expected to drive the membrane filtration market in this country.

Additionally, modern yogurt production needs high-volume and large continuous processing to maintain high product quality. Concentrated yogurts, such as skyr, labneh, and Greek, can be developed by incorporating two different processes. The most used process is concentrating the yogurt after fermentation by mechanical separators or ultrafiltration (UF), termed separated yogurt. Ultrafiltration is incorporated to cut down operational costs.

The growth of the membrane filtration market in France's food and beverages, dairy, and wine industries is further propelled by advancements in membrane materials, design, and automation. These innovations enable finer filtration, improved separation efficiency, and streamlined operations, thus enabling companies to meet evolving consumer demands and regulatory requirements.

TABLE 214 FRANCE: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2018–2022 (USD MILLION)

Application	2018	2019	2020	2021	2022	CAGR (2018–2022)
Dairy Products	33.1	34.7	36.4	38.1	40.0	4.8%
Drinks & Concentrates	21.5	22.9	24.4	26.1	27.9	6.8%
Wine & Beer	21.8	22.9	24.2	25.5	27.0	5.5%
Other Food & Beverage Applications	9.8	10.4	11.1	11.8	12.6	6.5%
Total	86.2	90.9	96.0	101.6	107.5	5.7%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 215 FRANCE: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2023–2028 (USD MILLION)

Application	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Dairy Products	42.0	44.2	46.5	49.1	51.9	55.0	5.6%
Drinks & Concentrates	29.9	32.1	34.5	37.1	40.1	43.3	7.7%
Wine & Beer	28.6	30.3	32.3	34.4	36.7	39.2	6.5%
Other Food & Beverage Applications	13.5	14.5	15.5	16.7	18.0	19.4	7.5%
Total	114.0	121.1	128.8	137.3	146.7	156.9	6.6%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 216 FRANCE: MEMBRANE FILTRATION MARKET, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	32.9	34.8	36.9	39.1	41.5	6.0%
Ultrafiltration (UF)	25.8	27.2	28.7	30.4	32.1	5.6%
Microfiltration (MF)	22.8	24.1	25.4	26.9	28.5	5.7%
Nanofiltration (NF)	4.6	4.8	5.0	5.2	5.4	3.8%
Total	86.2	90.9	96.0	101.6	107.5	5.7%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 217 FRANCE: MEMBRANE FILTRATION MARKET, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	44.2	47.1	50.2	53.7	57.5	61.7	6.9%
Ultrafiltration (UF)	34.0	36.1	38.4	40.9	43.6	46.6	6.5%
Microfiltration (MF)	30.2	32.1	34.1	36.4	38.8	41.6	6.6%
Nanofiltration (NF)	5.6	5.8	6.1	6.4	6.7	7.0	4.6%
Total	114.0	121.1	128.8	137.3	146.7	156.9	6.6%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 218 FRANCE: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	17.8	18.5	19.3	20.1	20.9	4.1%
Ultrafiltration (UF)	6.4	6.8	7.2	7.6	8.1	5.9%
Microfiltration (MF)	5.4	5.8	6.2	6.6	7.1	6.8%
Nanofiltration (NF)	3.4	3.6	3.7	3.8	3.9	3.4%
Total	33.1	34.7	36.4	38.1	40.0	4.8%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 219 FRANCE: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	21.8	22.7	23.7	24.8	26.0	27.3	4.6%
Ultrafiltration (UF)	8.6	9.2	9.8	10.5	11.2	12.0	7.0%
Microfiltration (MF)	7.5	8.1	8.6	9.3	9.9	10.7	7.2%
Nanofiltration (NF)	4.1	4.2	4.4	4.6	4.8	5.0	4.1%
Total	42.0	44.2	46.5	49.1	51.9	55.0	5.6%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 220 FRANCE: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	8.00	8.82	9.71	10.70	11.79	10.2%
Ultrafiltration (UF)	7.85	8.20	8.58	8.99	9.44	4.7%
Microfiltration (MF)	5.24	5.46	5.71	5.97	6.27	4.6%
Nanofiltration (NF)	0.36	0.38	0.39	0.40	0.42	3.5%
Total	21.46	22.85	24.38	26.06	27.92	6.8%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 221 FRANCE: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	12.99	14.32	15.80	17.44	19.26	21.29	5.8%
Ultrafiltration (UF)	9.90	10.40	10.96	11.56	12.22	12.94	5.5%
Microfiltration (MF)	6.57	6.90	7.26	7.65	8.08	8.54	5.4%
Nanofiltration (NF)	0.44	0.45	0.47	0.50	0.52	0.55	4.7%
Total	29.90	32.08	34.49	37.14	40.08	43.32	5.6%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 222 FRANCE: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	3.31	3.45	3.60	3.76	3.94	4.4%
Ultrafiltration (UF)	7.91	8.36	8.84	9.37	9.95	5.9%
Microfiltration (MF)	10.29	10.83	11.42	12.07	12.78	5.6%
Nanofiltration (NF)	0.28	0.30	0.31	0.32	0.34	4.7%
Total	21.80	22.94	24.17	25.53	27.01	5.5%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 223 FRANCE: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	4.14	4.36	4.60	4.86	5.14	5.46	5.7%
Ultrafiltration (UF)	10.55	11.20	11.92	12.71	13.57	14.52	6.6%
Microfiltration (MF)	13.55	14.41	15.34	16.36	17.49	18.73	6.7%
Nanofiltration (NF)	0.36	0.38	0.40	0.42	0.45	0.48	5.9%
Total	28.60	30.35	32.26	34.35	36.66	39.19	6.5%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 224 FRANCE: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	3.77	4.02	4.29	4.59	4.91	6.8%
Ultrafiltration (UF)	3.64	3.87	4.11	4.38	4.67	6.4%
Microfiltration (MF)	1.85	1.96	2.08	2.22	2.37	6.4%
Nanofiltration (NF)	0.56	0.59	0.62	0.65	0.69	5.3%
Total	9.82	10.43	11.10	11.83	12.64	6.5%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 225 FRANCE: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	5.27	5.66	6.09	6.56	7.09	7.67	7.8%
Ultrafiltration (UF)	4.99	5.34	5.72	6.15	6.61	7.13	7.4%
Microfiltration (MF)	2.53	2.70	2.89	3.10	3.34	3.59	7.3%
Nanofiltration (NF)	0.73	0.77	0.82	0.88	0.94	1.00	6.6%
Total	13.51	14.47	15.52	16.69	17.97	19.39	7.5%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

11.4.7 NETHERLANDS

11.4.7.1 Extensive use of membrane filtration by dairy, beverage, and functional food manufacturers to drive market

Membrane manufacturers are increasingly introducing technologically advanced products tailored for application in the food & beverage industry. A prominent player in this field, NOX Filtration, based in the Netherlands, has introduced a globally unique nanofiltration (NF) concept that holds vast potential across various processes within the food and beverage sector. This innovation effectively reduces water usage, enhances product quality, and lowers costs.

NOX Filtration's novel nanofiltration (NF) technology is characterized by its precise control over rejection rates and flow properties. Through their groundbreaking direct nanofiltration approach, water streams can be intricately tailored to meet the stringent demands of producing high-quality food and beverage items. This one-step process eliminates unwanted constituents such as organics, micropollutants, pathogens, viruses, bacteria, and heavy metals.

The membrane filtration landscape in the Netherlands is primarily driven by the widespread adoption of membrane-based filtration techniques. Industries such as dairy, beverages, and functional food manufacturing have embraced these technologies due to their inherent advantages. These advantages include user-friendly operation, energy efficiency, and dependable performance.

The membrane filtration market in the Netherlands is mainly driven by the extensive use of membrane filtration by dairy, beverage, and functional food manufacturers due to the advantages offered by this technology, such as ease of use, energy efficiency, and reliable purification.

TABLE 226 NETHERLANDS: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2018–2022 (USD MILLION)

Application	2018	2019	2020	2021	2022	CAGR (2018–2022)
Dairy Products	24.3	25.1	26.0	26.9	27.8	3.5%
Drinks & Concentrates	15.7	16.5	17.4	18.3	19.4	5.4%
Wine & Beer	16.2	16.8	17.5	18.2	19.0	4.1%
Other Food & Beverage Applications	5.9	6.2	6.5	6.8	7.2	5.1%
Total	62.0	64.6	67.3	70.3	73.4	4.3%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 227 NETHERLANDS: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2023–2028 (USD MILLION)

Application	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Dairy Products	28.9	30.0	31.2	32.5	33.9	35.5	4.2%
Drinks & Concentrates	20.5	21.7	23.0	24.5	26.0	27.8	6.3%
Wine & Beer	19.9	20.8	21.8	22.9	24.2	25.5	5.1%
Other Food & Beverage Applications	7.6	8.0	8.5	9.0	9.6	10.2	6.1%
Total	76.8	80.5	84.5	88.9	93.7	99.0	5.2%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 228 NETHERLANDS: MEMBRANE FILTRATION MARKET, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	23.7	24.7	25.9	27.1	28.4	4.6%
Ultrafiltration (UF)	18.5	19.2	20.0	20.8	21.7	4.1%
Microfiltration (MF)	16.4	17.1	17.9	18.7	19.5	4.4%
Nanofiltration (NF)	3.4	3.5	3.6	3.7	3.8	2.9%
Total	62.0	64.6	67.3	70.3	73.4	4.3%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 229 NETHERLANDS: MEMBRANE FILTRATION MARKET, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	29.8	31.3	32.9	34.7	36.7	38.9	5.5%
Ultrafiltration (UF)	22.7	23.7	24.9	26.1	27.5	29.0	5.0%
Microfiltration (MF)	20.4	21.4	22.5	23.7	25.0	26.4	5.3%
Nanofiltration (NF)	3.9	4.1	4.2	4.4	4.5	4.7	3.7%
Total	76.8	80.5	84.5	88.9	93.7	99.0	5.2%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 230 NETHERLANDS: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	13.48	14.04	14.63	15.26	15.92	4.2%
Ultrafiltration (UF)	5.08	5.19	5.29	5.38	5.47	1.8%
Microfiltration (MF)	4.07	4.23	4.39	4.56	4.72	3.8%
Nanofiltration (NF)	1.62	1.64	1.67	1.70	1.73	1.8%
Total	24.26	25.11	25.99	26.90	27.84	3.5%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 231 NETHERLANDS: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	16.63	17.40	18.23	19.14	20.13	21.21	5.0%
Ultrafiltration (UF)	5.61	5.76	5.92	6.09	6.28	6.49	3.0%
Microfiltration (MF)	4.87	5.04	5.21	5.41	5.61	5.84	3.7%
Nanofiltration (NF)	1.76	1.79	1.82	1.86	1.90	1.94	2.0%
Total	28.87	29.98	31.19	32.50	33.93	35.48	4.2%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 232 NETHERLANDS: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	5.70	6.01	6.35	6.73	7.14	5.8%
Ultrafiltration (UF)	5.59	5.87	6.17	6.51	6.87	5.3%
Microfiltration (MF)	3.67	3.85	4.05	4.26	4.50	5.2%
Nanofiltration (NF)	0.74	0.77	0.80	0.83	0.87	4.1%
Total	15.70	16.50	17.37	18.33	19.37	5.4%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 233 NETHERLANDS: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	7.57	8.04	8.55	9.12	9.74	10.43	6.6%
Ultrafiltration (UF)	7.25	7.68	8.14	8.64	9.19	9.80	6.2%
Microfiltration (MF)	4.75	5.02	5.31	5.64	5.99	6.38	6.1%
Nanofiltration (NF)	0.91	0.95	1.00	1.06	1.12	1.18	5.4%
Total	20.48	21.68	23.01	24.46	26.05	27.79	6.3%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 234 NETHERLANDS: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	2.30	2.36	2.43	2.51	2.59	3.0%
Ultrafiltration (UF)	5.72	5.96	6.22	6.50	6.82	4.5%
Microfiltration (MF)	7.64	7.94	8.26	8.62	9.00	4.2%
Nanofiltration (NF)	0.53	0.55	0.57	0.59	0.61	3.3%
Total	16.19	16.81	17.48	18.21	19.02	4.1%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 235 NETHERLANDS: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	2.68	2.77	2.88	2.99	3.12	3.26	4.0%
Ultrafiltration (UF)	7.11	7.43	7.78	8.16	8.58	9.03	4.9%
Microfiltration (MF)	9.46	9.95	10.49	11.08	11.72	12.42	5.6%
Nanofiltration (NF)	0.63	0.65	0.68	0.71	0.74	0.77	4.2%
Total	19.87	20.81	21.83	22.94	24.15	25.48	5.1%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 236 NETHERLANDS: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	2.20	2.32	2.45	2.58	2.73	5.5%
Ultrafiltration (UF)	2.13	2.23	2.34	2.46	2.59	5.0%
Microfiltration (MF)	1.05	1.10	1.15	1.21	1.28	5.0%
Nanofiltration (NF)	0.51	0.53	0.55	0.57	0.60	3.9%
Total	5.89	6.18	6.49	6.82	7.19	5.1%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 237 NETHERLANDS: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	2.89	3.07	3.26	3.47	3.70	3.96	6.5%
Ultrafiltration (UF)	2.73	2.88	3.05	3.23	3.43	3.65	6.0%
Microfiltration (MF)	1.34	1.42	1.50	1.59	1.68	1.79	5.9%
Nanofiltration (NF)	0.63	0.66	0.69	0.72	0.76	0.81	5.2%
Total	7.59	8.02	8.49	9.01	9.58	10.20	6.1%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

11.4.8 DENMARK

11.4.8.1 Increased consumption of cheese to propel market

Denmark's membrane filtration market has demonstrated notable growth within the food and beverages, dairy, and wine sectors. Membrane filtration technologies have emerged as crucial tools in elevating product quality and operational efficiency across these industries. In the food and beverages sector, membrane filtration is extensively utilized to enhance product clarity, prolong shelf life, and refine flavour profiles, aligning with stringent quality requirements. Danish membrane filtration company DSS Silkeborg A/S develops, designs, sells, builds, and commissions membrane filtration systems for dairy applications using reverse osmosis, nanofiltration, ultrafiltration, and microfiltration technologies. The dairy industry in Denmark benefits significantly from membrane filtration, optimizing processes like milk separation, cheese production, and yogurt manufacturing, which ensures consistent textures and Flavors while promoting sustainability. Moreover, the wine industry in Denmark leverages membrane filtration for precise clarifications, preserving the unique characteristics of wines. This robust integration of membrane filtration underscores Denmark's dedication to innovation and sustainable practices within its food and beverage sectors.

The utilization of milk fat and non-fat milk in Denmark shows significant growth in 2022. According to Mejeriforeningen 2022, the utilization of milk fat cheese in 2022 is 43% and non-fat milk cheese is 54%. This drives the great demand for membrane filtration and separation in the dairy industry.

TABLE 238 DENMARK: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2018–2022 (USD MILLION)

Application	2018	2019	2020	2021	2022	CAGR (2018–2022)
Dairy Products	28.7	29.7	30.8	32.0	33.3	3.8%
Drinks & Concentrates	18.7	19.7	20.8	22.0	23.3	5.7%
Wine & Beer	19.6	20.4	21.3	22.3	23.3	4.4%
Other Food & Beverage Applications	7.4	7.7	8.2	8.6	9.1	5.4%
Total	74.4	77.6	81.1	84.9	89.1	4.6%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 239 DENMARK: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2023–2028 (USD MILLION)

Application	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Dairy Products	34.8	36.3	38.0	39.7	41.5	43.4	4.5%
Drinks & Concentrates	24.7	26.3	28.0	29.9	31.9	34.2	6.7%
Wine & Beer	24.5	25.7	27.1	28.6	30.2	32.0	5.5%
Other Food & Beverage Applications	9.6	10.2	10.9	11.6	12.3	13.2	6.5%
Total	93.6	98.6	104.0	109.7	116.0	122.8	5.6%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 240 DENMARK: MEMBRANE FILTRATION MARKET, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	28.1	29.5	31.1	32.7	34.5	5.3%
Ultrafiltration (UF)	23.1	24.0	25.0	26.1	27.3	4.2%
Microfiltration (MF)	19.4	20.2	21.1	22.0	23.1	4.4%
Nanofiltration (NF)	3.7	3.8	3.9	4.0	4.2	2.9%
Total	74.4	77.6	81.1	84.9	89.1	4.6%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 241 DENMARK: MEMBRANE FILTRATION MARKET, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	36.5	38.7	41.1	43.5	46.1	49.0	6.0%
Ultrafiltration (UF)	28.6	30.0	31.5	33.2	35.0	37.0	5.3%
Microfiltration (MF)	24.2	25.4	26.8	28.3	29.9	31.6	5.5%
Nanofiltration (NF)	4.3	4.5	4.6	4.8	5.0	5.2	4.0%
Total	93.6	98.6	104.0	109.7	116.0	122.8	5.6%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 242 DENMARK: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	15.50	16.24	17.04	17.91	18.85	5.0%
Ultrafiltration (UF)	7.42	7.60	7.79	8.00	8.22	2.6%
Microfiltration (MF)	3.96	4.04	4.13	4.22	4.33	2.2%
Nanofiltration (NF)	1.83	1.85	1.88	1.90	1.93	1.3%
Total	28.72	29.73	30.83	32.03	33.33	3.8%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 243 DENMARK: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	19.92	21.08	22.35	23.53	24.81	26.20	5.6%
Ultrafiltration (UF)	8.45	8.70	8.96	9.25	9.56	9.89	3.2%
Microfiltration (MF)	4.44	4.57	4.70	4.84	5.00	5.17	3.1%
Nanofiltration (NF)	1.96	2.00	2.03	2.08	2.12	2.17	2.0%
Total	34.77	36.34	38.05	39.69	41.48	43.42	4.5%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 244 DENMARK: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	7.08	7.51	7.98	8.49	9.06	6.4%
Ultrafiltration (UF)	6.13	6.43	6.77	7.13	7.53	5.3%
Microfiltration (MF)	4.87	5.12	5.39	5.69	6.02	5.4%
Nanofiltration (NF)	0.60	0.62	0.65	0.68	0.71	4.4%
Total	18.68	19.68	20.79	21.99	23.31	5.7%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 245 DENMARK: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	9.63	10.27	10.97	11.73	12.58	13.51	7.0%
Ultrafiltration (UF)	7.98	8.48	9.02	9.62	10.27	10.99	6.6%
Microfiltration (MF)	6.37	6.76	7.18	7.65	8.16	8.73	6.5%
Nanofiltration (NF)	0.75	0.79	0.83	0.88	0.93	0.98	5.7%
Total	24.73	26.29	28.00	29.88	31.94	34.21	6.7%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 246 DENMARK: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	2.79	2.88	2.97	3.07	3.19	3.4%
Ultrafiltration (UF)	6.93	7.23	7.54	7.89	8.27	4.5%
Microfiltration (MF)	9.27	9.67	10.11	10.59	11.11	4.6%
Nanofiltration (NF)	0.65	0.67	0.70	0.73	0.77	4.3%
Total	19.64	20.45	21.33	22.29	23.34	4.4%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 247 DENMARK: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	3.31	3.45	3.60	3.76	3.94	4.13	4.5%
Ultrafiltration (UF)	8.68	9.13	9.63	10.17	10.76	11.40	5.6%
Microfiltration (MF)	11.68	12.30	12.98	13.72	14.53	15.41	5.7%
Nanofiltration (NF)	0.80	0.85	0.89	0.94	0.99	1.05	5.5%
Total	24.48	25.73	27.09	28.58	30.21	31.99	5.5%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 248 DENMARK: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	2.75	2.91	3.07	3.26	3.45	5.8%
Ultrafiltration (UF)	2.66	2.79	2.93	3.09	3.26	5.2%
Microfiltration (MF)	1.31	1.38	1.45	1.53	1.62	5.4%
Nanofiltration (NF)	0.64	0.67	0.70	0.73	0.76	4.4%
Total	7.37	7.74	8.15	8.60	9.09	5.4%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 249 DENMARK: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	3.67	3.91	4.17	4.46	4.78	5.13	6.9%
Ultrafiltration (UF)	3.45	3.65	3.88	4.13	4.40	4.70	6.4%
Microfiltration (MF)	1.71	1.81	1.92	2.04	2.18	2.32	6.3%
Nanofiltration (NF)	0.80	0.84	0.88	0.93	0.99	1.04	5.5%
Total	9.63	10.21	10.86	11.56	12.34	13.19	6.5%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

11.4.9 REST OF EUROPE

The Rest of Europe market comprises Finland and Sweden. Tetra Pak, the market leader in food processing and packaging solutions, acquired DSS. Becoming an integral part of Tetra Pak offers DSS the opportunity to grow in the global dairy industry.

Growing awareness among food, beverage, functional food, and dairy manufacturers about the advantages of membrane filtration for effective purification, separation, fractionation, whey concentration, and demineralization drives this market.

TABLE 250 REST OF EUROPE: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2018–2022 (USD MILLION)

Application	2018	2019	2020	2021	2022	CAGR (2018–2022)
Dairy Products	27.6	28.9	30.3	31.8	33.5	5.0%
Drinks & Concentrates	19.0	20.3	21.6	23.2	24.8	6.9%
Wine & Beer	19.4	20.5	21.6	22.8	24.2	5.6%
Other Food & Beverage Applications	6.8	7.2	7.7	8.2	8.7	6.6%
Total	72.8	76.8	81.2	86.0	91.3	5.8%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 251 REST OF EUROPE: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2023–2028 (USD MILLION)

Application	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Dairy Products	35.3	37.2	39.3	41.7	44.2	46.9	5.9%
Drinks & Concentrates	26.7	28.7	30.9	33.4	36.1	39.2	8.0%
Wine & Beer	25.7	27.3	29.1	31.1	33.3	35.7	6.8%
Other Food & Beverage Applications	9.4	10.1	10.8	11.7	12.6	13.7	7.8%
Total	97.0	103.3	110.2	117.8	126.2	135.4	6.9%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 252 REST OF EUROPE: MEMBRANE FILTRATION MARKET, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	27.9	29.6	31.5	33.6	35.8	6.4%
Ultrafiltration (UF)	22.3	23.4	24.7	26.0	27.5	5.4%
Microfiltration (MF)	19.3	20.3	21.4	22.7	24.0	5.6%
Nanofiltration (NF)	3.4	3.5	3.6	3.8	3.9	4.1%
Total	72.8	76.8	81.2	86.0	91.3	5.8%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 253 REST OF EUROPE: MEMBRANE FILTRATION MARKET, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	38.3	41.0	44.0	47.3	51.0	55.0	7.5%
Ultrafiltration (UF)	29.1	30.9	32.9	35.0	37.3	39.9	6.5%
Microfiltration (MF)	25.5	27.1	28.8	30.8	32.9	35.2	6.7%
Nanofiltration (NF)	4.1	4.3	4.5	4.8	5.0	5.3	5.2%
Total	97.0	103.3	110.2	117.8	126.2	135.4	6.9%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 254 REST OF EUROPE: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	15.40	16.30	17.29	18.37	19.55	6.2%
Ultrafiltration (UF)	6.74	6.97	7.22	7.49	7.78	3.6%
Microfiltration (MF)	3.96	4.08	4.22	4.37	4.52	3.4%
Nanofiltration (NF)	1.51	1.54	1.57	1.61	1.65	2.2%
Total	27.60	28.90	30.31	31.84	33.51	5.0%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 255 REST OF EUROPE: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	20.86	22.30	23.88	25.62	27.53	29.62	7.3%
Ultrafiltration (UF)	8.06	8.35	8.67	9.00	9.36	9.74	3.9%
Microfiltration (MF)	4.68	4.85	5.03	5.23	5.43	5.65	3.8%
Nanofiltration (NF)	1.69	1.72	1.76	1.81	1.85	1.90	2.4%
Total	35.29	37.23	39.35	41.65	44.17	46.92	5.9%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 256 REST OF EUROPE: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	7.20	7.73	8.30	8.94	9.64	7.6%
Ultrafiltration (UF)	6.24	6.62	7.05	7.51	8.02	6.5%
Microfiltration (MF)	4.96	5.27	5.62	5.99	6.41	6.6%
Nanofiltration (NF)	0.61	0.64	0.68	0.71	0.76	5.6%
Total	19.01	20.26	21.64	23.16	24.83	6.9%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 257 REST OF EUROPE: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	10.38	11.20	12.11	13.11	14.22	15.46	8.3%
Ultrafiltration (UF)	8.61	9.25	9.97	10.75	11.62	12.59	7.9%
Microfiltration (MF)	6.87	7.38	7.94	8.56	9.24	10.00	7.8%
Nanofiltration (NF)	0.80	0.86	0.92	0.98	1.05	1.13	7.0%
Total	26.66	28.69	30.93	33.40	36.14	39.17	8.0%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 258 REST OF EUROPE: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	2.76	2.88	3.01	3.15	3.31	4.6%
Ultrafiltration (UF)	6.86	7.24	7.64	8.08	8.57	5.7%
Microfiltration (MF)	9.18	9.69	10.24	10.85	11.51	5.8%
Nanofiltration (NF)	0.64	0.68	0.71	0.75	0.80	5.5%
Total	19.45	20.48	21.60	22.84	24.18	5.6%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 259 REST OF EUROPE: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	3.48	3.67	3.87	4.10	4.34	4.61	5.8%
Ultrafiltration (UF)	9.11	9.70	10.35	11.07	11.85	12.72	6.9%
Microfiltration (MF)	12.25	13.06	13.94	14.92	15.99	17.17	7.0%
Nanofiltration (NF)	0.85	0.90	0.97	1.03	1.11	1.19	7.1%
Total	25.68	27.33	29.13	31.11	33.29	35.68	6.8%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 260 REST OF EUROPE: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	2.53	2.70	2.89	3.10	3.32	7.0%
Ultrafiltration (UF)	2.45	2.59	2.76	2.94	3.13	6.4%
Microfiltration (MF)	1.21	1.28	1.36	1.46	1.56	6.6%
Nanofiltration (NF)	0.59	0.62	0.65	0.69	0.73	5.6%
Total	6.77	7.20	7.67	8.18	8.75	6.6%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 261 REST OF EUROPE: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	3.58	3.86	4.16	4.50	4.88	5.30	8.2%
Ultrafiltration (UF)	3.36	3.60	3.87	4.17	4.50	4.86	7.7%
Microfiltration (MF)	1.67	1.79	1.92	2.06	2.22	2.40	7.6%
Nanofiltration (NF)	0.78	0.83	0.88	0.94	1.01	1.08	6.8%
Total	9.38	10.07	10.84	11.68	12.62	13.65	7.8%

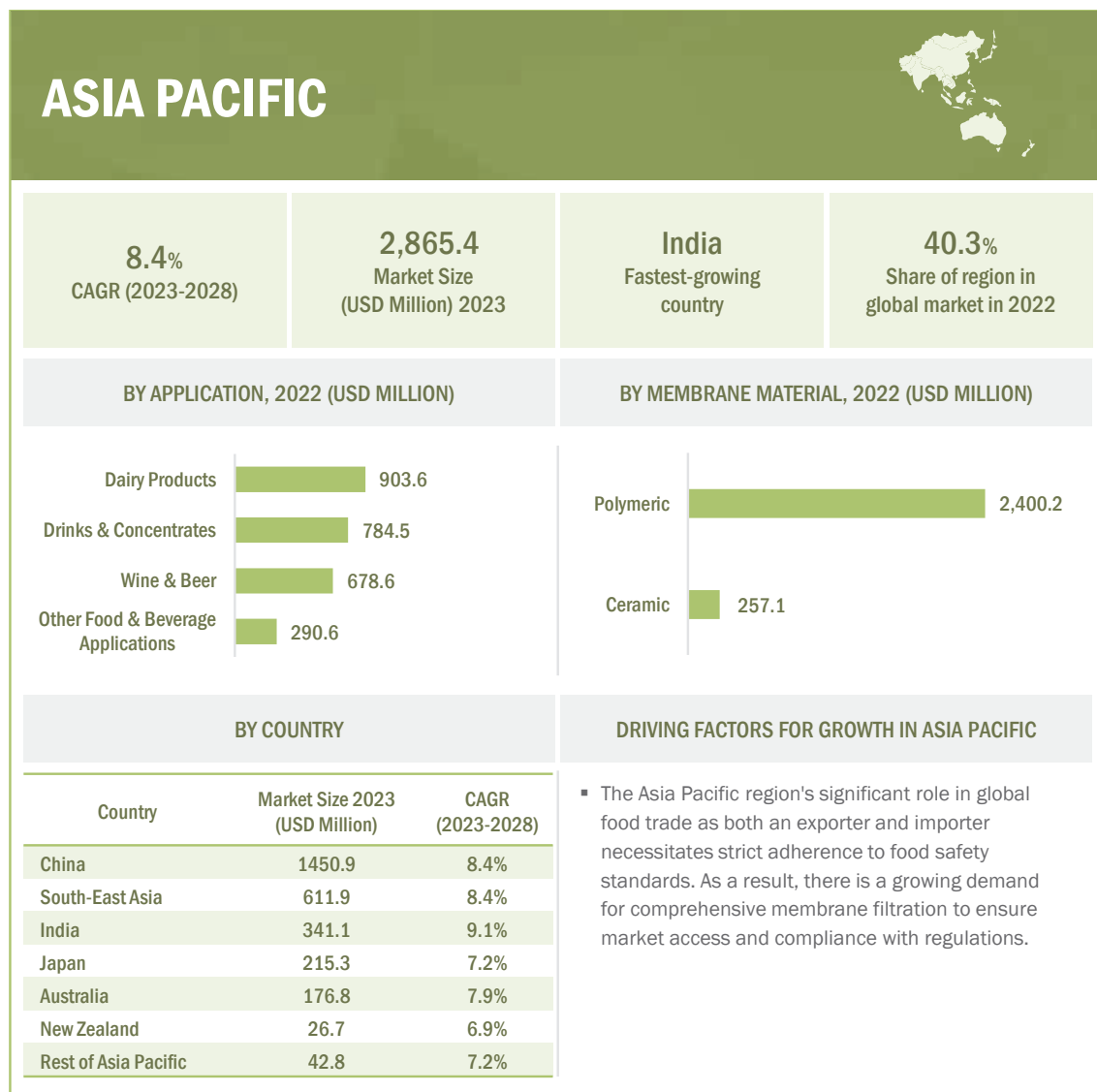
Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

11.5 ASIA PACIFIC

Asia Pacific is estimated to dominate the global membrane filtration market for applications. This regional segment accounted for 40.3% of the global market in 2022. Growth is largely driven by the increasing use of membrane filtration in water processing plants for purification and in the dairy and food industries for pasteurization, sterilization, and concentration processes.

China dominated the Asia Pacific membrane filtration market for applications, with a share of 50.5% in 2022. This market is mainly driven by the increasing use of membrane filtration technologies for functional beverages. The growing population in this country also increases the need for sustainable purification technologies to ensure a constant supply of safe drinking water.

India is expected to be the fastest-growing market during the review period. The growing demand for dairy products, government support for membrane filtration technologies for water purification, the growth in the purchasing power of the middle-class population, and the rising consumption of functional foods are some of the key factors driving market growth in this country.

FIGURE 46 ASIA PACIFIC: MEMBRANE FILTRATION MARKET SNAPSHOT

Source: Company Press Releases, Investor Presentations, Food Journals, Expert Interviews, and MarketsandMarkets Analysis

11.5.1 ASIA PACIFIC: RECESSION IMPACT ANALYSIS

The presence of thriving economies due to rising population, growing per capita incomes, and strong domestic demand for several industries has sustained the Asia Pacific region from major impacts of global crises such as economic recessions. Despite the COVID-19 impact, the region is estimated to have a comparatively low impact of recession than the global average. According to CNBC's article published in October 2022, Asia, particularly Southeast Asia, remains relatively undisturbed amid the global recession. As per IMF's forecast, the Asia Pacific region is projected to grow at 4% and 4.3% in 2023, which is significantly more than the forecast of Europe and the US, at 3.1% and 1.6%, respectively.

The article from the IMF released in 2022 highlights the waning momentum of Asia's strong economic rebound, which is impacting the region's growth prospects. The IMF has revised its growth forecasts for Asia and the Pacific, projecting a growth rate of 4% for the current year and 4.3% for the following year. These figures fall well below the 5.5% average growth rate seen over the last two decades. Despite the

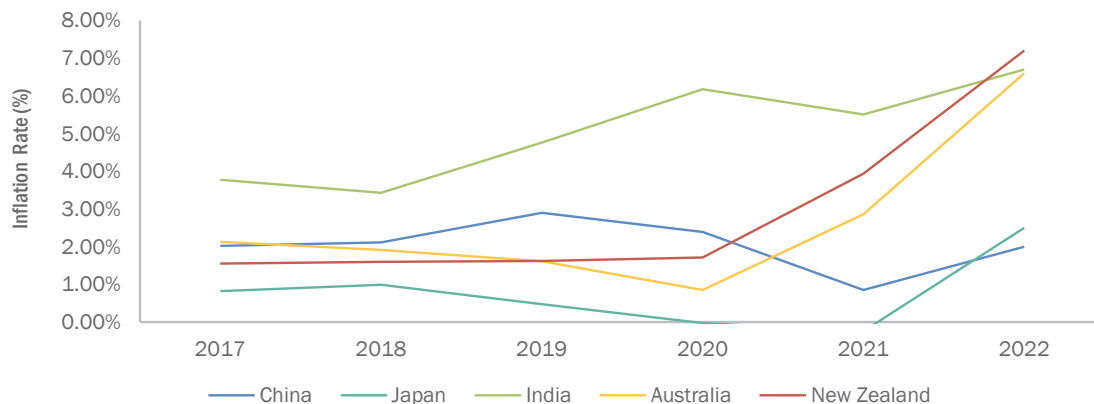
slowdown, Asia remains a relatively bright spot in the global economy, which is experiencing a general dimming of growth.

The article identifies 3 persistent headwinds contributing to the loss of momentum in Asia's economic growth. Firstly, financial conditions are significantly tightened, resulting in increased government borrowing costs. Central banks in major advanced economies are raising interest rates to curb inflation, the highest seen in decades. This tightening of financial conditions may become even more restrictive, potentially exacerbated by rapidly depreciating currencies, further complicating regional policy challenges.

Secondly, the ongoing conflict between Russia and Ukraine is causing a sharp slowdown in economic activity in Europe. This, in turn, reduces external demand for Asian exports, negatively impacting the region's economic growth. Lastly, China's strict zero-COVID policy and related lockdowns, combined with turmoil in the real estate sector, have led to an uncharacteristic and significant slowdown in growth. This slowdown has further weakened momentum in connected economies, affecting the region's overall economic performance.

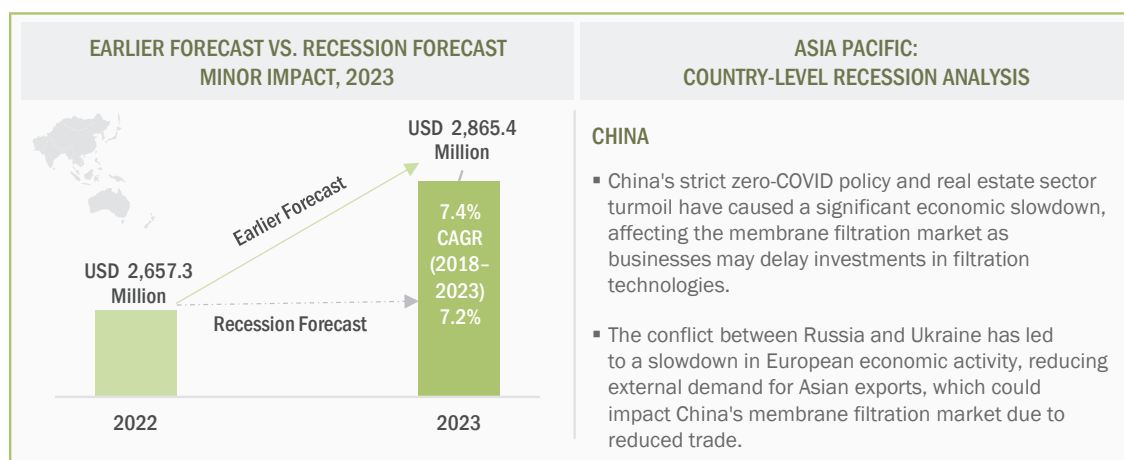
However, Asia's overall economic trends and growth prospects could indirectly impact the food pathogen testing industry. A slowdown in economic growth may lead to reduced consumer spending and business investments, potentially affecting the demand for and investment in food testing services. Furthermore, certain economies face challenges such as high debt and refinancing risks, which could indirectly affect their capacity to allocate resources towards food hygiene, filtration, and safety.

FIGURE 47 ASIA PACIFIC: INFLATION RATES, BY KEY COUNTRY, 2017–2022



Source: World Bank

FIGURE 48 ASIA PACIFIC MEMBRANE FILTRATION MARKET: EARLIER FORECAST VS. RECESSION FORECAST



Source: Secondary Sources, Related Research Publications, Expert Interviews, and MarketsandMarkets Analysis

TABLE 262 ASIA PACIFIC: MEMBRANE FILTRATION MARKET, BY COUNTRY, 2018-2022 (USD MILLION)

Country	2018	2019	2020	2021	2022	CAGR (2018-2022)
China	1,010.9	1,083.3	1,162.4	1,248.8	1,343.3	7.4%
Southeast Asia	425.3	456.3	490.1	528.8	567.6	7.5%
India	229.9	248.1	268.2	288.4	314.3	8.1%
Japan	158.3	167.9	178.3	189.7	201.9	6.3%
Australia	126.1	134.6	143.8	153.8	164.8	6.9%
New Zealand	20.0	21.1	22.3	23.6	25.1	5.8%
Rest of Asia Pacific	31.7	33.5	35.5	37.7	40.1	6.1%
Total	2,002.2	2,144.8	2,300.6	2,470.9	2,657.3	7.3%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 263 ASIA PACIFIC: MEMBRANE FILTRATION MARKET, BY COUNTRY, 2023–2028 (USD MILLION)

Country	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
China	1,450.9	1,569.1	1,699.1	1,842.4	2,000.5	2,175.2	8.4%
Southeast Asia	611.9	660.9	715.1	775.1	841.8	915.9	8.4%
India	341.1	370.7	403.7	440.5	481.4	527.2	9.1%
Japan	215.3	229.9	246.0	263.7	283.2	304.7	7.2%
Australia	176.8	190.1	204.7	220.9	238.8	258.6	7.9%
New Zealand	26.7	28.4	30.3	32.4	34.7	37.2	6.9%
Rest of Asia Pacific	42.8	45.7	48.9	52.4	56.3	60.6	7.2%
Total	2,865.4	3,094.8	3,347.8	3,627.5	3,936.8	4,279.4	8.4%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 264 ASIA PACIFIC: MEMBRANE FILTRATION MARKET, BY MODULE DESIGN, 2018–2022 (USD MILLION)

Module Design	2018	2019	2020	2021	2022	CAGR (2018–2022)
Spiral Wound	1,217.0	1,303.9	1,398.8	1,502.6	1,616.2	7.4%
Tubular Systems	314.3	337.7	363.2	391.1	421.8	7.6%
Plate & Frame and Hollow Fiber	470.9	503.3	538.7	577.2	619.4	7.1%
Total	2,002.2	2,144.8	2,300.6	2,470.9	2,657.3	7.3%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 265 ASIA PACIFIC: MEMBRANE FILTRATION MARKET, BY MODULE DESIGN, 2023–2028 (USD MILLION)

Module Design	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Spiral Wound	1,744.9	1,886.6	2,042.9	2,215.4	2,406.1	2,614.2	8.4%
Tubular Systems	455.0	491.7	532.4	577.5	627.5	683.9	8.5%
Plate & Frame and Hollow Fiber	665.6	716.4	772.6	834.6	903.2	981.4	8.1%
Total	2,865.4	3,094.8	3,347.8	3,627.5	3,936.8	4,279.4	8.4%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 266 ASIA PACIFIC: MEMBRANE FILTRATION MARKET, BY MEMBRANE MATERIAL, 2018–2022 (USD MILLION)

Membrane Material	2018	2019	2020	2021	2022	CAGR (2018–2022)
Polymeric	1,818.4	1,945.0	2,083.3	2,234.5	2,400.2	7.2%
Ceramic	183.8	199.9	217.4	236.4	257.1	8.8%
Total	2,002.2	2,144.8	2,300.6	2,470.9	2,657.3	7.3%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 267 ASIA PACIFIC: MEMBRANE FILTRATION MARKET, BY MEMBRANE MATERIAL, 2023–2028 (USD MILLION)

Membrane Material	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Polymeric	2,585.8	2,790.1	3,015.5	3,264.3	3,539.3	3,843.7	8.3%
Ceramic	279.7	304.6	332.4	363.2	397.5	435.7	9.3%
Total	2,865.4	3,094.8	3,347.8	3,627.5	3,936.8	4,279.4	8.4%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 268 ASIA PACIFIC: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2018–2022 (USD MILLION)

Application	2018	2019	2020	2021	2022	CAGR (2018–2022)
Dairy Products	692.8	738.5	788.6	843.5	903.6	6.9%
Drinks & Concentrates	571.3	617.5	668.1	723.5	784.5	8.2%
Wine & Beer	522.6	556.9	594.1	634.6	678.6	6.7%
Other Food & Beverage Applications	215.5	232.0	249.8	269.4	290.6	7.8%
Total	2,002.2	2,144.8	2,300.6	2,470.9	2,657.3	7.3%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 269 ASIA PACIFIC: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2023–2028 (USD MILLION)

Application	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Dairy Products	971.0	1,045.0	1,126.2	1,215.6	1,314.1	1,422.6	7.9%
Drinks & Concentrates	852.6	928.1	1,011.8	1,104.8	1,208.3	1,323.6	9.2%
Wine & Beer	726.5	779.1	837.0	900.7	970.9	1,048.4	7.6%
Other Food & Beverage Applications	315.3	342.6	372.8	406.3	443.5	484.8	9.0%
Total	2,865.4	3,094.8	3,347.8	3,627.5	3,936.8	4,279.4	8.4%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 270 ASIA PACIFIC: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY SUBAPPLICATION, 2018–2022 (USD MILLION)

Subapplication	2018	2019	2020	2021	2022	CAGR (2018–2022)
Liquid Milk	448.8	476.7	507.3	540.9	577.8	6.5%
Other Dairy Products	244.0	261.8	281.3	302.6	325.9	7.5%
Total	692.8	738.5	788.6	843.5	903.6	6.9%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 271 ASIA PACIFIC: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY SUBAPPLICATION, 2023–2028 (USD MILLION)

Subapplication	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Liquid Milk	618.6	666.2	718.6	776.2	839.8	910.0	8.0%
Other Dairy Products	352.4	378.7	407.6	439.4	474.2	512.6	7.8%
Total	971.0	1,045.0	1,126.2	1,215.6	1,314.1	1,422.6	7.9%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 272 ASIA PACIFIC: MEMBRANE FILTRATION MARKET FOR LIQUID MILK, BY SUBAPPLICATION, 2018–2022 (USD MILLION)

Subapplication	2018	2019	2020	2021	2022	CAGR (2018–2022)
Milk Concentration	225.9	237.4	250.2	264.3	279.7	5.5%
Milk Protein Fractionation	158.2	169.6	182.1	195.7	210.7	7.4%
Milk Pre-Concentration	39.0	42.1	45.5	49.3	53.5	8.2%
Water Recovery	25.8	27.6	29.5	31.6	33.9	7.1%
Total	448.8	476.7	507.3	540.9	577.8	6.5%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 273 ASIA PACIFIC: MEMBRANE FILTRATION MARKET FOR LIQUID MILK, BY SUBAPPLICATION, 2023–2028 (USD MILLION)

Subapplication	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Milk Concentration	296.8	318.3	341.9	367.9	396.6	428.3	7.6%
Milk Protein Fractionation	227.3	245.6	265.6	287.6	311.9	338.6	8.3%
Milk Pre-Concentration	58.1	63.2	68.9	75.2	82.3	90.1	9.2%
Water Recovery	36.4	39.2	42.2	45.5	49.1	53.0	7.8%
Total	618.6	666.2	718.6	776.2	839.8	910.0	8.0%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 274 ASIA PACIFIC: MEMBRANE FILTRATION MARKET FOR OTHER DAIRY PRODUCTS, BY SUBAPPLICATION, 2018–2022 (USD MILLION)

Subapplication	2018	2019	2020	2021	2022	CAGR (2018–2022)
Whey	107.0	114.9	123.6	133.0	143.4	7.6%
Milk & Whey Based Ingredients	31.2	33.3	35.7	38.2	40.9	7.0%
Cheese	105.7	113.5	122.1	131.4	141.5	7.6%
Total	244.0	261.8	281.3	302.6	325.9	7.5%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 275 ASIA PACIFIC: MEMBRANE FILTRATION MARKET FOR OTHER DAIRY PRODUCTS, BY SUBAPPLICATION, 2023–2028 (USD MILLION)

Subapplication	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Whey	156.6	168.4	181.4	195.6	211.3	228.5	7.8%
Milk & Whey Based Ingredients	43.7	46.8	50.1	53.7	57.7	62.1	7.3%
Cheese	152.0	163.5	176.2	190.0	205.3	222.1	7.9%
Total	352.4	378.7	407.6	439.4	474.2	512.6	7.8%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 276 ASIA PACIFIC: MEMBRANE FILTRATION MARKET, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	824.1	886.6	955.3	1030.7	1113.7	7.8%
Ultrafiltration (UF)	618.7	662.2	709.6	761.1	817.6	7.2%
Microfiltration (MF)	465.2	498.8	535.4	575.3	619.3	7.4%
Nanofiltration (NF)	94.2	97.2	100.3	103.8	106.8	3.2%
Total	2,002.2	2,144.8	2,300.6	2,470.9	2,657.3	7.3%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 277 ASIA PACIFIC: MEMBRANE FILTRATION MARKET, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	1203.5	1302.7	1412.6	1534.2	1669.1	1812.5	8.5%
Ultrafiltration (UF)	882.1	953.1	1031.5	1118.1	1213.8	1319.8	8.4%
Microfiltration (MF)	667.8	721.1	780.0	845.0	916.8	1002.8	8.5%
Nanofiltration (NF)	112.1	117.7	123.8	130.2	137.1	144.4	5.2%
Total	2,865.4	3,094.8	3,347.8	3,627.5	3,936.8	4,279.4	8.4%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 278 ASIA PACIFIC: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	285.1	303.8	325.2	349.6	377.6	7.3%
Ultrafiltration (UF)	214.1	228.8	244.4	260.9	278.7	6.8%
Microfiltration (MF)	161.0	172.3	184.4	197.1	211.1	7.0%
Nanofiltration (NF)	32.6	33.7	34.6	35.9	36.2	2.7%
Total	692.8	738.5	788.6	843.5	903.6	6.9%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 279 ASIA PACIFIC: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	405.8	437.2	472.3	511.4	555.2	597.6	8.1%
Ultrafiltration (UF)	300.2	323.6	349.1	377.0	407.4	440.8	8.0%
Microfiltration (MF)	226.9	244.0	262.7	283.1	305.3	336.0	8.2%
Nanofiltration (NF)	38.2	40.1	42.2	44.2	46.2	48.2	4.8%
Total	971.0	1,045.0	1,126.2	1,215.6	1,314.1	1,422.6	7.9%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 280 ASIA PACIFIC: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	235.2	255.9	278.4	302.8	329.2	8.8%
Ultrafiltration (UF)	176.5	190.3	205.5	222.4	241.1	8.1%
Microfiltration (MF)	132.7	143.4	155.1	168.2	182.6	8.3%
Nanofiltration (NF)	26.9	27.9	29.0	30.2	31.6	4.1%
Total	571.3	617.5	668.1	723.5	784.5	8.2%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 281 ASIA PACIFIC: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	359.0	391.9	428.3	468.6	513.3	562.9	9.4%
Ultrafiltration (UF)	261.8	284.8	310.5	339.0	370.9	406.5	9.2%
Microfiltration (MF)	198.5	216.2	235.8	257.8	282.3	309.6	9.3%
Nanofiltration (NF)	33.3	35.1	37.2	39.4	41.9	44.5	6.0%
Total	852.6	928.1	1,011.8	1,104.8	1,208.3	1,323.6	9.2%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 282 ASIA PACIFIC: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	215.1	230.8	247.5	265.5	284.8	7.3%
Ultrafiltration (UF)	161.5	171.6	182.8	195.1	208.5	6.6%
Microfiltration (MF)	121.4	129.3	138.0	147.5	158.0	6.8%
Nanofiltration (NF)	24.6	25.2	25.8	26.5	27.3	2.6%
Total	522.6	556.9	594.1	634.6	678.6	6.7%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 283 ASIA PACIFIC: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	305.8	328.8	354.0	381.7	412.2	445.8	7.8%
Ultrafiltration (UF)	223.3	239.6	257.6	277.4	299.3	323.6	7.7%
Microfiltration (MF)	169.0	181.2	194.6	209.4	225.7	243.8	7.6%
Nanofiltration (NF)	28.3	29.5	30.7	32.1	33.6	35.3	4.5%
Total	726.5	779.1	837.0	900.7	970.9	1,048.4	7.6%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 284 ASIA PACIFIC: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	88.7	96.2	104.2	112.8	122.1	8.3%
Ultrafiltration (UF)	66.6	71.5	76.8	82.7	89.3	7.6%
Microfiltration (MF)	50.1	53.8	58.0	62.6	67.6	7.8%
Nanofiltration (NF)	10.1	10.5	10.8	11.2	11.7	3.6%
Total	215.5	232.0	249.8	269.4	290.6	7.8%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 285 ASIA PACIFIC: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	132.9	144.8	158.0	172.5	188.5	206.2	9.2%
Ultrafiltration (UF)	96.8	105.1	114.3	124.6	136.1	148.9	9.0%
Microfiltration (MF)	73.4	79.8	86.9	94.8	103.6	113.4	9.1%
Nanofiltration (NF)	12.3	13.0	13.7	14.5	15.3	16.3	5.8%
Total	315.3	342.6	372.8	406.3	443.5	484.8	9.0%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

11.5.2 CHINA

11.5.2.1 Rising demand for milk products in high-end restaurants to drive growth

Various food & beverage manufacturing companies use spiral membranes for applications such as water filtration, lactose concentration, juice clarifying, and other beverage processing and purification.

The increasing demand for quality cheese and other milk products in this country from households, hotels, and high-end restaurants also encourages dairy product manufacturers in China to utilize filtration technologies such as UF and MF. The various functions offered by these technologies include milk pasteurization, taste enhancement, and shelf-life extension.

According to Food Navigator Asia 2022, the year 2021 marked a substantial increase in per capita milk consumption within China's dairy sector, driven by growing consumer incomes and companies' proactive adaptation to prevailing preferences through the introduction of innovative functional products. Data provided by the Dairy Association of China (DAC) reveals that milk consumption per person reached 14.4kg during 2021, indicating a remarkable growth of 10.6% compared to the preceding year.

According to USDA, 2023, the estimated cheese consumption for 2023 has been elevated to 175 TMT (thousand metric tons) due to an increase in domestic production. The expected gradual economic recovery is positioned to stimulate the demand for cheese products. Online retail and collaborative group purchasing methods are anticipated to continue being favored and convenient choices. As a result of these trends, there is a growing requirement for membrane filtration technology in China.

TABLE 286 CHINA: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2018–2022 (USD MILLION)

Application	2018	2019	2020	2021	2022	CAGR (2018–2022)
Dairy Products	349.2	371.9	397.4	426.0	458.1	7.0%
Drinks & Concentrates	289.7	313.2	338.7	366.3	396.3	8.1%
Wine & Beer	261.8	278.8	297.0	316.6	337.5	6.6%
Other Food & Beverage Applications	110.2	119.4	129.3	140.0	151.5	8.3%
Total	1,010.9	1,083.3	1,162.4	1,248.8	1,343.3	7.4%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 287 CHINA: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2023–2028 (USD MILLION)

Application	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Dairy Products	493.3	531.9	574.2	620.6	671.7	727.8	8.1%
Drinks & Concentrates	430.7	468.8	510.9	557.4	609.0	666.2	9.1%
Wine & Beer	361.0	386.7	414.8	445.7	479.6	516.8	7.4%
Other Food & Beverage Applications	165.8	181.7	199.2	218.7	240.3	264.4	9.8%
Total	1,450.9	1,569.1	1,699.1	1,842.4	2,000.5	2,175.2	8.4%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 288 CHINA: MEMBRANE FILTRATION MARKET, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	418.7	451.4	487.5	527.1	571.1	8.1%
Ultrafiltration (UF)	291.8	312.4	334.8	359.1	385.6	7.2%
Microfiltration (MF)	248.8	267.2	287.2	309.0	333.0	7.6%
Nanofiltration (NF)	51.6	52.3	52.9	53.6	53.8	1.0%
Total	1,010.9	1,083.3	1,162.4	1,248.8	1,343.3	7.4%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 289 CHINA: MEMBRANE FILTRATION MARKET, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	618.0	669.9	727.2	790.6	860.8	932.3	8.6%
Ultrafiltration (UF)	417.2	451.9	490.1	532.1	578.4	629.5	8.6%
Microfiltration (MF)	359.8	389.2	421.6	457.3	496.7	546.6	8.7%
Nanofiltration (NF)	55.9	58.1	60.3	62.5	64.7	66.9	3.7%
Total	1,450.9	1,569.1	1,699.1	1,842.4	2,000.5	2,175.2	8.4%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 290 CHINA: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	136.7	147.1	159.7	174.7	193.0	9.0%
Ultrafiltration (UF)	94.8	101.4	108.4	115.8	123.4	6.8%
Microfiltration (MF)	69.3	74.3	79.7	85.3	91.3	7.1%
Nanofiltration (NF)	48.4	49.1	49.6	50.2	50.3	1.0%
Total	349.2	371.9	397.4	426.0	458.1	7.0%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 291 CHINA: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	209.3	227.7	248.6	272.2	299.0	323.0	9.1%
Ultrafiltration (UF)	133.5	144.4	156.0	168.5	181.9	196.3	8.0%
Microfiltration (MF)	98.1	105.4	113.1	121.3	130.1	145.9	8.3%
Nanofiltration (NF)	52.4	54.4	56.5	58.6	60.6	62.6	3.7%
Total	493.3	531.9	574.2	620.6	671.7	727.8	8.1%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 292 CHINA: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	121.97	132.42	143.47	155.13	167.42	8.2%
Ultrafiltration (UF)	87.21	93.92	101.34	109.55	118.64	8.0%
Microfiltration (MF)	78.51	84.80	91.75	99.46	108.01	8.3%
Nanofiltration (NF)	2.03	2.06	2.09	2.13	2.18	1.8%
Total	289.72	313.19	338.65	366.27	396.25	8.1%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 293 CHINA: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	181.89	197.67	214.91	233.76	254.39	276.98	8.8%
Ultrafiltration (UF)	129.08	140.70	153.64	168.09	184.22	202.28	9.4%
Microfiltration (MF)	117.51	128.09	139.87	153.02	167.71	184.15	9.4%
Nanofiltration (NF)	2.26	2.35	2.44	2.55	2.66	2.79	4.3%
Total	430.74	468.80	510.87	557.42	608.99	666.19	9.1%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 294 CHINA: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	112.83	120.59	128.67	137.08	145.81	6.6%
Ultrafiltration (UF)	76.97	81.66	86.81	92.45	98.65	6.4%
Microfiltration (MF)	70.95	75.49	80.47	85.94	91.96	6.7%
Nanofiltration (NF)	1.05	1.06	1.07	1.09	1.11	1.5%
Total	261.80	278.80	297.03	316.57	337.53	6.6%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 295 CHINA: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	155.83	166.70	178.51	191.35	205.34	220.58	7.2%
Ultrafiltration (UF)	105.55	113.15	121.52	130.76	140.96	152.23	7.6%
Microfiltration (MF)	98.49	105.68	113.60	122.35	132.02	142.71	7.7%
Nanofiltration (NF)	1.13	1.16	1.19	1.22	1.26	1.30	2.7%
Total	361.00	386.68	414.82	445.68	479.57	516.82	7.4%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 296 CHINA: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	47.180	51.307	55.623	60.126	64.817	8.3%
Ultrafiltration (UF)	32.849	35.412	38.245	41.381	44.857	8.1%
Microfiltration (MF)	30.094	32.561	35.296	38.332	41.705	8.5%
Nanofiltration (NF)	0.110	0.113	0.116	0.120	0.124	2.9%
Total	110.233	119.393	129.280	139.959	151.503	8.3%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 297 CHINA: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	71.000	77.751	85.129	93.202	102.043	111.736	9.5%
Ultrafiltration (UF)	49.028	53.686	58.894	64.724	71.261	78.601	9.9%
Microfiltration (MF)	45.667	50.097	55.056	60.617	66.861	73.881	10.1%
Nanofiltration (NF)	0.129	0.135	0.141	0.147	0.154	0.161	4.6%
Total	165.825	181.668	199.220	218.690	240.319	264.379	9.8%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

11.5.3 SOUTHEAST ASIA

11.5.3.1 Growing demand for functional foods and nutraceutical products to encourage market expansion

The Southeast Asian (SEA) region includes Indonesia, the Philippines, Vietnam, Thailand, Malaysia, and Singapore.

Due to consumers' busy lifestyles and preference for quick meals, there has been an increase in the demand for fortified dairy products. At the same time, stress in the workplace has also increased consumer exposure to digestive health issues. Consequently, customers increasingly opt for packaged food containing ingredients that can improve digestive health, particularly probiotics. The willingness of consumers to pay premium costs for quality products and the growing consumption of functional foods and nutraceutical products are some of the major factors encouraging the adoption of membrane filtration technologies in this regional segment.

TABLE 298 SOUTHEAST ASIA: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2018–2022 (USD MILLION)

Application	2018	2019	2020	2021	2022	CAGR (2018–2022)
Dairy Products	148.4	157.6	167.4	179.4	188.7	6.2%
Drinks & Concentrates	119.9	130.3	141.7	154.5	168.7	8.9%
Wine & Beer	111.9	119.9	128.8	138.6	149.4	7.5%
Other Food & Beverage Applications	45.1	48.5	52.2	56.3	60.9	7.8%
Total	425.3	456.3	490.1	528.8	567.6	7.5%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 299 SOUTHEAST ASIA: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2023–2028 (USD MILLION)

Application	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Dairy Products	201.1	214.6	229.4	245.6	263.4	282.9	7.1%
Drinks & Concentrates	184.2	201.5	220.9	242.5	266.8	294.0	9.8%
Wine & Beer	160.9	173.6	187.7	203.2	220.5	239.7	8.3%
Other Food & Beverage Applications	65.8	71.1	77.1	83.8	91.1	99.3	8.6%
Total	611.9	660.9	715.1	775.1	841.8	915.9	8.4%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 300 SOUTHEAST ASIA: MEMBRANE FILTRATION MARKET, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	171.7	184.7	198.9	215.2	231.7	7.8%
Ultrafiltration (UF)	137.6	147.4	158.1	170.3	182.5	7.3%
Microfiltration (MF)	101.6	109.0	117.1	126.3	135.5	7.5%
Nanofiltration (NF)	14.4	15.2	16.0	17.0	17.9	5.6%
Total	425.3	456.3	490.1	528.8	567.6	7.5%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 301 SOUTHEAST ASIA: MEMBRANE FILTRATION MARKET, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	250.3	270.9	293.7	319.0	347.2	378.5	8.6%
Ultrafiltration (UF)	196.6	212.1	229.3	248.3	269.4	292.8	8.3%
Microfiltration (MF)	146.1	157.8	170.7	185.1	201.0	218.7	8.4%
Nanofiltration (NF)	18.9	20.1	21.3	22.7	24.2	25.8	6.4%
Total	611.9	660.9	715.1	775.1	841.8	915.9	8.4%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 302 SOUTHEAST ASIA: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	59.9	63.8	67.9	73.0	76.9	6.4%
Ultrafiltration (UF)	48.0	50.9	54.0	57.9	60.8	6.1%
Microfiltration (MF)	35.5	37.6	40.0	42.8	45.0	6.1%
Nanofiltration (NF)	5.0	5.3	5.5	5.8	5.9	4.3%
Total	148.4	157.6	167.4	179.4	188.7	6.2%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 303 SOUTHEAST ASIA: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	82.1	87.6	93.6	100.1	107.3	115.1	7.0%
Ultrafiltration (UF)	64.8	69.2	74.0	79.4	85.2	91.6	7.2%
Microfiltration (MF)	48.0	51.3	54.9	58.9	63.3	68.1	7.3%
Nanofiltration (NF)	6.2	6.5	6.9	7.2	7.6	8.0	5.3%
Total	201.1	214.6	229.4	245.6	263.4	282.9	7.1%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 304 SOUTHEAST ASIA: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	48.4	52.7	57.5	62.9	68.9	9.2%
Ultrafiltration (UF)	38.8	42.1	45.7	49.7	54.2	8.7%
Microfiltration (MF)	28.7	31.1	33.9	36.9	40.3	8.9%
Nanofiltration (NF)	4.1	4.3	4.6	5.0	5.3	7.0%
Total	119.9	130.3	141.7	154.5	168.7	8.9%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 305 SOUTHEAST ASIA: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	75.4	82.9	91.3	100.7	111.3	123.2	10.3%
Ultrafiltration (UF)	59.1	64.4	70.4	77.1	84.6	93.0	9.5%
Microfiltration (MF)	44.0	48.1	52.6	57.6	63.3	69.6	9.6%
Nanofiltration (NF)	5.7	6.1	6.6	7.1	7.6	8.2	7.6%
Total	184.2	201.5	220.9	242.5	266.8	294.0	9.8%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 306 SOUTHEAST ASIA: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	45.2	48.5	52.3	56.4	61.0	7.8%
Ultrafiltration (UF)	36.2	38.7	41.5	44.6	48.0	7.3%
Microfiltration (MF)	26.7	28.6	30.8	33.1	35.7	7.5%
Nanofiltration (NF)	3.8	4.0	4.2	4.4	4.7	5.6%
Total	111.9	119.9	128.8	138.6	149.4	7.5%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 307 SOUTHEAST ASIA: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	65.8	71.2	77.1	83.7	91.0	99.1	8.5%
Ultrafiltration (UF)	51.6	55.7	60.1	65.0	70.5	76.6	8.2%
Microfiltration (MF)	38.4	41.5	44.8	48.6	52.7	57.3	8.3%
Nanofiltration (NF)	5.0	5.3	5.6	5.9	6.3	6.8	6.3%
Total	160.9	173.6	187.7	203.2	220.5	239.7	8.3%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 308 SOUTHEAST ASIA: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	18.2	19.6	21.2	22.9	24.9	8.1%
Ultrafiltration (UF)	14.6	15.7	16.8	18.1	19.6	7.6%
Microfiltration (MF)	10.8	11.6	12.5	13.5	14.5	7.8%
Nanofiltration (NF)	1.5	1.6	1.7	1.8	1.9	5.9%
Total	45.1	48.5	52.2	56.3	60.9	7.8%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 309 SOUTHEAST ASIA: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	26.9	29.2	31.7	34.5	37.6	41.1	8.8%
Ultrafiltration (UF)	21.1	22.8	24.7	26.8	29.1	31.7	8.5%
Microfiltration (MF)	15.7	17.0	18.4	20.0	21.8	23.7	8.6%
Nanofiltration (NF)	2.0	2.2	2.3	2.5	2.6	2.8	6.6%
Total	65.8	71.1	77.1	83.8	91.1	99.3	8.6%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

11.5.4 INDIA

11.5.4.1 Growing use of UF and MF technologies in dairy industry to drive market

The major factors driving the Indian membrane filtration market include the rising demand for dairy products, government support for membrane filtration, growth in the middle-class population, higher purchasing power, and the increasing consumption of functional foods and nutraceutical products. In addition, the increasing use of UF and MF technologies for dairy products such as cheese, ice cream, and yogurt further drive the Indian membrane filtration market.

By 2025–2026, the Indian food market is projected to reach USD 535 billion. Expanding at a rate of around 11%, it currently holds a share of 32% of the global food industry, according to data released by the Indian Brand Equity Foundation (IBEF) 2020. According to Wine Intelligence, most of India's wine consumption takes place in urban centers, including Mumbai (32%), Delhi (25%), Bangalore (20%), Pune (5%), and Hyderabad (3%). This high growth is due to the country's ever-expanding food & beverage industry. This highlights the need for membrane filtration in the country.

Membrane separation technologies are utilized in India for various purposes, including the processing of food and beverages, the treatment of wastewater, the production of pharmaceuticals, the processing of water, and the production of filtered water. The widespread adoption by important end-use industries, such as the food & beverage, wastewater, and water treatment industries; replacement of traditional filtration equipment; increased attention to the purity levels of process fluids; and strict regulations about food & beverage, wastewater, and water quality are all factors that have contributed to the increase in domestic demand.

The adoption of healthier lifestyles, changes in dietary patterns, increasing nutrition care awareness, and rising disposable incomes have contributed to the growth of the functional foods and nutraceutical industries in India, which, in turn, has driven the demand for membrane filtration technologies by functional food manufacturers. Manufacturers use these membranes for clarification, concentration, fractionation (separation of components), desalting, and purification purposes.

TABLE 310 INDIA: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2018–2022 (USD MILLION)

Application	2018	2019	2020	2021	2022	CAGR (2018–2022)
Dairy Products	79.3	85.7	92.6	98.4	108.2	8.1%
Drinks & Concentrates	66.0	71.7	78.0	85.0	92.8	8.9%
Wine & Beer	60.5	64.8	69.6	74.9	80.7	7.5%
Other Food & Beverage Applications	24.1	26.0	27.9	30.2	32.6	7.8%
Total	229.9	248.1	268.2	288.4	314.3	8.1%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 311 INDIA: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2023–2028 (USD MILLION)

Application	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Dairy Products	117.6	128.0	139.5	152.4	166.7	182.7	9.2%
Drinks & Concentrates	101.3	110.9	121.5	133.4	146.8	161.7	9.8%
Wine & Beer	87.0	93.8	101.4	109.9	119.2	129.6	8.3%
Other Food & Beverage Applications	35.2	38.1	41.3	44.8	48.8	53.2	8.6%
Total	341.1	370.7	403.7	440.5	481.4	527.2	9.1%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 312 INDIA: MEMBRANE FILTRATION MARKET, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	98.7	106.7	115.6	124.6	136.0	8.4%
Ultrafiltration (UF)	87.1	94.1	101.7	109.4	119.3	8.2%
Microfiltration (MF)	39.3	42.3	45.5	48.8	53.0	7.8%
Nanofiltration (NF)	4.8	5.1	5.4	5.6	6.0	5.6%
Total	229.9	248.1	268.2	288.4	314.3	8.1%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 313 INDIA: MEMBRANE FILTRATION MARKET, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	148.0	161.3	176.0	192.5	210.9	231.5	9.4%
Ultrafiltration (UF)	129.5	140.7	153.2	167.2	182.7	200.1	9.1%
Microfiltration (MF)	57.3	62.1	67.3	73.2	79.7	87.0	8.7%
Nanofiltration (NF)	6.3	6.7	7.1	7.6	8.0	8.6	6.3%
Total	341.1	370.7	403.7	440.5	481.4	527.2	9.1%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 314 INDIA: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	34.04	36.85	39.89	42.44	46.77	8.3%
Ultrafiltration (UF)	30.06	32.52	35.19	37.41	41.19	8.2%
Microfiltration (MF)	13.55	14.58	15.70	16.60	18.19	7.6%
Nanofiltration (NF)	1.66	1.76	1.86	1.93	2.06	5.5%
Total	79.32	85.72	92.63	98.39	108.21	8.1%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 315 INDIA: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	50.94	55.58	60.75	66.51	72.95	80.14	9.5%
Ultrafiltration (UF)	44.75	48.71	53.10	58.00	63.46	69.55	9.2%
Microfiltration (MF)	19.69	21.35	23.19	25.23	27.51	30.04	8.8%
Nanofiltration (NF)	2.19	2.32	2.46	2.62	2.79	2.98	6.4%
Total	117.56	127.95	139.51	152.37	166.71	182.71	9.2%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 316 INDIA: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	28.3	30.8	33.6	36.7	40.2	9.1%
Ultrafiltration (UF)	25.0	27.2	29.5	32.2	35.2	8.9%
Microfiltration (MF)	11.3	12.2	13.2	14.4	15.7	8.6%
Nanofiltration (NF)	1.4	1.5	1.6	1.7	1.8	6.3%
Total	66.0	71.7	78.0	85.0	92.8	8.9%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 317 INDIA: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	44.0	48.2	53.0	58.3	64.3	71.1	10.1%
Ultrafiltration (UF)	38.4	42.0	46.0	50.6	55.6	61.3	9.8%
Microfiltration (MF)	17.1	18.6	20.3	22.2	24.3	26.7	9.4%
Nanofiltration (NF)	1.9	2.0	2.1	2.3	2.5	2.6	7.0%
Total	101.3	110.9	121.5	133.4	146.8	161.7	9.8%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 318 INDIA: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	25.95	27.88	30.01	32.37	34.97	7.7%
Ultrafiltration (UF)	22.92	24.57	26.38	28.39	30.60	7.5%
Microfiltration (MF)	10.33	11.04	11.83	12.69	13.64	7.2%
Nanofiltration (NF)	1.27	1.33	1.39	1.46	1.54	4.9%
Total	60.46	64.82	69.61	74.91	80.75	7.5%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 319 INDIA: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	37.76	40.85	44.26	48.06	52.27	56.95	8.6%
Ultrafiltration (UF)	32.96	35.56	38.44	41.64	45.17	49.10	8.3%
Microfiltration (MF)	14.64	15.73	16.95	18.28	19.77	21.41	7.9%
Nanofiltration (NF)	1.61	1.69	1.78	1.88	1.99	2.11	5.5%
Total	86.97	93.84	101.44	109.86	119.19	129.56	8.3%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 320 INDIA: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	10.36	11.16	12.05	13.03	14.12	8.0%
Ultrafiltration (UF)	9.15	9.84	10.59	11.43	12.36	7.8%
Microfiltration (MF)	4.12	4.42	4.75	5.11	5.51	7.5%
Nanofiltration (NF)	0.51	0.53	0.56	0.59	0.62	5.2%
Total	24.14	25.95	27.95	30.16	32.60	7.8%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 321 INDIA: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	15.29	16.58	18.02	19.62	21.39	23.37	8.9%
Ultrafiltration (UF)	13.34	14.44	15.65	17.00	18.49	20.16	8.6%
Microfiltration (MF)	5.93	6.39	6.90	7.46	8.09	8.79	8.2%
Nanofiltration (NF)	0.65	0.69	0.73	0.77	0.81	0.86	5.8%
Total	35.21	38.09	41.29	44.85	48.79	53.18	8.6%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

11.5.5 JAPAN

11.5.5.1 Increasing need for membrane filtration in functional food industry to boost growth

The functional food and nutraceutical industries are growing rapidly in Japan due to the aging population. Agriculture and Agri-food Canada states, “The Japanese population is aging, and it is estimated that 30% of the population will be over 65 by 2025.” Due to this, functional food and nutraceutical product manufacturers are increasingly opting for filtration methods such as membrane filtration.

In November 2021, Japan-based Toray Industries developed a hollow fiber ultrafiltration membrane module for food & beverage manufacturing, biotechnology purification, and concentration procedures. By achieving CO₂ emissions that are more than 80% lower than those from traditional thermal concentration procedures used in the food production sector, this module can conserve energy and help reduce carbon footprints. Other advantages include reductions in the number of modules required, lowered space requirement by 50%, and possible reductions of more than 20% in cleaning and equipment expenses. According to USDA 2022, Japanese household consumption of powdered milk increased by 13% in 2022 compared to 2021, and consumption of milk beverages increased by 6%, giving rise to the demand for the membrane filtration market.

TABLE 322 JAPAN: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2018–2022 (USD MILLION)

Application	2018	2019	2020	2021	2022	CAGR (2018–2022)
Dairy Products	54.0	57.3	60.9	64.7	68.7	6.2%
Drinks & Concentrates	45.4	48.5	51.9	55.6	59.8	7.1%
Wine & Beer	42.3	44.5	46.9	49.6	52.6	5.6%
Other Food & Beverage Applications	16.6	17.5	18.6	19.7	20.9	5.9%
Total	158.3	167.9	178.3	189.7	201.9	6.3%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 323 JAPAN: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2023–2028 (USD MILLION)

Application	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Dairy Products	73.4	78.5	84.1	90.2	97.0	104.5	7.3%
Drinks & Concentrates	64.1	68.9	74.2	80.1	86.6	93.8	7.9%
Wine & Beer	55.6	58.9	62.6	66.6	71.0	75.8	6.4%
Other Food & Beverage Applications	22.2	23.6	25.1	26.8	28.6	30.7	6.7%
Total	215.3	229.9	246.0	263.7	283.2	304.7	7.2%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 324 JAPAN: MEMBRANE FILTRATION MARKET, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	64.7	68.8	73.2	78.0	83.3	6.5%
Ultrafiltration (UF)	47.7	50.4	53.4	56.5	60.1	6.0%
Microfiltration (MF)	31.4	33.2	35.2	37.3	39.6	6.0%
Nanofiltration (NF)	14.5	15.5	16.5	17.8	19.0	7.0%
Total	158.3	167.9	178.3	189.7	201.9	6.3%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 325 JAPAN: MEMBRANE FILTRATION MARKET, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	89.0	95.3	102.3	109.9	118.4	127.7	7.5%
Ultrafiltration (UF)	63.9	68.0	72.6	77.6	83.1	89.2	6.9%
Microfiltration (MF)	42.0	44.7	47.6	50.8	54.3	58.1	6.7%
Nanofiltration (NF)	20.4	21.9	23.6	25.4	27.5	29.8	7.9%
Total	215.3	229.9	246.0	263.7	283.2	304.7	7.2%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 326 JAPAN: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	22.1	23.5	25.0	26.7	28.4	6.5%
Ultrafiltration (UF)	16.3	17.2	18.2	19.2	20.4	5.9%
Microfiltration (MF)	10.7	11.3	12.0	12.7	13.5	5.9%
Nanofiltration (NF)	4.9	5.3	5.6	6.1	6.4	6.9%
Total	54.0	57.3	60.9	64.7	68.7	6.2%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 327 JAPAN: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	30.4	32.6	35.0	37.7	40.6	43.8	7.6%
Ultrafiltration (UF)	21.7	23.2	24.8	26.5	28.4	30.5	7.0%
Microfiltration (MF)	14.3	15.2	16.3	17.4	18.6	19.9	6.8%
Nanofiltration (NF)	6.9	7.5	8.0	8.7	9.4	10.2	8.0%
Total	73.4	78.5	84.1	90.2	97.0	104.5	7.3%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 328 JAPAN: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	18.6	19.9	21.3	22.9	24.6	7.3%
Ultrafiltration (UF)	13.7	14.6	15.5	16.6	17.8	6.8%
Microfiltration (MF)	9.0	9.6	10.2	10.9	11.7	6.8%
Nanofiltration (NF)	4.2	4.5	4.8	5.2	5.6	7.8%
Total	45.4	48.5	51.9	55.6	59.8	7.1%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 329 JAPAN: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	26.5	28.6	30.8	33.4	36.2	39.3	8.2%
Ultrafiltration (UF)	19.0	20.4	21.9	23.6	25.4	27.5	7.6%
Microfiltration (MF)	12.5	13.4	14.4	15.4	16.6	17.9	7.4%
Nanofiltration (NF)	6.1	6.6	7.1	7.7	8.4	9.2	8.6%
Total	64.1	68.9	74.2	80.1	86.6	93.8	7.9%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 330 JAPAN: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	17.3	18.2	19.3	20.4	21.7	5.8%
Ultrafiltration (UF)	12.7	13.4	14.1	14.8	15.6	5.3%
Microfiltration (MF)	8.4	8.8	9.3	9.8	10.3	5.3%
Nanofiltration (NF)	3.9	4.1	4.4	4.6	4.9	6.3%
Total	42.3	44.5	46.9	49.6	52.6	5.6%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 331 JAPAN: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	23.0	24.4	26.0	27.7	29.6	31.7	6.7%
Ultrafiltration (UF)	16.5	17.5	18.5	19.6	20.8	22.2	6.1%
Microfiltration (MF)	10.9	11.5	12.1	12.8	13.6	14.5	5.9%
Nanofiltration (NF)	5.3	5.6	6.0	6.4	6.9	7.4	7.1%
Total	55.6	58.9	62.6	66.6	71.0	75.8	6.4%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 332 JAPAN: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	6.8	7.2	7.6	8.1	8.6	6.1%
Ultrafiltration (UF)	5.0	5.3	5.6	5.9	6.2	5.6%
Microfiltration (MF)	3.3	3.5	3.7	3.9	4.1	5.6%
Nanofiltration (NF)	1.5	1.6	1.7	1.8	2.0	6.6%
Total	16.6	17.5	18.6	19.7	20.9	5.9%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 333 JAPAN: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	9.2	9.8	10.4	11.2	12.0	12.8	7.0%
Ultrafiltration (UF)	6.6	7.0	7.4	7.9	8.4	9.0	6.4%
Microfiltration (MF)	4.3	4.6	4.9	5.2	5.5	5.8	6.2%
Nanofiltration (NF)	2.1	2.2	2.4	2.6	2.8	3.0	7.4%
Total	22.2	23.6	25.1	26.8	28.6	30.7	6.7%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

11.5.6 AUSTRALIA

11.5.6.1 Rising health concerns and demand for nutritious food products to drive growth

Australia's food & beverage industry also benefits from membrane filtration's efficiency in separating and purifying various components. With the increasing demand for premium products, the application of membrane filtration becomes essential to maintain the desired product attributes. The market's growth is driven by factors such as rising consumer awareness, economic recovery, and the convenience of online retail and group purchasing methods.

Membrane filtration is widely used in the production of dairy-based products in Australia to prevent microbial contamination and enhance the flavor and shelf life of these products. The dairy industry is one of the leading industries in terms of volume in Australia. According to the Australian Competition and Consumer Commission Organization, "Dairy is Australia's third-largest agricultural commodity in terms of farmgate value, and fourth in terms of export value." According to the USDA, "milk production in 2022 in Australia is expected to increase moderately to 9.1 million metric tons (MMT) after falling in 2021 to an estimated 9.0 MMT, a 1% decline from 2020. The forecast cheese production for 2023 equates to utilizing 38 percent of total fluid milk production, by far the highest use of Australia's overall annual milk production."

The country's functional food and nutraceutical industries are also growing due to the rising awareness among Australian consumers about food products and supplements with additional health benefits. Therefore, the demand for membrane filtration technologies such as UF and MF is also projected to increase in the coming years, as they provide excellent separation and purification properties without causing any harm to the product quality.

The high demand for Australian dairy products from South American countries such as Chile also supports the growth of the membrane filtration market in Australia, as most dairy product manufacturers incorporate UF, NF, and MF to upscale their production. According to UN Comtrade 2022, "the value of Chilean dairy imports rose by 32.2% from USD 339.8 million in 2020 to USD 449.2 million in 2021." Additionally, in 2021, Australia exported around USD 1.05 million worth of cheese to Chile. As per an article published by the Australian Trade and Investment Commission (Austrade), "beer sales increased by 42.6% from USD 177.9 million in 2020 to USD 292.5 million in 2021. In 2021, the main suppliers of beer to Chile were Mexico (37.7%), the US (29.4%), and the European Union (20.8%) (UN Comtrade 2022)." Thus, the high demand for agricultural products, including dairy and alcoholic beverages, from South America will create enormous opportunities for the market in Australia.

TABLE 334 AUSTRALIA: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2018–2022 (USD MILLION)

Application	2018	2019	2020	2021	2022	CAGR (2018–2022)
Dairy Products	43.9	46.9	50.1	53.6	57.3	6.9%
Drinks & Concentrates	35.7	38.3	41.2	44.5	48.0	7.7%
Wine & Beer	33.3	35.3	37.5	39.9	42.5	6.3%
Other Food & Beverage Applications	13.2	14.1	15.0	15.9	17.0	6.5%
Total	126.1	134.6	143.8	153.8	164.8	6.9%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 335 AUSTRALIA: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2023–2028 (USD MILLION)

Application	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Dairy Products	61.5	66.2	71.4	77.2	83.5	90.5	8.0%
Drinks & Concentrates	51.9	56.1	60.8	66.0	71.9	78.3	8.6%
Wine & Beer	45.3	48.3	51.6	55.3	59.3	63.8	7.1%
Other Food & Beverage Applications	18.2	19.5	20.9	22.4	24.1	26.0	7.4%
Total	176.8	190.1	204.7	220.9	238.8	258.6	7.9%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and Marketsandmarkets Analysis

TABLE 336 AUSTRALIA: MEMBRANE FILTRATION MARKET, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	48.8	52.2	55.8	59.9	64.1	7.0%
Ultrafiltration (UF)	38.2	40.7	43.4	46.4	49.6	6.8%
Microfiltration (MF)	32.0	34.4	37.1	39.7	43.1	7.7%
Nanofiltration (NF)	7.1	7.3	7.5	7.8	8.0	3.1%
Total	126.1	134.6	143.8	153.8	164.8	6.9%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, And Marketsandmarkets Analysis

TABLE 337 AUSTRALIA: MEMBRANE FILTRATION MARKET, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	68.9	74.1	79.9	86.3	93.4	101.2	8.0%
Ultrafiltration (UF)	53.2	57.0	61.3	66.0	71.3	77.0	7.7%
Microfiltration (MF)	46.5	50.3	54.5	59.1	64.2	70.0	8.5%
Nanofiltration (NF)	8.3	8.7	9.0	9.5	9.9	10.4	4.7%
Total	176.8	190.1	204.7	220.9	238.8	258.6	7.9%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, And Marketsandmarkets Analysis

TABLE 338 AUSTRALIA: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	17.00	18.18	19.45	20.96	22.30	7.0%
Ultrafiltration (UF)	13.28	14.17	15.11	16.15	17.20	6.7%
Microfiltration (MF)	11.14	12.00	12.92	13.67	14.98	7.7%
Nanofiltration (NF)	2.46	2.55	2.63	2.79	2.77	3.1%
Total	43.88	46.89	50.11	53.56	57.26	6.9%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 339 AUSTRALIA: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	24.00	25.86	27.92	30.19	32.70	35.48	8.1%
Ultrafiltration (UF)	18.45	19.82	21.33	23.00	24.85	26.89	7.8%
Microfiltration (MF)	16.19	17.52	19.00	20.64	22.46	24.49	8.6%
Nanofiltration (NF)	2.89	3.02	3.16	3.31	3.48	3.66	4.8%
Total	61.52	66.23	71.42	77.15	83.49	90.52	8.0%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 340 AUSTRALIA: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	13.82	14.86	16.01	17.27	18.65	7.8%
Ultrafiltration (UF)	10.80	11.59	12.46	13.42	14.48	7.6%
Microfiltration (MF)	9.06	9.80	10.63	11.54	12.56	8.5%
Nanofiltration (NF)	2.00	2.07	2.15	2.23	2.32	3.8%
Total	35.68	38.33	41.24	44.45	48.01	7.7%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 341 AUSTRALIA: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	20.17	21.86	23.72	25.78	28.08	30.63	8.7%
Ultrafiltration (UF)	15.61	16.86	18.24	19.77	21.47	23.36	8.4%
Microfiltration (MF)	13.64	14.84	16.17	17.66	19.32	21.17	9.2%
Nanofiltration (NF)	2.43	2.56	2.69	2.83	2.99	3.17	5.4%
Total	51.85	56.10	60.82	66.05	71.86	78.33	8.6%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 342 AUSTRALIA: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	12.89	13.68	14.54	15.49	16.51	6.4%
Ultrafiltration (UF)	10.08	10.67	11.32	12.04	12.82	6.2%
Microfiltration (MF)	8.45	9.03	9.66	10.35	11.12	7.1%
Nanofiltration (NF)	1.87	1.91	1.95	2.00	2.05	2.4%
Total	33.29	35.29	37.47	39.87	42.50	6.3%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 343 AUSTRALIA: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	17.61	18.82	20.14	21.59	23.18	24.94	7.2%
Ultrafiltration (UF)	13.62	14.51	15.48	16.55	17.73	19.02	6.9%
Microfiltration (MF)	11.91	12.78	13.74	14.80	15.96	17.26	7.7%
Nanofiltration (NF)	2.12	2.19	2.27	2.36	2.46	2.57	3.9%
Total	45.27	48.30	51.63	55.30	59.34	63.79	7.1%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 344 AUSTRALIA: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	5.13	5.45	5.81	6.19	6.62	6.6%
Ultrafiltration (UF)	4.01	4.25	4.52	4.81	5.14	6.4%
Microfiltration (MF)	3.36	3.60	3.86	4.14	4.46	7.3%
Nanofiltration (NF)	0.74	0.76	0.78	0.80	0.82	2.6%
Total	13.24	14.06	14.96	15.95	17.03	6.5%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 345 AUSTRALIA: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	7.08	7.58	8.14	8.75	9.42	10.16	7.5%
Ultrafiltration (UF)	5.48	5.85	6.26	6.71	7.20	7.75	7.2%
Microfiltration (MF)	4.79	5.15	5.55	6.00	6.49	7.03	8.0%
Nanofiltration (NF)	0.85	0.88	0.92	0.96	1.00	1.05	4.2%
Total	18.19	19.46	20.87	22.41	24.11	25.99	7.4%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

11.5.7 NEW ZEALAND

The membrane filtration market in New Zealand is characterized by various applications across sectors, such as water treatment, dairy, and beverages. Companies like FILTEC New Zealand provide pressurized ultrafiltration water treatment solutions based on ZeeWeed 1500 Membrane Ultra Filtration, offering high mechanical strength and chemical resistance. In milk and plant-based product processing, membrane filtration solutions are continuously innovated for improved optimization and sustainability.

According to USDA 2023, domestic consumption of fresh and processed dairy products in New Zealand continues to represent a small portion of the milk produced, accounting for less than five percent. The country's processors remain heavily focused on global exports to new and existing markets. Around 95 percent of all dairy milk produced in New Zealand is exported as milk or dairy products, with export revenues of NZ USD 22.6 billion in 2022 (USD 14.2 billion). Dairy accounts for 35 percent of New Zealand's total merchandise exports and around 5.9 percent of gross domestic product (GDP).

According to a report published by the UK Food & Drink Exporters Association in October 2021, in New Zealand, "dairy is the lead export commodity generating in excess of USD 9 billion in export sales." This country is also home to one of the topmost dairy companies, Fonterra, which utilizes membrane filtration technologies to produce NZMP Milk Protein Concentrates (MPC).

According to Wine Australia 2022, New Zealand has a developed wine culture with around 18 liters per capita of wine. New Zealand has an international reputation as an outstanding producer of white wines, most particularly through the success of its Sauvignon Blanc. While it is best known for producing this variety, New Zealand also produces Chardonnay, Pinot Gris, Riesling, Merlot, and Pinot Noir in sizeable

quantities. Wine consumers in New Zealand are quality-conscious and brand-driven. New Zealand is predominantly an urbanized society, with much of the population residing in the urban areas of Auckland, Wellington, and Christchurch. New Zealanders are generally very health conscious. This health consciousness of people drives the demand for membrane filtration in the region.

TABLE 346 NEW ZEALAND: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2018–2022 (USD MILLION)

Application	2018	2019	2020	2021	2022	CAGR (2018–2022)
Dairy Products	7.1	7.5	7.9	8.3	8.8	5.8%
Drinks & Concentrates	5.6	6.0	6.4	6.8	7.3	6.6%
Wine & Beer	5.0	5.2	5.5	5.8	6.1	5.1%
Other Food & Beverage Applications	2.3	2.5	2.6	2.7	2.9	5.4%
Total	20.0	21.1	22.3	23.6	25.1	5.8%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 347 NEW ZEALAND: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2023–2028 (USD MILLION)

Application	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Dairy Products	9.4	10.0	10.7	11.5	12.3	13.2	7.0%
Drinks & Concentrates	7.8	8.3	9.0	9.6	10.4	11.2	7.6%
Wine & Beer	6.4	6.8	7.2	7.6	8.1	8.6	6.1%
Other Food & Beverage Applications	3.1	3.2	3.4	3.7	3.9	4.2	6.4%
Total	26.7	28.4	30.3	32.4	34.7	37.2	6.9%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 348 NEW ZEALAND: MEMBRANE FILTRATION MARKET, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	8.31	8.78	9.29	9.84	10.45	5.9%
Ultrafiltration (UF)	6.29	6.64	7.02	7.45	7.91	5.9%
Microfiltration (MF)	4.63	4.87	5.13	5.42	5.73	5.5%
Nanofiltration (NF)	0.80	0.84	0.89	0.94	1.00	5.6%
Total	20.02	21.12	22.33	23.64	25.09	5.8%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 349 NEW ZEALAND: MEMBRANE FILTRATION MARKET, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	11.12	11.85	12.65	13.53	14.50	15.57	7.0%
Ultrafiltration (UF)	8.43	9.00	9.63	10.33	11.09	11.93	7.2%
Microfiltration (MF)	6.08	6.47	6.90	7.37	7.89	8.45	6.8%
Nanofiltration (NF)	1.03	1.07	1.12	1.17	1.22	1.27	4.3%
Total	26.67	28.40	30.30	32.39	34.69	37.23	6.9%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 350 NEW ZEALAND: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	2.93	3.10	3.28	3.47	3.69	5.9%
Ultrafiltration (UF)	2.22	2.34	2.48	2.63	2.79	5.9%
Microfiltration (MF)	1.63	1.72	1.81	1.91	2.02	5.5%
Nanofiltration (NF)	0.28	0.30	0.31	0.33	0.35	5.6%
Total	7.07	7.46	7.88	8.34	8.85	5.8%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 351 NEW ZEALAND: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	3.93	4.19	4.48	4.80	5.15	5.53	7.1%
Ultrafiltration (UF)	2.98	3.18	3.41	3.66	3.93	4.23	7.3%
Microfiltration (MF)	2.15	2.29	2.44	2.61	2.80	3.00	6.9%
Nanofiltration (NF)	0.36	0.38	0.40	0.41	0.43	0.45	4.4%
Total	9.42	10.04	10.73	11.48	12.31	13.22	7.0%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 352 NEW ZEALAND: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	2.33	2.48	2.65	2.82	3.02	6.6%
Ultrafiltration (UF)	1.77	1.88	2.01	2.15	2.30	6.8%
Microfiltration (MF)	1.30	1.38	1.46	1.56	1.66	6.3%
Nanofiltration (NF)	0.23	0.24	0.25	0.27	0.29	6.4%
Total	5.63	5.98	6.37	6.80	7.27	6.6%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 353 NEW ZEALAND: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	3.23	3.47	3.73	4.01	4.33	4.67	7.7%
Ultrafiltration (UF)	2.47	2.65	2.86	3.08	3.33	3.61	7.9%
Microfiltration (MF)	1.77	1.90	2.04	2.19	2.36	2.55	7.5%
Nanofiltration (NF)	0.30	0.31	0.33	0.35	0.36	0.38	5.0%
Total	7.77	8.33	8.95	9.63	10.38	11.21	7.6%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 354 NEW ZEALAND: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	2.07	2.17	2.28	2.41	2.54	5.3%
Ultrafiltration (UF)	1.57	1.64	1.72	1.81	1.91	5.1%
Microfiltration (MF)	1.15	1.20	1.26	1.32	1.39	4.8%
Nanofiltration (NF)	0.20	0.21	0.22	0.23	0.24	4.9%
Total	4.99	5.22	5.49	5.77	6.08	5.1%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 355 NEW ZEALAND: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	2.68	2.84	3.01	3.19	3.40	3.62	6.2%
Ultrafiltration (UF)	2.02	2.14	2.27	2.42	2.58	2.76	6.4%
Microfiltration (MF)	1.46	1.55	1.64	1.73	1.84	1.96	6.0%
Nanofiltration (NF)	0.25	0.26	0.26	0.27	0.28	0.30	3.5%
Total	6.42	6.78	7.18	7.62	8.10	8.63	6.1%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 356 NEW ZEALAND: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	0.97	1.02	1.08	1.14	1.20	5.5%
Ultrafiltration (UF)	0.74	0.77	0.82	0.86	0.91	5.5%
Microfiltration (MF)	0.54	0.57	0.60	0.63	0.66	5.1%
Nanofiltration (NF)	0.09	0.10	0.10	0.11	0.11	5.2%
Total	2.34	2.46	2.59	2.74	2.89	5.4%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 357 NEW ZEALAND: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	1.28	1.35	1.44	1.53	1.63	1.74	6.5%
Ultrafiltration (UF)	0.97	1.03	1.09	1.17	1.25	1.34	6.7%
Microfiltration (MF)	0.70	0.74	0.78	0.83	0.89	0.95	6.3%
Nanofiltration (NF)	0.12	0.12	0.13	0.13	0.14	0.14	3.8%
Total	3.06	3.24	3.44	3.66	3.91	4.17	6.4%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

11.5.8 REST OF ASIA PACIFIC

The Rest of Asia Pacific region includes South Korea, Taiwan, Pakistan, and Bangladesh.

At the Woongjin Chemical R&D Center in Suwon, Korea, Woongjin Chemical (Manufacturers of CSM Membranes) is currently taking part in the National Research Project to develop pressure-retarded osmosis (PRO), which is financed by the Ministry of Land, Transport, and Maritime Affairs in Korea. Referred to as “the next-generation membrane,” this market is anticipated to expand more quickly in the coming years.

According to the Pakistan Journal of Public Health 2021, consumption of ultra-heat-treated milk was statistically higher than other types of milk; the study provided that 45% of people consumed ultra-heat-treated milk (UHT), followed by fresh milk at 15.5%. About 9.5 % consumed pasteurized milk, followed by powdered milk, which was about 5.5%. A research endeavor was carried out involving the analysis of data from recurring cross-sectional observations spanning 1999 to 2016 as part of the National Health and Nutrition Examination Survey (NHANES). The study focused on individuals aged 2 to 20 years. The survey findings revealed that 32.4% of participants opted for whole milk, 41.8% chose milk containing 4% fat, 11.8% selected milk with 1% fat, and 10.3% preferred fat-free milk. The necessity for segregating fats from milk has consequently generated a surge in demand for the membrane filtration market within the region.

The prospects for the market in South Korea are set to expand within the food and beverage industry. The South Korean government focuses on enhancing the food and beverage sector’s growth potential, aiming to propel its advancement by 2030. As stated by the South Korean Ministry of Agriculture, Food, and Rural Affairs (MAFRA), 5 key segments are poised for growth: ready-to-eat foods, environmentally conscious foods, export-oriented foods, specialized and unique foods, and functional foods. MAFRA projects that the cumulative value of these five segments is anticipated to reach USD 21.3 billion by 2030. Concurrently, the nation’s requirement for managing domestic and industrial wastewater has escalated due to urbanization and industrial development. This trend, coupled with the rise in the middle-class populace and per capita income, has spurred the demand for effectively treated water, thus propelling the microfiltration membranes market in the country.

The various advantages offered by membrane filtration and the increasing focus of food, beverage, and functional food manufacturers on enhancing product quality and reducing overall production costs are the major factors driving the market for membrane filtration in the region.

TABLE 358 REST OF ASIA PACIFIC: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2018–2022 (USD MILLION)

Application	2018	2019	2020	2021	2022	CAGR (2018–2022)
Dairy Products	10.9	11.6	12.3	13.0	13.8	6.1%
Drinks & Concentrates	9.0	9.6	10.2	10.9	11.7	6.9%
Wine & Beer	7.9	8.3	8.8	9.2	9.8	5.4%
Other Food & Beverage Applications	3.9	4.1	4.3	4.6	4.8	5.7%
Total	31.7	33.5	35.5	37.7	40.1	6.1%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 359 REST OF ASIA PACIFIC: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2023–2028 (USD MILLION)

Application	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Dairy Products	14.8	15.8	16.9	18.2	19.5	21.0	7.3%
Drinks & Concentrates	12.6	13.5	14.5	15.7	17.0	18.4	7.9%
Wine & Beer	10.3	11.0	11.6	12.4	13.2	14.1	6.4%
Other Food & Beverage Applications	5.1	5.4	5.8	6.2	6.6	7.1	6.7%
Total	42.8	45.7	48.9	52.4	56.3	60.6	7.2%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 360 REST OF ASIA PACIFIC: MEMBRANE FILTRATION MARKET, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	13.24	14.08	14.99	16.00	17.10	6.6%
Ultrafiltration (UF)	10.01	10.56	11.16	11.82	12.54	5.8%
Microfiltration (MF)	7.41	7.83	8.28	8.78	9.32	5.9%
Nanofiltration (NF)	1.01	1.05	1.09	1.13	1.18	3.9%
Total	31.68	33.52	35.53	37.73	40.15	6.1%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 361 REST OF ASIA PACIFIC: MEMBRANE FILTRATION MARKET, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	18.22	19.46	20.82	22.31	23.96	25.77	7.2%
Ultrafiltration (UF)	13.41	14.36	15.41	16.57	17.84	19.25	7.5%
Microfiltration (MF)	9.93	10.60	11.33	12.13	13.02	13.99	7.1%
Nanofiltration (NF)	1.23	1.29	1.35	1.42	1.49	1.57	5.0%
Total	42.80	45.71	48.91	52.43	56.31	60.59	7.2%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 362 REST OF ASIA PACIFIC: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	4.57	4.86	5.17	5.52	5.89	6.6%
Ultrafiltration (UF)	3.45	3.64	3.85	4.08	4.32	5.8%
Microfiltration (MF)	2.56	2.70	2.86	3.03	3.21	5.9%
Nanofiltration (NF)	0.35	0.36	0.38	0.39	0.41	3.9%
Total	10.93	11.56	12.25	13.01	13.84	6.1%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 363 REST OF ASIA PACIFIC: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	6.31	6.76	7.26	7.81	8.42	9.08	7.6%
Ultrafiltration (UF)	4.62	4.94	5.30	5.69	6.13	6.61	7.4%
Microfiltration (MF)	3.42	3.65	3.90	4.17	4.47	4.80	7.0%
Nanofiltration (NF)	0.42	0.44	0.47	0.49	0.51	0.54	4.9%
Total	14.77	15.80	16.92	18.16	19.53	21.03	7.3%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 364 REST OF ASIA PACIFIC: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	3.75	4.01	4.31	4.63	4.99	7.4%
Ultrafiltration (UF)	2.83	3.01	3.21	3.42	3.66	6.6%
Microfiltration (MF)	2.10	2.23	2.38	2.54	2.72	6.7%
Nanofiltration (NF)	0.29	0.30	0.31	0.33	0.34	4.7%
Total	8.97	9.56	10.21	10.92	11.71	6.9%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 365 REST OF ASIA PACIFIC: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	5.35	5.75	6.19	6.68	7.22	7.81	7.9%
Ultrafiltration (UF)	3.94	4.24	4.58	4.96	5.38	5.84	8.2%
Microfiltration (MF)	2.92	3.13	3.37	3.63	3.92	4.24	7.8%
Nanofiltration (NF)	0.36	0.38	0.40	0.43	0.45	0.48	5.7%
Total	12.56	13.51	14.54	15.69	16.97	18.37	7.9%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 366 REST OF ASIA PACIFIC: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	3.31	3.50	3.70	3.92	4.16	5.9%
Ultrafiltration (UF)	2.50	2.62	2.75	2.90	3.05	5.1%
Microfiltration (MF)	1.85	1.94	2.04	2.15	2.27	5.2%
Nanofiltration (NF)	0.25	0.26	0.27	0.28	0.29	3.2%
Total	7.92	8.32	8.77	9.25	9.77	5.4%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 367 REST OF ASIA PACIFIC: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	4.39	4.63	4.90	5.19	5.51	5.86	6.0%
Ultrafiltration (UF)	3.25	3.46	3.70	3.96	4.24	4.56	7.0%
Microfiltration (MF)	2.41	2.56	2.72	2.90	3.10	3.31	6.6%
Nanofiltration (NF)	0.30	0.31	0.32	0.34	0.35	0.37	4.5%
Total	10.34	10.96	11.64	12.39	13.20	14.10	6.4%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 368 REST OF ASIA PACIFIC: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	1.62	1.71	1.82	1.93	2.05	6.2%
Ultrafiltration (UF)	1.22	1.28	1.35	1.43	1.51	5.4%
Microfiltration (MF)	0.90	0.95	1.00	1.06	1.12	5.5%
Nanofiltration (NF)	0.12	0.13	0.13	0.14	0.14	3.5%
Total	3.87	4.07	4.30	4.55	4.82	5.7%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 369 REST OF ASIA PACIFIC: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	2.18	2.32	2.47	2.63	2.81	3.01	6.7%
Ultrafiltration (UF)	1.60	1.71	1.83	1.95	2.09	2.25	7.0%
Microfiltration (MF)	1.19	1.26	1.34	1.43	1.53	1.63	6.6%
Nanofiltration (NF)	0.15	0.15	0.16	0.17	0.18	0.18	4.5%
Total	5.12	5.44	5.79	6.18	6.61	7.08	6.7%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

11.6 SOUTH AMERICA

The membrane filtration market in South America has witnessed notable expansion within the food & beverages, dairy, wine, and beer sectors. This growth can be attributed to a surge in consumer preferences for superior quality products, coupled with advancements in filtration technologies. The region's abundant agricultural resources and burgeoning food and beverage industry have spurred the integration of membrane filtration processes to ensure product safety, elevate production efficiency, and adhere to rigorous quality standards. This technology finds diverse applications, from enhancing the clarity and stability of wines and beers to concentrating proteins in dairy products and clarifying juices and sauces. Nonetheless, challenges such as initial investment costs and ongoing maintenance requirements must be addressed to fully capitalize on membrane filtration's benefits to these industries.

The demand for membrane filtration market in South America is mainly due to the increased health awareness and preference towards quality food products, particularly in Brazil. The growth of advanced laboratories and strict compliance with food safety regulations have led to an increase in export earnings and the spread of organic product markets in the region.

11.6.1 SOUTH AMERICA: RECESSION IMPACT ANALYSIS

Despite the economic recession's significant impact on South American countries, the demand for hygienic and quality food products remained strong. Consumers prioritized the safety and quality of their food purchases, leading to an increased emphasis on tested and certified food items. The heightened health awareness and concerns for food safety drove consumers to choose filtered products over unverified alternatives, even though they were more cautious about their overall spending. As a result, the South American membrane filtration market experienced steady demand, with consumers willing to pay a premium to ensure safe and disease-free food. This positive consumer behavior benefitted food testing agencies and organizations, as they continued to provide essential services and maintained their market share despite the economic challenges.

According to an article from the IMF, Latin America is facing a difficult socio-economic situation in 2023. The region is expected to experience slowed growth, high inflation, and global uncertainty, which may negatively impact living standards and increase anxiety among the population. This has resulted in a rise in social discontent and a loss of trust in public institutions. The pandemic has further exacerbated social tensions, with poorer individuals being disproportionately affected by the economic fallout. Increased poverty and food insecurity are prominent consequences of the pandemic's long-term socio-economic effects. Furthermore, the middle class has experienced an unstable economic situation, with small businesses struggling during lockdowns and middle-income workers experiencing wage erosion due to rising prices.

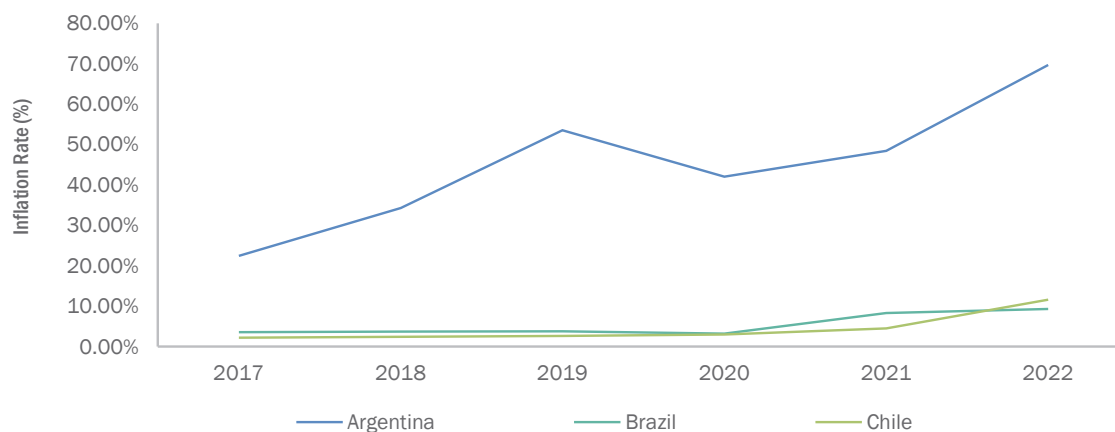
Additionally, the article highlights the importance of achieving macroeconomic stability and implementing structural reforms to counteract the adverse effects of the pandemic and reverse negative trends. However, reaching a consensus on economic reforms can be difficult when social tensions are high. The presence of uncertainty, unrest, and political gridlock may undermine confidence and hinder economic activity, ultimately affecting the membrane filtration market.

Indicators impacting the South American membrane filtration market:

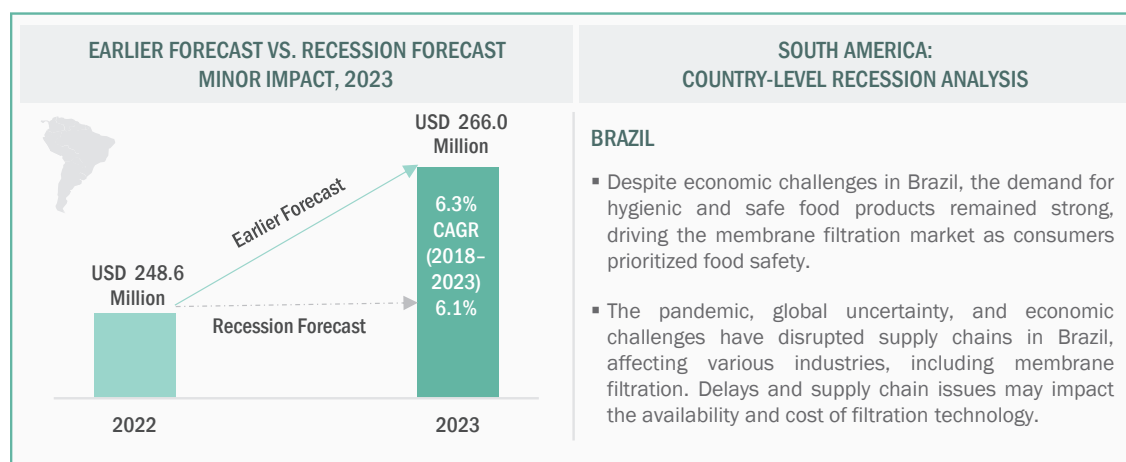
Consumer Demand: In Latin America, the consumer demand for milk and milk products rises yearly. According to OECD Stat 2023, the consumption of fresh dairy products, cheese, whole milk powder is increased by 3.5%, 3.9%, and 3.7%, respectively, from 2020 to 2022. The rise in consumer demand for these dairy products will give rise to the region's membrane filtration market.

Inflation: According to BNP Paribas' Economic Research Department, in Latin America, inflation has reached its highest level in over 20 years. In 2021, inflation rose to 6.6%, comparable to the 2008 financial crisis. Countries such as Bolivia, Brazil, Chile, Colombia, Ecuador, Mexico, Peru, Paraguay, and Uruguay are expected to experience a 6.1% inflation rate in April 2023, down from 9.8% in April 2022, as predicted by CEIC data. The COVID pandemic, China's re-consolidation, and the war in Ukraine have all negatively impacted the availability and prices of inputs in industry, which has led to increased transportation, food, and energy costs. However, the International Monetary Fund reported in 2023 that the region's economy grew by approximately 4% in 2022, employment rates increased significantly, and the service sector responded well to the pandemic's effects. Central banks' proactive and deliberate actions and decreased food and energy prices worldwide have helped ease inflationary pressures in several nations. Nonetheless, core inflation, which excludes food and energy, remains high at nearly 8% in Brazil, Mexico, and Chile.

The Latin American membrane filtration market is affected by socio-economic difficulties such as reduced living standards and increased uncertainty about the future, which may influence people's purchasing behaviors. Nevertheless, the growing emphasis on health consciousness and the need for tested and disease-free food items helps to combat any adverse effects of the membrane filtration market.

FIGURE 49 SOUTH AMERICA: INFLATION RATES, BY KEY COUNTRY, 2017–2022

Source: World Bank

FIGURE 50 SOUTH AMERICAN MEMBRANE FILTRATION MARKET: EARLIER FORECAST VS. RECESSION IMPACT

Source: Secondary Sources, Related Research Publications, Expert Interviews, and MarketsandMarkets Analysis

TABLE 370 SOUTH AMERICA: MEMBRANE FILTRATION MARKET, BY COUNTRY, 2018–2022 (USD MILLION)

Country	2018	2019	2020	2021	2022	CAGR (2018–2022)
Brazil	74.4	78.5	82.8	87.5	92.5	5.6%
Chile	48.8	52.3	56.1	60.3	64.8	7.3%
Argentina	40.7	43.1	45.8	48.7	51.9	6.3%
Rest of South America	32.5	34.0	35.6	37.4	39.3	4.9%
Total	196.4	207.9	220.3	233.9	248.6	6.1%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 371 SOUTH AMERICA: MEMBRANE FILTRATION MARKET, BY COUNTRY, 2023–2028 (USD MILLION)

Country	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Brazil	99.3	106.8	115.0	124.1	134.1	145.2	7.9%
Chile	69.8	75.3	81.4	88.2	95.7	104.0	8.3%
Argentina	55.4	59.3	63.6	68.3	73.5	79.2	7.4%
Rest of South America	41.4	43.7	46.2	48.9	51.9	55.1	5.9%
Total	266.0	285.1	306.2	329.5	355.2	383.6	7.6%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 372 SOUTH AMERICA: MEMBRANE FILTRATION MARKET, BY MODULE DESIGN, 2018–2022 (USD MILLION)

Module Design	2018	2019	2020	2021	2022	CAGR (2018–2022)
Spiral Wound	124.6	131.8	139.7	148.3	157.6	6.1%
Tubular Systems	32.8	34.8	37.0	39.3	41.9	6.3%
Plate & Frame and Hollow Fiber	39.0	41.2	43.6	46.2	49.0	5.9%
Total	196.4	207.9	220.3	233.9	248.6	6.1%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 373 SOUTH AMERICA: MEMBRANE FILTRATION MARKET, BY MODULE DESIGN, 2023–2028 (USD MILLION)

Module Design	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Spiral Wound	169.2	181.9	196.0	211.5	228.6	247.6	7.9%
Tubular Systems	44.7	47.8	51.2	55.0	59.1	63.6	7.3%
Plate & Frame and Hollow Fiber	52.1	55.4	59.0	63.1	67.5	72.3	6.8%
Total	266.0	285.1	306.2	329.5	355.2	383.6	7.6%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 374 SOUTH AMERICA: MEMBRANE FILTRATION MARKET, BY MEMBRANE MATERIAL, 2018–2022 (USD MILLION)

Membrane Material	2018	2019	2020	2021	2022	CAGR (2018–2022)
Polymeric	179.7	190.2	201.6	213.9	227.3	6.1%
Ceramic	16.7	17.7	18.8	19.9	21.2	6.2%
Total	196.4	207.9	220.3	233.9	248.6	6.1%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 375 SOUTH AMERICA: MEMBRANE FILTRATION MARKET, BY MEMBRANE MATERIAL, 2023–2028 (USD MILLION)

Membrane Material	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Polymeric	243.3	260.9	280.3	301.6	325.3	351.4	7.6%
Ceramic	22.7	24.2	25.9	27.8	29.9	32.2	7.3%
Total	266.0	285.1	306.2	329.5	355.2	383.6	7.6%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 376 SOUTH AMERICA: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2018–2022 (USD MILLION)

Application	2018	2019	2020	2021	2022	CAGR (2018–2022)
Dairy Products	69.7	73.5	77.6	82.0	86.8	5.6%
Drinks & Concentrates	56.8	60.5	64.4	68.7	73.4	6.6%
Wine & Beer	28.1	29.7	31.4	33.2	35.2	5.7%
Other Food & Beverage Applications	41.7	44.2	46.9	49.9	53.1	6.3%
Total	196.4	207.9	220.3	233.9	248.6	6.1%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 377 SOUTH AMERICA: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2023–2028 (USD MILLION)

Application	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Dairy Products	93.2	100.2	107.9	116.5	125.9	136.4	7.9%
Drinks & Concentrates	78.7	84.4	90.7	97.7	105.4	114.0	7.7%
Wine & Beer	37.4	39.8	42.5	45.4	48.6	52.2	6.9%
Other Food & Beverage Applications	56.7	60.7	65.1	69.9	75.2	81.1	7.4%
Total	266.0	285.1	306.2	329.5	355.2	383.6	7.6%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 378 SOUTH AMERICA: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY SUBAPPLICATION, 2018–2022 (USD MILLION)

Subapplication	2018	2019	2020	2021	2022	CAGR (2018–2022)
Liquid Milk	46.1	48.8	51.7	54.8	58.2	6.0%
Other Dairy Products	23.6	24.7	25.9	27.2	28.6	4.9%
Total	69.7	73.5	77.6	82.0	86.8	5.6%

Source: Related Journals, Annual Reports, Press Releases, Company Publications, Company Websites, Expert Interviews, and MarketsandMarkets Analysis

TABLE 379 SOUTH AMERICA: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY SUBAPPLICATION, 2023–2028 (USD MILLION)

Subapplication	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Liquid Milk	62.6	67.4	72.7	78.5	85.0	92.2	8.1%
Other Dairy Products	30.6	32.8	35.3	37.9	40.9	44.2	7.6%
Total	93.2	100.2	107.9	116.5	125.9	136.4	7.9%

Source: Related Journals, Annual Reports, Press Releases, Company Publications, Company Websites, Expert Interviews, and MarketsandMarkets Analysis

TABLE 380 SOUTH AMERICA: MEMBRANE FILTRATION MARKET FOR LIQUID MILK, BY SUBAPPLICATION, 2018–2022 (USD MILLION)

Subapplication	2018	2019	2020	2021	2022	CAGR (2018–2022)
Milk Concentration	23.9	25.5	27.3	29.2	31.3	7.0%
Milk Protein Fractionation	15.8	16.5	17.3	18.1	19.1	4.8%
Milk Pre-Concentration	3.4	3.6	3.8	4.0	4.3	5.8%
Water Recovery	3.0	3.1	3.3	3.4	3.6	4.4%
Total	46.1	48.8	51.7	54.8	58.2	6.0%

Source: Related Journals, Annual Reports, Press Releases, Company Publications, Company Websites, Expert Interviews, and MarketsandMarkets Analysis

TABLE 381 SOUTH AMERICA: MEMBRANE FILTRATION MARKET FOR LIQUID MILK, BY SUBAPPLICATION, 2023–2028 (USD MILLION)

Subapplication	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Milk Concentration	33.8	36.5	39.5	42.8	46.5	50.6	8.4%
Milk Protein Fractionation	20.4	21.8	23.4	25.2	27.1	29.3	7.5%
Milk Pre-Concentration	4.6	5.0	5.4	5.9	6.4	6.9	8.5%
Water Recovery	3.8	4.0	4.3	4.6	5.0	5.3	7.1%
Total	62.6	67.4	72.7	78.5	85.0	92.2	8.1%

Source: Related Journals, Annual Reports, Press Releases, Company Publications, Company Websites, Expert Interviews, and MarketsandMarkets Analysis

TABLE 382 SOUTH AMERICA: MEMBRANE FILTRATION MARKET FOR OTHER DAIRY PRODUCTS, BY SUBAPPLICATION, 2018–2022 (USD MILLION)

Subapplication	2018	2019	2020	2021	2022	CAGR (2018–2022)
Whey	10.9	11.4	12.0	12.7	13.4	5.3%
Milk & Whey Based Ingredients	3.4	3.5	3.6	3.8	3.9	4.0%
Cheese	9.4	9.8	10.3	10.8	11.3	4.8%
Total	23.6	24.7	25.9	27.2	28.6	4.9%

Source: Related Journals, Annual Reports, Press Releases, Company Publications, Company Websites, Expert Interviews, and MarketsandMarkets Analysis

TABLE 383 SOUTH AMERICA: MEMBRANE FILTRATION MARKET FOR OTHER DAIRY PRODUCTS, BY SUBAPPLICATION, 2023–2028 (USD MILLION)

Subapplication	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Whey	14.4	15.4	16.6	18.0	19.4	21.0	7.9%
Milk & Whey Based Ingredients	4.2	4.4	4.7	5.0	5.4	5.8	6.7%
Cheese	12.1	13.0	13.9	15.0	16.1	17.4	7.5%
Total	30.6	32.8	35.3	37.9	40.9	44.2	7.6%

Source: Related Journals, Annual Reports, Press Releases, Company Publications, Company Websites, Expert Interviews, and MarketsandMarkets Analysis

TABLE 384 SOUTH AMERICA: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	27.2	28.8	30.5	32.4	34.6	6.2%
Ultrafiltration (UF)	21.1	22.3	23.5	24.8	26.1	5.5%
Microfiltration (MF)	17.4	18.3	19.2	20.3	21.4	5.3%
Nanofiltration (NF)	4.1	4.2	4.4	4.6	4.7	3.7%
Total	69.7	73.5	77.6	82.0	86.8	5.6%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 385 SOUTH AMERICA: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	38.3	42.4	47.0	52.1	57.8	65.0	11.2%
Ultrafiltration (UF)	27.5	28.9	30.5	32.2	34.1	36.2	5.7%
Microfiltration (MF)	22.4	23.6	24.9	26.2	27.7	28.6	5.0%
Nanofiltration (NF)	5.0	5.2	5.5	5.9	6.2	6.6	5.8%
Total	93.2	100.2	107.9	116.5	125.9	136.4	7.9%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 386 SOUTH AMERICA: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	22.2	23.6	25.2	27.0	28.8	6.8%
Ultrafiltration (UF)	17.2	18.3	19.4	20.7	22.1	6.5%
Microfiltration (MF)	14.1	15.1	16.1	17.2	18.5	6.9%
Nanofiltration (NF)	3.3	3.5	3.6	3.8	4.0	4.7%
Total	56.8	60.5	64.4	68.7	73.4	6.6%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 387 SOUTH AMERICA: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	31.3	34.0	37.1	40.4	44.2	48.3	9.1%
Ultrafiltration (UF)	23.5	25.0	26.7	28.5	30.5	32.7	6.8%
Microfiltration (MF)	19.7	21.0	22.4	24.0	25.7	27.6	7.0%
Nanofiltration (NF)	4.2	4.4	4.6	4.8	5.1	5.4	5.2%
Total	78.7	84.4	90.7	97.7	105.4	114.0	7.7%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 388 SOUTH AMERICA: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	10.97	11.61	12.30	13.03	13.82	5.9%
Ultrafiltration (UF)	8.52	8.97	9.46	10.00	10.59	5.6%
Microfiltration (MF)	7.00	7.40	7.84	8.32	8.84	6.0%
Nanofiltration (NF)	1.65	1.70	1.77	1.84	1.91	3.8%
Total	28.13	29.68	31.36	33.18	35.16	5.7%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 389 SOUTH AMERICA: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	14.91	16.12	17.45	18.92	20.54	22.33	8.4%
Ultrafiltration (UF)	11.15	11.76	12.43	13.17	13.97	14.85	5.9%
Microfiltration (MF)	9.33	9.86	10.44	11.08	11.78	12.54	6.1%
Nanofiltration (NF)	1.98	2.06	2.14	2.24	2.34	2.45	4.3%
Total	37.37	39.80	42.47	45.40	48.62	52.17	6.9%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 390 SOUTH AMERICA: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	16.3	17.3	18.4	19.6	20.9	6.5%
Ultrafiltration (UF)	12.6	13.3	14.2	15.0	16.0	6.1%
Microfiltration (MF)	10.4	11.0	11.7	12.5	13.3	6.5%
Nanofiltration (NF)	2.4	2.5	2.6	2.8	2.9	4.3%
Total	41.7	44.2	46.9	49.9	53.1	6.3%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 391 SOUTH AMERICA: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	22.7	24.6	26.8	29.2	31.8	34.7	8.9%
Ultrafiltration (UF)	16.9	17.9	19.0	20.3	21.6	23.1	6.4%
Microfiltration (MF)	14.2	15.0	16.0	17.0	18.2	19.5	6.6%
Nanofiltration (NF)	3.0	3.1	3.3	3.4	3.6	3.8	4.8%
Total	56.7	60.7	65.1	69.9	75.2	81.1	7.4%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

11.6.2 BRAZIL

11.6.2.1 Focus of manufacturers on adding value to products and ensuring sustainable production processes to propel growth

One of the major factors driving the Brazilian membrane filtration market is the increasing use of membrane filtration technologies in the dairy industry. Brazil is one of the largest producers of dairy products in South America and has the potential to become one of the largest exporting countries due to competitive advantages, such as abundant water and land and comparatively low production costs. Along with the increase in dairy production, manufacturers are also focusing on adding value to the products and deploying more efficient and sustainable sanitation and production processes to gain a competitive edge in the global market. Due to these factors, food & beverage companies are opting for membrane filtration technologies.

According to the United States Department of Agriculture (USDA), in 2022, Brazil's dairy production was expected to increase by 1%, reaching 25.1 MMT. According to the Brazilian Institute of Geography and Statistics, in 2019, "Brazil produced 58.37 billion liters of cow milk, collected at the national level and from dairy industries from the different units of the Federation."

The USDA stated that Brazil's 2021 factory milk consumption fell by 0.8% to 16.51 MMT because of rising production costs and fluctuations in dairy consumption, considering Brazil's economic uncertainties. However, production levels of butter, milk powder (both whole and nonfat), and cheese witnessed slight growth during the year, in part specifically due to the uplifting of lockdowns across Brazil and full functionality of the food & beverage industry.

TABLE 392 BRAZIL: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2018–2022 (USD MILLION)

Application	2018	2019	2020	2021	2022	CAGR (2018–2022)
Dairy Products	26.4	27.7	29.0	30.5	32.2	5.1%
Drinks & Concentrates	23.0	24.4	25.9	27.5	29.3	6.2%
Wine & Beer	9.5	10.0	10.6	11.1	11.7	5.3%
Other Food & Beverage Applications	15.5	16.4	17.3	18.3	19.4	5.8%
Total	74.4	78.5	82.8	87.5	92.5	5.6%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 393 BRAZIL: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2023–2028 (USD MILLION)

Application	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Dairy Products	34.6	37.2	40.1	43.3	46.9	50.8	8.0%
Drinks & Concentrates	31.4	33.8	36.4	39.3	42.5	46.0	7.9%
Wine & Beer	12.5	13.4	14.4	15.4	16.6	17.9	7.4%
Other Food & Beverage Applications	20.8	22.4	24.1	26.0	28.1	30.5	7.9%
Total	99.3	106.8	115.0	124.1	134.1	145.2	7.9%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 394 BRAZIL: MEMBRANE FILTRATION MARKET, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	28.2	29.1	30.1	31.2	32.4	3.6%
Ultrafiltration (UF)	22.5	23.9	25.3	26.8	28.5	6.0%
Microfiltration (MF)	18.4	19.9	21.5	23.2	25.1	8.0%
Nanofiltration (NF)	5.3	5.6	5.9	6.2	6.5	5.5%
Total	74.4	78.5	82.8	87.5	92.5	5.6%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 395 BRAZIL: MEMBRANE FILTRATION MARKET, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	35.3	38.4	41.9	45.8	50.1	55.7	9.6%
Ultrafiltration (UF)	30.1	31.9	33.9	36.0	38.4	40.9	6.3%
Microfiltration (MF)	27.0	29.1	31.4	34.0	36.8	39.0	7.6%
Nanofiltration (NF)	6.9	7.3	7.8	8.3	8.9	9.6	6.8%
Total	99.3	106.8	115.0	124.1	134.1	145.2	7.9%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 396 BRAZIL: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	12.31	12.58	12.93	13.39	14.02	3.3%
Ultrafiltration (UF)	6.71	7.03	7.34	7.63	7.90	4.2%
Microfiltration (MF)	6.02	6.63	7.27	7.94	8.64	9.4%
Nanofiltration (NF)	1.36	1.44	1.50	1.56	1.62	4.4%
Total	26.41	27.68	29.04	30.53	32.18	5.1%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 397 BRAZIL: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	15.17	16.46	17.91	19.53	21.35	24.24	9.8%
Ultrafiltration (UF)	8.26	8.64	9.05	9.48	9.93	10.42	4.7%
Microfiltration (MF)	9.40	10.23	11.13	12.12	13.20	13.54	7.6%
Nanofiltration (NF)	1.74	1.88	2.03	2.20	2.40	2.61	8.5%
Total	34.57	37.21	40.12	43.33	46.88	50.81	8.0%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 398 BRAZIL: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	7.6	7.9	8.3	8.7	9.0	4.5%
Ultrafiltration (UF)	7.5	8.0	8.6	9.2	9.9	7.1%
Microfiltration (MF)	5.6	6.0	6.4	6.9	7.4	7.1%
Nanofiltration (NF)	2.3	2.4	2.6	2.7	2.9	6.3%
Total	23.0	24.4	25.9	27.5	29.3	6.2%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 399 BRAZIL: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	9.9	10.8	11.8	12.9	14.2	15.5	9.5%
Ultrafiltration (UF)	10.5	11.3	12.1	12.9	13.9	14.9	7.2%
Microfiltration (MF)	7.9	8.5	9.1	9.8	10.5	11.3	7.4%
Nanofiltration (NF)	3.1	3.3	3.5	3.7	4.0	4.2	6.6%
Total	31.4	33.8	36.4	39.3	42.5	46.0	7.9%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 400 BRAZIL: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	3.15	3.27	3.38	3.48	3.57	3.1%
Ultrafiltration (UF)	3.16	3.35	3.56	3.79	4.04	6.3%
Microfiltration (MF)	2.41	2.57	2.74	2.93	3.14	6.8%
Nanofiltration (NF)	0.80	0.83	0.87	0.91	0.95	4.5%
Total	9.53	10.03	10.55	11.11	11.70	5.3%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 401 BRAZIL: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	3.90	4.27	4.67	5.12	5.61	6.15	3.90
Ultrafiltration (UF)	4.27	4.52	4.80	5.10	5.43	5.80	4.27
Microfiltration (MF)	3.34	3.56	3.81	4.08	4.38	4.71	3.34
Nanofiltration (NF)	0.99	1.04	1.09	1.14	1.20	1.26	0.99
Total	12.51	13.39	14.37	15.44	16.61	17.91	12.51

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 402 BRAZIL: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	5.16	5.35	5.52	5.68	5.82	3.1%
Ultrafiltration (UF)	5.14	5.46	5.81	6.19	6.62	6.5%
Microfiltration (MF)	4.37	4.70	5.07	5.47	5.92	7.9%
Nanofiltration (NF)	0.82	0.87	0.92	0.97	1.03	5.8%
Total	15.49	16.37	17.31	18.32	19.39	5.8%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 403 BRAZIL: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	6.34	6.90	7.53	8.22	8.97	9.81	9.1%
Ultrafiltration (UF)	7.03	7.48	7.97	8.51	9.11	9.76	6.8%
Microfiltration (MF)	6.37	6.87	7.42	8.02	8.70	9.45	8.2%
Nanofiltration (NF)	1.09	1.15	1.21	1.29	1.37	1.46	6.1%
Total	20.82	22.39	24.13	26.04	28.15	30.48	7.9%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

11.6.3 CHILE

11.6.3.1 Rising income of people and inclination to healthy living to drive market

The growing use of membrane filtration for sanitation and purification purposes in the dairy industry is expected to drive the membrane filtration market in this country. In addition, the middle-class population and its rising income levels are growing in the country. Individuals are becoming increasingly conscious and aware of the quality and benefits offered by food products, thus encouraging food & beverage manufacturers to opt for better and more sustainable sanitation and purification technologies such as UF and MF, which enhance the quality of products and reduce the overall production cost.

Chile is the largest market in South America for US consumer-oriented agricultural products. According to an article published by the USDA in April 2022, “Chile’s Oficina de Estudios y Políticas Agrarias reports that domestic cheese production has increased by more than 20% year-over-year for the past five years.”

According to a report published by Foreign Investment Promotion Agency in March 2021, “the food processing sector in Chile is modern and developed, with annual sales worth USD 34 billion, and approximately 25% of all food exports relate to processed products.” The Chilean food retail market comprises sales of all packaged and unpackaged food products along with beverages, household products, and tobacco products. This market was valued at USD 39.9 billion in 2018, growing at a CAGR of 5.6% between 2014 and 2018. The beverages segment contributes USD 9.6 billion (23.9%). Since these beverages need to incorporate filtration technologies such as ultrafiltration, microfiltration, and nanofiltration to attain the desired purity, it is anticipated that the market for membrane filtration will flourish in Chile in the next couple of years.

TABLE 404 CHILE: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2018–2022 (USD MILLION)

Application	2018	2019	2020	2021	2022	CAGR (2018–2022)
Dairy Products	17.5	18.7	20.0	21.4	22.9	7.0%
Drinks & Concentrates	13.8	14.9	16.0	17.3	18.7	7.9%
Wine & Beer	7.0	7.5	8.0	8.6	9.2	7.0%
Other Food & Beverage Applications	10.4	11.2	12.0	12.9	14.0	7.5%
Total	48.8	52.3	56.1	60.3	64.8	7.3%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 405 CHILE: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2023–2028 (USD MILLION)

Application	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Dairy Products	24.8	26.8	29.1	31.6	34.4	37.4	8.6%
Drinks & Concentrates	20.2	21.8	23.6	25.6	27.8	30.2	8.4%
Wine & Beer	9.9	10.6	11.4	12.2	13.2	14.2	7.6%
Other Food & Beverage Applications	15.0	16.2	17.4	18.8	20.4	22.1	8.1%
Total	69.8	75.3	81.4	88.2	95.7	104.0	8.3%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 406 CHILE: MEMBRANE FILTRATION MARKET, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	19.43	21.24	23.20	25.34	27.67	9.2%
Ultrafiltration (UF)	15.67	16.77	17.97	19.30	20.77	7.3%
Microfiltration (MF)	11.76	12.28	12.85	13.46	14.14	4.7%
Nanofiltration (NF)	1.95	2.02	2.09	2.16	2.25	3.6%
Total	48.82	52.30	56.11	60.27	64.83	7.3%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 407 CHILE: MEMBRANE FILTRATION MARKET, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	30.50	33.65	37.15	41.05	45.40	50.27	10.5%
Ultrafiltration (UF)	22.20	23.78	25.52	27.43	29.54	31.88	7.5%
Microfiltration (MF)	14.77	15.47	16.23	17.05	17.96	18.94	5.1%
Nanofiltration (NF)	2.34	2.44	2.54	2.66	2.79	2.93	4.6%
Total	69.82	75.33	81.44	88.20	95.69	104.02	8.3%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 408 CHILE: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	6.00	6.76	7.58	8.44	9.35	11.7%
Ultrafiltration (UF)	4.62	4.95	5.30	5.69	6.12	7.3%
Microfiltration (MF)	5.77	5.88	6.00	6.13	6.26	2.1%
Nanofiltration (NF)	1.13	1.15	1.16	1.18	1.21	1.7%
Total	17.52	18.74	20.04	21.44	22.94	7.0%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 409 CHILE: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	10.65	12.11	13.74	15.56	17.60	19.88	13.3%
Ultrafiltration (UF)	6.53	6.97	7.46	8.00	8.59	9.24	7.2%
Microfiltration (MF)	6.36	6.46	6.57	6.68	6.80	6.91	1.7%
Nanofiltration (NF)	1.23	1.26	1.30	1.33	1.37	1.41	2.7%
Total	24.78	26.81	29.07	31.57	34.35	37.45	8.6%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 410 CHILE: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	5.86	6.36	6.92	7.53	8.22	8.8%
Ultrafiltration (UF)	4.72	5.06	5.44	5.85	6.31	7.5%
Microfiltration (MF)	2.91	3.10	3.31	3.54	3.79	6.8%
Nanofiltration (NF)	0.32	0.34	0.36	0.38	0.40	6.2%
Total	13.81	14.86	16.02	17.31	18.73	7.9%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 411 CHILE: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	8.95	9.75	10.65	11.65	12.77	14.01	9.4%
Ultrafiltration (UF)	6.76	7.26	7.82	8.43	9.10	9.85	7.8%
Microfiltration (MF)	4.05	4.33	4.63	4.97	5.34	5.76	7.3%
Nanofiltration (NF)	0.43	0.46	0.49	0.52	0.56	0.60	6.8%
Total	20.19	21.80	23.59	25.57	27.77	30.21	8.4%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 412 CHILE: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	3.02	3.23	3.47	3.73	4.02	7.5%
Ultrafiltration (UF)	2.49	2.64	2.81	3.00	3.20	6.5%
Microfiltration (MF)	1.36	1.46	1.56	1.67	1.79	7.1%
Nanofiltration (NF)	0.16	0.17	0.18	0.19	0.20	5.3%
Total	7.03	7.50	8.02	8.59	9.21	7.0%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 413 CHILE: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	4.34	4.69	5.08	5.51	5.98	6.51	8.5%
Ultrafiltration (UF)	3.40	3.62	3.86	4.12	4.41	4.72	6.8%
Microfiltration (MF)	1.91	2.04	2.19	2.34	2.52	2.71	7.2%
Nanofiltration (NF)	0.21	0.22	0.23	0.25	0.26	0.28	5.8%
Total	9.86	10.57	11.35	12.21	13.17	14.22	7.6%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 414 CHILE: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	4.55	4.88	5.24	5.64	6.08	7.5%
Ultrafiltration (UF)	3.83	4.11	4.42	4.76	5.14	7.6%
Microfiltration (MF)	1.71	1.84	1.97	2.12	2.29	7.5%
Nanofiltration (NF)	0.34	0.37	0.39	0.41	0.44	6.3%
Total	10.45	11.20	12.03	12.94	13.95	7.5%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 415 CHILE: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	6.56	7.09	7.68	8.33	9.06	9.86	8.5%
Ultrafiltration (UF)	5.51	5.93	6.38	6.89	7.45	8.06	7.9%
Microfiltration (MF)	2.45	2.63	2.83	3.06	3.30	3.57	7.8%
Nanofiltration (NF)	0.47	0.50	0.53	0.56	0.60	0.64	6.6%
Total	15.00	16.15	17.43	18.84	20.40	22.14	8.1%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

11.6.4 ARGENTINA

11.6.4.1 Increased demand for drinks and concentrates to drive adoption of membrane filtration technology

The membrane filtration market in Argentina has experienced significant expansion, particularly within the food & beverage, dairy, and wine industries. This growth is attributed to technology's pivotal role in enhancing product quality and safety. In the food & beverage sector, membrane filtration is employed to purify liquids, while in the dairy industry, it aids in milk clarification and protein concentration. Moreover, the wine industry benefits from membrane filtration for wine clarification and stabilization.

Argentina has a significant industrial structure for producing food and beverages, with exhaustive experience and history at the local and regional levels. Argentina's food processing industry provides export opportunities to more than 50 countries worldwide. Beer and wine are the most popular alcoholic beverages consumed by South Americans.

According to an article published by Wines of Argentina, "between 2018 and 2020, wine consumption increased by about 10% while figures for the first 6 months of this year suggest an overall increase of 21%. Per capita consumption is projected to be around 22.5 liters in 2021, a bump that has a lot to do with the price and quality of the product." Hence, the increase in the consumption of wine, coupled with the adoption of advanced technologies by beverage manufacturers, is anticipated to boost the market growth.

TABLE 416 ARGENTINA: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2018–2022 (USD MILLION)

Application	2018	2019	2020	2021	2022	CAGR (2018–2022)
Dairy Products	14.4	15.2	16.1	17.1	18.1	5.9%
Drinks & Concentrates	11.2	11.9	12.8	13.6	14.6	6.8%
Wine & Beer	6.3	6.7	7.1	7.5	8.0	6.0%
Other Food & Beverage Applications	8.7	9.2	9.8	10.5	11.2	6.5%
Total	40.7	43.1	45.8	48.7	51.9	6.3%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 417 ARGENTINA: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2023–2028 (USD MILLION)

Application	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Dairy Products	19.4	20.9	22.5	24.3	26.3	28.5	8.0%
Drinks & Concentrates	15.6	16.7	17.9	19.3	20.8	22.4	7.5%
Wine & Beer	8.5	9.0	9.6	10.2	10.9	11.7	6.6%
Other Food & Beverage Applications	11.9	12.7	13.5	14.5	15.5	16.6	6.9%
Total	55.4	59.3	63.6	68.3	73.5	79.2	7.4%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 418 ARGENTINA: MEMBRANE FILTRATION MARKET, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	16.30	17.53	18.87	20.35	21.98	7.8%
Ultrafiltration (UF)	11.59	12.18	12.82	13.53	14.30	5.4%
Microfiltration (MF)	10.37	10.92	11.52	12.17	12.89	5.6%
Nanofiltration (NF)	2.40	2.47	2.55	2.64	2.74	3.4%
Total	40.65	43.09	45.76	48.69	51.91	6.3%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 419 ARGENTINA: MEMBRANE FILTRATION MARKET, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	24.12	26.49	29.12	32.04	35.29	38.90	10.0%
Ultrafiltration (UF)	14.99	15.73	16.55	17.45	18.42	19.49	5.4%
Microfiltration (MF)	13.50	14.16	14.88	15.67	16.53	17.47	5.3%
Nanofiltration (NF)	2.83	2.93	3.03	3.13	3.24	3.35	3.4%
Total	55.44	59.32	63.59	68.29	73.48	79.22	7.4%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 420 ARGENTINA: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	5.98	6.34	6.74	7.17	7.64	6.3%
Ultrafiltration (UF)	3.87	4.08	4.31	4.56	4.84	5.8%
Microfiltration (MF)	3.75	3.96	4.19	4.44	4.72	5.9%
Nanofiltration (NF)	0.80	0.82	0.85	0.88	0.91	3.4%
Total	14.39	15.20	16.08	17.05	18.11	5.9%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 421 ARGENTINA: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	8.54	9.54	10.66	11.91	13.30	14.86	11.7%
Ultrafiltration (UF)	5.06	5.29	5.55	5.84	6.14	6.48	5.1%
Microfiltration (MF)	4.91	5.11	5.33	5.56	5.82	6.11	4.5%
Nanofiltration (NF)	0.95	0.98	1.01	1.04	1.06	1.08	2.7%
Total	19.45	20.92	22.55	24.34	26.33	28.52	8.0%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 422 ARGENTINA: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	4.41	4.79	5.21	5.68	6.19	8.9%
Ultrafiltration (UF)	3.30	3.47	3.66	3.86	4.09	5.5%
Microfiltration (MF)	2.83	2.98	3.15	3.33	3.53	5.7%
Nanofiltration (NF)	0.68	0.71	0.73	0.76	0.79	3.7%
Total	11.22	11.95	12.75	13.63	14.60	6.8%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 423 ARGENTINA: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	6.76	7.39	8.08	8.86	9.71	10.66	9.5%
Ultrafiltration (UF)	4.30	4.54	4.80	5.08	5.39	5.73	5.9%
Microfiltration (MF)	3.72	3.94	4.17	4.42	4.70	5.01	6.1%
Nanofiltration (NF)	0.82	0.85	0.88	0.92	0.96	1.00	4.1%
Total	15.61	16.71	17.93	19.28	20.76	22.40	7.5%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 424 ARGENTINA: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	2.49	2.69	2.90	3.14	3.40	8.0%
Ultrafiltration (UF)	1.86	1.95	2.04	2.13	2.24	4.7%
Microfiltration (MF)	1.60	1.67	1.75	1.84	1.94	4.9%
Nanofiltration (NF)	0.39	0.40	0.41	0.42	0.43	2.9%
Total	6.34	6.70	7.10	7.53	8.01	6.0%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 425 ARGENTINA: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	3.68	3.99	4.33	4.70	5.11	5.57	8.6%
Ultrafiltration (UF)	2.34	2.45	2.56	2.69	2.83	2.99	5.0%
Microfiltration (MF)	2.02	2.12	2.23	2.34	2.47	2.61	5.2%
Nanofiltration (NF)	0.44	0.46	0.47	0.49	0.50	0.52	3.2%
Total	8.49	9.01	9.59	10.22	10.92	11.68	6.6%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 426 ARGENTINA: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	3.42	3.70	4.02	4.37	4.75	8.5%
Ultrafiltration (UF)	2.56	2.68	2.82	2.97	3.13	5.2%
Microfiltration (MF)	2.19	2.30	2.43	2.56	2.71	5.4%
Nanofiltration (NF)	0.53	0.55	0.57	0.58	0.61	3.4%
Total	8.70	9.24	9.83	10.48	11.19	6.5%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 427 ARGENTINA: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	5.14	5.58	6.05	6.58	7.17	7.81	8.7%
Ultrafiltration (UF)	3.29	3.45	3.64	3.84	4.06	4.29	5.5%
Microfiltration (MF)	2.84	2.99	3.16	3.34	3.54	3.75	5.7%
Nanofiltration (NF)	0.63	0.65	0.67	0.69	0.72	0.75	3.7%
Total	11.90	12.67	13.52	14.45	15.48	16.61	6.9%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

11.6.5 REST OF SOUTH AMERICA

For the purpose of this study, the rest of South America includes Bolivia and Ecuador. It accounted for a share of 16.5% of the South American membrane filtration market in 2022. The increasing demand for quality food & beverage products is projected to drive the demand for membrane filtration technologies among food & beverage manufacturers in the coming years. The dairy industry benefits from membrane filtration's ability to improve milk quality, extend shelf life, and reduce energy consumption. Likewise, the wine industry seeks membrane filtration for gentle clarification, flavor preservation, and reduced chemical usage. The food and beverage sector utilizes membrane filtration for efficient separation processes, leading to improved product quality and safety.

TABLE 428 REST OF SOUTH AMERICA: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2018–2022 (USD MILLION)

Application	2018	2019	2020	2021	2022	CAGR (2018–2022)
Dairy Products	11.4	11.9	12.4	13.0	13.6	4.5%
Drinks & Concentrates	8.8	9.3	9.7	10.3	10.9	5.4%
Wine & Beer	5.2	5.5	5.7	6.0	6.2	4.5%
Other Food & Beverage Applications	7.1	7.4	7.8	8.2	8.6	5.1%
Total	32.5	34.0	35.6	37.4	39.3	4.9%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 429 REST OF SOUTH AMERICA: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2023–2028 (USD MILLION)

Application	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Dairy Products	14.4	15.2	16.2	17.2	18.3	19.6	6.4%
Drinks & Concentrates	11.5	12.1	12.8	13.6	14.4	15.3	6.0%
Wine & Beer	6.5	6.8	7.2	7.5	7.9	8.4	5.1%
Other Food & Beverage Applications	9.0	9.5	10.0	10.6	11.2	11.9	5.6%
Total	41.4	43.7	46.2	48.9	51.9	55.1	5.9%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 430 REST OF SOUTH AMERICA: MEMBRANE FILTRATION MARKET, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	12.64	13.40	14.22	15.12	16.07	6.2%
Ultrafiltration (UF)	9.65	10.02	10.42	10.86	11.33	4.1%
Microfiltration (MF)	8.32	8.66	9.03	9.44	9.88	4.4%
Nanofiltration (NF)	1.88	1.91	1.95	1.98	2.02	1.8%
Total	32.49	33.99	35.62	37.40	39.31	4.9%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 431 REST OF SOUTH AMERICA: MEMBRANE FILTRATION MARKET, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	17.31	18.67	20.16	21.78	23.57	25.53	8.1%
Ultrafiltration (UF)	11.75	12.21	12.71	13.26	13.85	14.51	4.3%
Microfiltration (MF)	10.26	10.67	11.12	11.60	12.14	12.72	4.4%
Nanofiltration (NF)	2.07	2.12	2.17	2.23	2.30	2.37	2.8%
Total	41.39	43.67	46.16	48.88	51.86	55.13	5.9%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 432 REST OF SOUTH AMERICA: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	4.44	4.64	4.86	5.10	5.32	4.7%
Ultrafiltration (UF)	3.39	3.53	3.69	3.86	4.04	4.5%
Microfiltration (MF)	2.92	3.05	3.20	3.35	3.52	4.8%
Nanofiltration (NF)	0.66	0.67	0.68	0.70	0.71	1.8%
Total	11.40	11.89	12.42	13.00	13.60	4.5%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 433 REST OF SOUTH AMERICA: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	5.83	6.38	6.99	7.66	8.39	9.19	9.5%
Ultrafiltration (UF)	4.18	4.34	4.51	4.70	4.90	5.13	4.1%
Microfiltration (MF)	3.64	3.76	3.90	4.05	4.21	4.38	3.8%
Nanofiltration (NF)	0.73	0.76	0.78	0.81	0.84	0.87	3.6%
Total	14.38	15.24	16.18	17.21	18.34	19.58	6.4%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 434 REST OF SOUTH AMERICA: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	3.43	3.67	3.93	4.22	4.54	7.3%
Ultrafiltration (UF)	2.62	2.72	2.83	2.95	3.08	4.2%
Microfiltration (MF)	2.25	2.35	2.45	2.57	2.69	4.5%
Nanofiltration (NF)	0.51	0.52	0.53	0.54	0.55	2.1%
Total	8.81	9.25	9.75	10.28	10.87	5.4%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 435 REST OF SOUTH AMERICA: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	4.87	5.22	5.61	6.04	6.50	7.02	7.6%
Ultrafiltration (UF)	3.21	3.35	3.51	3.68	3.86	4.06	4.8%
Microfiltration (MF)	2.81	2.94	3.09	3.24	3.41	3.60	5.1%
Nanofiltration (NF)	0.57	0.58	0.59	0.61	0.63	0.65	2.7%
Total	11.45	12.10	12.80	13.56	14.41	15.33	6.0%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 436 REST OF SOUTH AMERICA: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	2.03	2.16	2.30	2.45	2.61	6.4%
Ultrafiltration (UF)	1.55	1.60	1.65	1.71	1.77	3.3%
Microfiltration (MF)	1.34	1.38	1.43	1.48	1.54	3.6%
Nanofiltration (NF)	0.30	0.31	0.31	0.31	0.32	1.2%
Total	5.23	5.45	5.69	5.95	6.24	4.5%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 437 REST OF SOUTH AMERICA: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	2.77	2.95	3.14	3.35	3.58	3.83	6.7%
Ultrafiltration (UF)	1.83	1.89	1.96	2.04	2.12	2.21	3.9%
Microfiltration (MF)	1.60	1.66	1.73	1.80	1.88	1.96	4.2%
Nanofiltration (NF)	0.32	0.33	0.33	0.34	0.34	0.35	1.8%
Total	6.52	6.83	7.16	7.53	7.92	8.36	5.1%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 438 REST OF SOUTH AMERICA: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	2.74	2.93	3.13	3.35	3.60	7.0%
Ultrafiltration (UF)	2.09	2.17	2.25	2.34	2.44	3.9%
Microfiltration (MF)	1.81	1.88	1.95	2.04	2.13	4.2%
Nanofiltration (NF)	0.41	0.42	0.42	0.43	0.44	1.8%
Total	7.05	7.39	7.76	8.16	8.60	5.1%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 439 REST OF SOUTH AMERICA: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	3.85	4.12	4.41	4.74	5.10	5.48	7.4%
Ultrafiltration (UF)	2.53	2.62	2.73	2.84	2.97	3.11	4.2%
Microfiltration (MF)	2.21	2.31	2.41	2.52	2.64	2.77	4.6%
Nanofiltration (NF)	0.45	0.46	0.46	0.48	0.49	0.50	2.3%
Total	9.03	9.50	10.02	10.58	11.19	11.86	5.6%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

11.7 REST OF THE WORLD (ROW)

The rest of the world region encompasses diverse countries across Africa and the Middle East, each characterized by varying economic landscapes, levels of infrastructure development, and other macro and microeconomic factors. The region exhibits disparities in terms of economic conditions and infrastructural development. One notable aspect is the variation in the stages of food processing, with many countries still in the early stages of developing their food processing industries.

The diverse economic conditions and infrastructural landscapes of the countries impact the adoption and growth of membrane filtration technologies. These technologies find applications in various sectors, ranging from water treatment to industrial processes. As with food safety, the unique circumstances of each country influence the demand and adoption of membrane filtration systems.

Membrane filtration solutions play a pivotal role in addressing challenges related to water quality and industrial processes in the region. The differing levels of development across countries result in varying requirements for water treatment for various beverage products and process optimization. Therefore, the adoption of membrane filtration technologies is tailored to the specific needs of each country. This approach ensures that these technologies effectively address local challenges while promoting sustainable development.

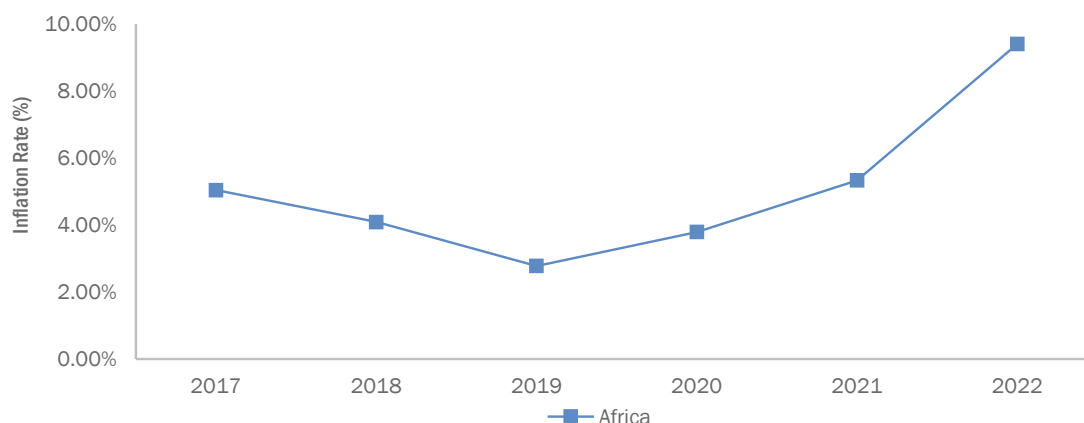
11.7.1 ROW: RECESSION IMPACT ANALYSIS

The economies of many Middle Eastern and African countries have been impacted by various factors, such as political instability, conflict, low oil prices, and the COVID-19 pandemic, leading to recessions and economic downturns.

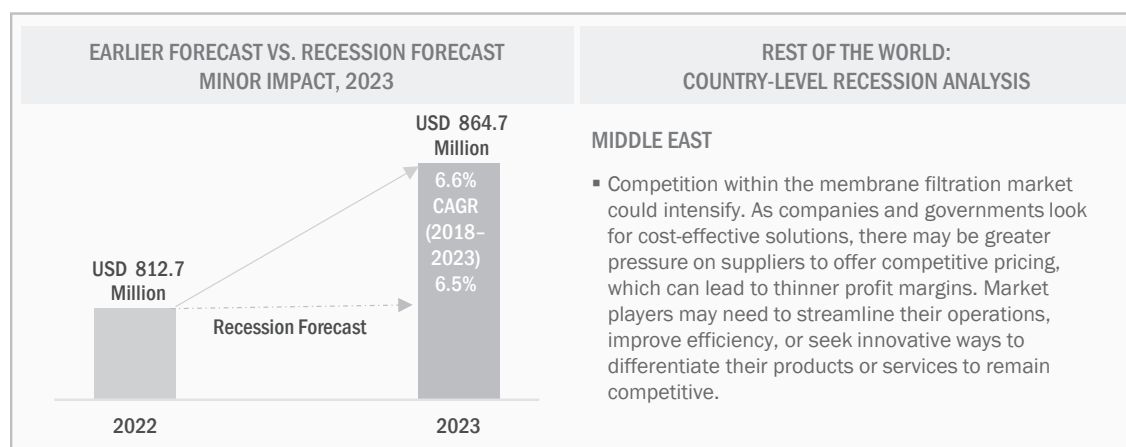
According to the information mentioned by the Statistics South Africa released by the Republic of South Africa, the country faced an economic contraction of 1.4% in the fourth quarter of 2019. Since 2019, there is a constant decline in the economy has been observed. This situation led to price hikes in transport and trade. Transport and trade were the main drags on overall activity, affecting agricultural industries, transportation, and sales.

The Middle East and North Africa region's major economies are Egypt, South Africa, the United Arab Emirates, Israel, and Saudi Arabia. According to the data by the General Authority for Statistics (GSTAT), Saudi Arabia's inflation rate had reduced to 2.7% in March 2023 from 3.4% recorded in January 2023. Although the inflation rate slightly increased to 2.8% in May 2023. According to Trading Economics, the annual urban inflation rate in Egypt increased to 32.7% in May 2023 from 30.6% in April. Moreover, The Middle East and North Africa are facing significant challenges because of the Ukraine conflict and related sanctions, particularly for the region's oil importers. Rising commodity prices have one of the most direct effects on inflation.

Although the inflation rate fluctuated in the major economies of South Africa and the Middle East, it's important to note that food safety and quality remain critical concerns regardless of economic conditions. In some cases, the focus on food quality and adherence to standards may even intensify during recessions, as consumers prioritize health and safety in their purchasing decisions. Additionally, certain sectors, such as organic or specialty food markets, might continue to value certifications despite economic challenges as they cater to niche consumer segments.

FIGURE 51 ROW: INFLATION RATES, BY KEY COUNTRY, 2017–2022

Source: World Bank

FIGURE 52 ROW MEMBRANE FILTRATION MARKET: EARLIER FORECAST VS. RECESSION FORECAST

Source: Secondary Sources, Related Research Publications, Expert Interviews, and MarketsandMarkets Analysis

TABLE 440 ROW: MEMBRANE FILTRATION MARKET, BY COUNTRY, 2018–2022 (USD MILLION)

Country	2018	2019	2020	2021	2022	CAGR (2018–2022)
Middle East	580.5	617.5	657.7	701.6	749.4	6.6%
Africa	48.6	51.8	55.3	59.1	63.3	6.8%
Total	629.1	669.3	713.0	760.7	812.7	6.6%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 441 ROW: MEMBRANE FILTRATION MARKET, BY COUNTRY, 2023–2028 (USD MILLION)

Country	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Middle East	796.9	848.9	906.1	968.9	1,037.9	1,114.0	6.9%
Africa	67.8	72.9	78.4	84.5	91.3	98.8	7.8%
Total	864.7	921.8	984.5	1,053.4	1,129.2	1,212.8	7.0%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 442 ROW: MEMBRANE FILTRATION MARKET, BY MODULE DESIGN, 2018–2022 (USD MILLION)

Module Design	2018	2019	2020	2021	2022	CAGR (2018–2022)
Spiral Wound	413.5	440.2	469.2	500.9	535.5	6.7%
Tubular Systems	93.8	99.9	106.5	113.7	121.6	6.7%
Plate & Frame and Hollow Fiber	121.8	129.2	137.3	146.1	155.7	6.3%
Total	629.1	669.3	713.0	760.7	812.7	6.6%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 443 ROW: MEMBRANE FILTRATION MARKET, BY MODULE DESIGN, 2023–2028 (USD MILLION)

Module Design	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Spiral Wound	568.4	604.7	644.7	688.7	737.4	794.1	6.9%
Tubular Systems	130.2	139.6	149.9	161.2	173.6	186.4	7.4%
Plate & Frame and Hollow Fiber	166.1	177.5	189.9	203.4	218.3	232.2	6.9%
Total	864.7	921.8	984.5	1,053.4	1,129.2	1,212.8	7.0%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 444 ROW: MEMBRANE FILTRATION MARKET, BY MEMBRANE MATERIAL, 2018–2022 (USD MILLION)

Membrane Material	2018	2019	2020	2021	2022	CAGR (2018–2022)
Polymeric	574.3	611.3	651.5	695.3	743.1	6.7%
Ceramic	54.7	58.0	61.5	65.4	69.6	6.2%
Total	629.1	669.3	713.0	760.7	812.7	6.6%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 445 ROW: MEMBRANE FILTRATION MARKET, BY MEMBRANE MATERIAL, 2023–2028 (USD MILLION)

Membrane Material	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Polymeric	790.4	842.4	899.4	962.1	1,031.1	1,107.1	7.0%
Ceramic	74.3	79.4	85.0	91.3	98.1	105.6	7.3%
Total	864.7	921.8	984.5	1,053.4	1,129.2	1,212.8	7.0%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 446 ROW: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2018–2022 (USD MILLION)

Application	2018	2019	2020	2021	2022	CAGR (2018–2022)
Dairy Products	223.7	240.6	258.9	278.6	300.0	7.6%
Drinks & Concentrates	181.0	192.3	204.6	218.1	232.9	6.5%
Wine & Beer	89.3	93.9	99.0	104.5	110.6	5.5%
Other Food & Beverage Applications	135.1	142.5	150.6	159.5	169.2	5.8%
Total	629.1	669.3	713.0	760.7	812.7	6.6%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 447 ROW: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2023–2028 (USD MILLION)

Application	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Dairy Products	322.5	347.3	374.6	404.8	438.1	474.9	8.0%
Drinks & Concentrates	247.3	263.2	280.5	299.6	320.6	343.6	6.8%
Wine & Beer	116.3	122.6	129.5	137.0	145.2	154.2	5.8%
Other Food & Beverage Applications	178.5	188.7	199.8	212.0	225.4	240.0	6.1%
Total	864.7	921.8	984.5	1,053.4	1,129.2	1,212.8	7.0%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 448 ROW: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY SUBAPPLICATION, 2018–2022 (USD MILLION)

Subapplication	2018	2019	2020	2021	2022	CAGR (2018–2022)
Liquid Milk	144.7	157.5	171.1	185.9	201.8	8.7%
Other Dairy Products	79.0	83.2	87.7	92.7	98.2	5.6%
Total	223.7	240.6	258.9	278.6	300.0	7.6%

Source: Related Journals, Annual Reports, Press Releases, Company Publications, Company Websites, Expert Interviews, and MarketsandMarkets Analysis

TABLE 449 ROW: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY SUBAPPLICATION, 2023–2028 (USD MILLION)

Subapplication	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Liquid Milk	219.8	236.9	255.7	276.4	299.3	324.6	8.1%
Other Dairy Products	102.7	110.4	118.9	128.3	138.7	150.2	7.9%
Total	322.5	347.3	374.6	404.8	438.1	474.9	8.0%

Source: Related Journals, Annual Reports, Press Releases, Company Publications, Company Websites, Expert Interviews, and MarketsandMarkets Analysis

TABLE 450 ROW: MEMBRANE FILTRATION MARKET FOR LIQUID MILK, BY SUBAPPLICATION, 2018–2022 (USD MILLION)

Subapplication	2018	2019	2020	2021	2022	CAGR (2018–2022)
Milk Concentration	75.8	85.6	96.0	107.2	119.3	12.0%
Milk Protein Fractionation	49.8	51.9	54.2	56.7	59.4	4.5%
Milk Pre-Concentration	10.7	11.3	11.9	12.5	13.3	5.5%
Water Recovery	8.4	8.7	9.1	9.4	9.9	4.1%
Total	144.7	157.5	171.1	185.9	201.8	8.7%

Source: Related Journals, Annual Reports, Press Releases, Company Publications, Company Websites, Expert Interviews, and MarketsandMarkets Analysis

TABLE 451 ROW: MEMBRANE FILTRATION MARKET FOR LIQUID MILK, BY SUBAPPLICATION, 2023–2028 (USD MILLION)

Subapplication	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Milk Concentration	133.0	145.3	159.0	174.1	190.9	209.5	9.5%
Milk Protein Fractionation	62.4	65.7	69.3	73.3	77.6	82.3	5.7%
Milk Pre-Concentration	14.1	15.0	15.9	16.9	18.0	19.2	6.4%
Water Recovery	10.4	10.9	11.5	12.1	12.8	13.6	5.6%
Total	219.8	236.9	255.7	276.4	299.3	324.6	8.1%

Source: Related Journals, Annual Reports, Press Releases, Company Publications, Company Websites, Expert Interviews, and MarketsandMarkets Analysis

TABLE 452 ROW: MEMBRANE FILTRATION MARKET FOR OTHER DAIRY PRODUCTS, BY SUBAPPLICATION, 2018–2022 (USD MILLION)

Subapplication	2018	2019	2020	2021	2022	CAGR (2018–2022)
Whey	36.2	38.7	41.4	44.4	47.6	7.0%
Milk & Whey Based Ingredients	9.5	9.8	10.2	10.5	11.0	3.7%
Cheese	33.2	34.6	36.2	37.8	39.6	4.5%
Total	79.0	83.2	87.7	92.7	98.2	5.6%

Source: Related Journals, Annual Reports, Press Releases, Company Publications, Company Websites, Expert Interviews, and MarketsandMarkets Analysis

TABLE 453 ROW: MEMBRANE FILTRATION MARKET FOR OTHER DAIRY PRODUCTS, BY SUBAPPLICATION, 2023–2028 (USD MILLION)

Subapplication	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Whey	49.1	53.4	58.3	63.6	69.6	76.3	9.2%
Milk & Whey Based Ingredients	11.6	12.2	12.9	13.7	14.5	15.5	6.0%
Cheese	42.1	44.8	47.8	51.0	54.6	58.5	6.8%
Total	102.7	110.4	118.9	128.3	138.7	150.2	7.9%

Source: Related Journals, Annual Reports, Press Releases, Company Publications, Company Websites, Expert Interviews, and MarketsandMarkets Analysis

TABLE 454 ROW: MEMBRANE FILTRATION MARKET, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	261.6	278.0	295.6	314.5	334.8	6.4%
Ultrafiltration (UF)	225.3	239.5	255.1	272.2	291.0	6.6%
Microfiltration (MF)	67.1	70.4	73.9	77.7	81.9	5.1%
Nanofiltration (NF)	75.0	81.3	88.4	96.3	105.0	8.8%
Total	629.1	669.3	713.0	760.7	812.7	6.6%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 455 ROW: MEMBRANE FILTRATION MARKET, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	354.8	376.7	400.6	426.8	455.4	486.7	6.5%
Ultrafiltration (UF)	309.9	330.7	353.5	378.6	406.2	436.7	7.1%
Microfiltration (MF)	85.9	90.3	95.1	100.3	106.0	112.3	5.5%
Nanofiltration (NF)	114.1	124.1	135.3	147.7	161.6	177.1	9.2%
Total	864.7	921.8	984.5	1,053.4	1,129.2	1,212.8	7.0%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 456 ROW: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	93.0	101.3	110.1	119.4	129.3	8.6%
Ultrafiltration (UF)	80.1	85.3	90.9	97.1	103.9	6.7%
Microfiltration (MF)	23.9	25.1	26.4	27.9	29.4	5.4%
Nanofiltration (NF)	26.7	28.9	31.5	34.3	37.4	8.8%
Total	223.7	240.6	258.9	278.6	300.0	7.6%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 457 ROW: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	139.2	150.1	162.0	175.2	189.7	205.7	8.1%
Ultrafiltration (UF)	111.4	119.6	128.7	138.7	149.7	161.9	7.8%
Microfiltration (MF)	31.1	32.9	34.9	37.0	39.4	41.9	6.2%
Nanofiltration (NF)	40.9	44.7	49.1	53.9	59.3	65.3	9.8%
Total	322.5	347.3	374.6	404.8	438.1	474.9	8.0%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 458 ROW: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	75.3	79.6	84.3	89.4	95.0	6.0%
Ultrafiltration (UF)	64.8	69.0	73.6	78.6	84.1	6.7%
Microfiltration (MF)	19.3	20.2	21.2	22.3	23.5	5.0%
Nanofiltration (NF)	21.6	23.4	25.5	27.8	30.3	8.9%
Total	181.0	192.3	204.6	218.1	232.9	6.5%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 459 ROW: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	100.7	106.9	113.7	121.1	129.2	138.1	6.5%
Ultrafiltration (UF)	89.3	95.0	101.2	108.1	115.7	124.0	6.8%
Microfiltration (MF)	24.5	25.7	26.9	28.3	29.8	31.5	5.1%
Nanofiltration (NF)	32.8	35.6	38.6	42.0	45.8	50.0	8.8%
Total	247.3	263.2	280.5	299.6	320.6	343.6	6.8%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 460 ROW: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	37.1	39.0	41.0	43.1	45.5	5.2%
Ultrafiltration (UF)	32.0	33.6	35.5	37.4	39.6	5.5%
Microfiltration (MF)	9.5	9.9	10.3	10.7	11.1	4.0%
Nanofiltration (NF)	10.6	11.4	12.3	13.3	14.3	7.7%
Total	89.3	93.9	99.0	104.5	110.6	5.5%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 461 ROW: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	47.7	50.1	52.6	55.4	58.5	61.8	5.3%
Ultrafiltration (UF)	41.7	44.0	46.5	49.3	52.3	55.6	5.9%
Microfiltration (MF)	11.6	12.0	12.5	13.0	13.6	14.3	4.3%
Nanofiltration (NF)	15.4	16.5	17.8	19.3	20.8	22.6	8.0%
Total	116.3	122.6	129.5	137.0	145.2	154.2	5.8%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 462 ROW: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	56.2	58.2	60.3	62.6	65.0	3.7%
Ultrafiltration (UF)	48.4	51.6	55.2	59.1	63.4	7.0%
Microfiltration (MF)	14.4	15.2	16.0	16.9	17.9	5.5%
Nanofiltration (NF)	16.1	17.5	19.2	21.0	23.0	9.3%
Total	135.1	142.5	150.6	159.5	169.2	5.8%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 463 ROW: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	67.3	69.7	72.3	75.0	78.0	81.1	3.8%
Ultrafiltration (UF)	67.5	72.1	77.0	82.5	88.5	95.2	7.1%
Microfiltration (MF)	18.7	19.7	20.8	22.0	23.2	24.6	5.6%
Nanofiltration (NF)	25.0	27.2	29.7	32.5	35.7	39.2	9.4%
Total	178.5	188.7	199.8	212.0	225.4	240.0	6.1%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

11.7.2 MIDDLE EAST

11.7.2.1 Rising demand for functional food products and beverages to boost market

The Middle East includes Saudi Arabia, Qatar, Oman, UAE, and the other remaining countries in the row. The Middle East is home to the world's largest oil-producing and exporting countries. The high per capita income with the willingness to adopt and pay for premium food and supplementary products fuels the growth of the membrane filtration market in this region. Awareness plays a vital role in the purchasing decisions of consumers. Healthy ingredients in functional foods and nutraceuticals appeal to the geriatric population in the Middle East and North Africa. Owing to this, functional food and nutraceutical manufacturers in this region are increasingly adopting membrane filtration technologies, as they offer effective bacteria removal properties, enhanced texture, and prolonged shelf-life of products.

Rising health consciousness among consumers and initiatives to combat diseases like diabetes are anticipated to drive the expansion of the functional food sector in Saudi Arabia. This growth trajectory is projected to amplify the demand for membrane filtration technologies like Ultrafiltration (UF) and Nanofiltration (NF). Positioned in the heart of the Middle East, Saudi Arabia boasts a robust food and beverage industry, housing prominent manufacturers like Al Jomath and Al Safi Danone. These industry leaders employ membrane filtration solutions to streamline operational expenses. Oman is also gaining popularity among food & beverage as well as dairy producers. Oman is a rich desert country, and people here are willing to pay for high-quality and value-added food & beverage products.

TABLE 464 MIDDLE EAST: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2018–2022 (USD MILLION)

Application	2018	2019	2020	2021	2022	CAGR (2018–2022)
Dairy Products	206.2	222.1	239.4	258.0	278.3	7.8%
Drinks & Concentrates	167.3	177.4	188.6	200.8	214.2	6.4%
Wine & Beer	82.5	86.7	91.3	96.3	101.8	5.4%
Other Food & Beverage Applications	124.6	131.2	138.5	146.4	155.1	5.6%
Total	580.5	617.5	657.7	701.6	749.4	6.6%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 465 MIDDLE EAST: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2023–2028 (USD MILLION)

Application	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Dairy Products	299.2	322.2	347.6	375.6	406.5	440.7	8.1%
Drinks & Concentrates	227.2	241.5	257.2	274.3	293.2	314.0	6.7%
Wine & Beer	107.1	112.8	119.0	125.8	133.3	141.4	5.7%
Other Food & Beverage Applications	163.4	172.4	182.3	193.1	204.9	217.9	5.9%
Total	796.9	848.9	906.1	968.9	1,037.9	1,114.0	6.9%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 466 MIDDLE EAST: MEMBRANE FILTRATION MARKET, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	242.1	257.5	274.1	292.0	311.2	6.5%
Ultrafiltration (UF)	207.9	220.7	234.7	250.1	267.0	6.5%
Microfiltration (MF)	61.8	64.7	67.8	71.2	75.0	5.0%
Nanofiltration (NF)	68.8	74.6	81.1	88.2	96.2	8.8%
Total	580.5	617.5	657.7	701.6	749.4	6.6%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 467 MIDDLE EAST: MEMBRANE FILTRATION MARKET, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	330.1	350.8	373.5	398.3	425.4	455.2	6.6%
Ultrafiltration (UF)	283.8	302.3	322.5	344.7	369.2	396.0	6.9%
Microfiltration (MF)	78.5	82.3	86.5	91.1	96.0	101.5	5.3%
Nanofiltration (NF)	104.4	113.5	123.6	134.8	147.3	161.3	9.1%
Total	796.9	848.9	906.1	968.9	1,037.9	1,114.0	6.9%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 468 MIDDLE EAST: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	84.3	92.2	100.6	109.4	118.8	8.9%
Ultrafiltration (UF)	76.5	81.3	86.4	92.1	98.4	6.5%
Microfiltration (MF)	17.7	18.4	19.3	20.2	21.4	4.9%
Nanofiltration (NF)	27.7	30.3	33.1	36.3	39.8	9.5%
Total	206.2	222.1	239.4	258.0	278.3	7.8%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 469 MIDDLE EAST: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	129.2	140.7	153.4	167.4	182.9	200.2	9.2%
Ultrafiltration (UF)	103.7	109.6	116.0	123.0	130.6	138.9	6.0%
Microfiltration (MF)	22.3	23.4	24.5	25.7	27.1	28.5	5.0%
Nanofiltration (NF)	44.0	48.6	53.7	59.5	65.9	73.1	10.7%
Total	299.2	322.2	347.6	375.6	406.5	440.7	8.1%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 470 MIDDLE EAST: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	71.4	76.0	81.1	86.7	92.9	6.8%
Ultrafiltration (UF)	57.2	60.5	64.2	68.1	72.5	6.1%
Microfiltration (MF)	22.1	23.0	24.0	25.0	26.0	4.2%
Nanofiltration (NF)	16.6	17.9	19.4	21.0	22.8	8.3%
Total	167.3	177.4	188.6	200.8	214.2	6.4%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 471 MIDDLE EAST: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	97.6	102.8	108.4	114.4	121.0	128.1	5.6%
Ultrafiltration (UF)	77.6	83.2	89.3	96.1	103.6	111.9	7.6%
Microfiltration (MF)	27.1	28.3	29.6	31.0	32.6	34.3	4.8%
Nanofiltration (NF)	24.9	27.2	29.8	32.8	36.0	39.7	9.8%
Total	227.2	241.5	257.2	274.3	293.2	314.0	6.7%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 472 MIDDLE EAST: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	34.4	35.7	37.1	38.7	40.4	4.1%
Ultrafiltration (UF)	29.5	31.3	33.2	35.4	37.7	6.3%
Microfiltration (MF)	8.8	9.3	9.9	10.5	11.2	6.2%
Nanofiltration (NF)	9.8	10.4	11.0	11.8	12.6	6.5%
Total	82.5	86.7	91.3	96.3	101.8	5.4%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 473 MIDDLE EAST: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	41.5	42.7	43.9	45.3	46.7	48.2	3.0%
Ultrafiltration (UF)	40.3	43.1	46.2	49.6	53.4	57.5	7.4%
Microfiltration (MF)	11.8	12.5	13.3	14.1	15.0	16.0	6.3%
Nanofiltration (NF)	13.5	14.5	15.6	16.9	18.2	19.7	7.9%
Total	107.1	112.8	119.0	125.8	133.3	141.4	5.7%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 474 MIDDLE EAST: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	51.9	53.6	55.3	57.2	59.1	3.3%
Ultrafiltration (UF)	44.6	47.6	50.9	54.5	58.5	7.0%
Microfiltration (MF)	13.3	13.9	14.7	15.5	16.4	5.5%
Nanofiltration (NF)	14.8	16.1	17.6	19.2	21.1	9.3%
Total	124.6	131.2	138.5	146.4	155.1	5.6%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 475 MIDDLE EAST: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	61.8	64.7	67.8	71.1	74.8	78.8	5.0%
Ultrafiltration (UF)	62.3	66.4	71.0	76.1	81.6	87.7	7.1%
Microfiltration (MF)	17.2	18.1	19.1	20.2	21.4	22.6	5.6%
Nanofiltration (NF)	22.1	23.2	24.4	25.7	27.1	28.7	5.4%
Total	163.4	172.4	182.3	193.1	204.9	217.9	5.9%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

11.7.3 AFRICA

11.7.3.1 Increasing water scarcity and environmental concerns to drive popularity of membrane filtration technologies

The market for membrane filtration in Africa is experiencing remarkable growth, driven by a convergence of factors that underscore its importance across various sectors. As countries within the African continent continue to develop and urbanize, there is an increasing need for sustainable and efficient solutions to address water scarcity, environmental concerns, and industrial requirements. Membrane filtration technologies have emerged as a crucial answer to these challenges, contributing to improved water quality, industrial processes, and overall development. Membrane filtration offers a reliable solution by effectively removing contaminants, pathogens, and impurities from water sources that are used to prepare the beverages.

According to OECD stat 2023, the demand for dairy products in Africa is on the upswing, driven by growing consumer preferences. The consumption of fresh dairy items and cheese has surged by 6.05% and 3.6%, respectively, between 2020 and 2022, reflecting a significant increase. This rise underscores the region's expanding dairy industry, as consumers increasingly favor these products for their nutritional value and culinary versatility. This rise in demand surges the demand for membrane filtration market.

TABLE 476 AFRICA: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2018–2022 (USD MILLION)

Application	2018	2019	2020	2021	2022	CAGR (2018–2022)
Dairy Products	17.5	18.5	19.5	20.6	21.7	5.5%
Drinks & Concentrates	13.7	14.8	16.0	17.3	18.7	8.0%
Wine & Beer	6.8	7.2	7.7	8.2	8.7	6.5%
Other Food & Beverage Applications	10.5	11.3	12.1	13.1	14.1	7.7%
Total	48.6	51.8	55.3	59.1	63.3	6.8%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 477 AFRICA: MEMBRANE FILTRATION MARKET, BY APPLICATION, 2023–2028 (USD MILLION)

Application	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Dairy Products	23.3	25.1	27.0	29.2	31.5	34.2	7.9%
Drinks & Concentrates	20.1	21.7	23.4	25.3	27.4	29.7	8.1%
Wine & Beer	9.3	9.8	10.5	11.2	11.9	12.8	6.6%
Other Food & Beverage Applications	15.1	16.3	17.5	18.9	20.5	22.2	7.9%
Total	67.8	72.9	78.4	84.5	91.3	98.8	7.8%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 478 AFRICA: MEMBRANE FILTRATION MARKET, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	19.6	20.5	21.5	22.5	23.6	4.8%
Ultrafiltration (UF)	17.5	18.9	20.4	22.1	24.0	8.2%
Microfiltration (MF)	5.3	5.7	6.1	6.5	6.9	6.7%
Nanofiltration (NF)	6.2	6.7	7.3	8.0	8.8	9.3%
Total	48.6	51.8	55.3	59.1	63.3	6.8%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 479 AFRICA: MEMBRANE FILTRATION MARKET, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	24.7	25.9	27.1	28.5	29.9	31.5	5.0%
Ultrafiltration (UF)	26.1	28.4	31.0	33.8	37.0	40.6	9.3%
Microfiltration (MF)	7.4	8.0	8.6	9.2	10.0	10.8	7.8%
Nanofiltration (NF)	9.7	10.6	11.7	12.9	14.3	15.9	10.4%
Total	67.8	72.9	78.4	84.5	91.3	98.8	7.8%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 480 AFRICA: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	7.1	7.3	7.5	7.6	7.7	2.3%
Ultrafiltration (UF)	6.3	6.8	7.3	7.8	8.4	7.5%
Microfiltration (MF)	1.9	2.0	2.2	2.3	2.4	6.0%
Nanofiltration (NF)	2.2	2.4	2.6	2.8	3.1	8.6%
Total	17.5	18.5	19.5	20.6	21.7	5.5%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 481 AFRICA: MEMBRANE FILTRATION MARKET FOR DAIRY PRODUCTS, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	8.1	8.5	8.9	9.3	9.8	10.3	4.9%
Ultrafiltration (UF)	9.2	10.0	10.9	12.0	13.1	14.4	9.4%
Microfiltration (MF)	2.6	2.8	3.0	3.3	3.5	3.8	7.9%
Nanofiltration (NF)	3.4	3.8	4.1	4.6	5.1	5.6	10.5%
Total	23.3	25.1	27.0	29.2	31.5	34.2	7.9%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 482 AFRICA: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	5.5	5.9	6.3	6.7	7.1	6.5%
Ultrafiltration (UF)	4.9	5.4	5.9	6.4	7.0	9.0%
Microfiltration (MF)	1.5	1.6	1.7	1.9	2.0	7.5%
Nanofiltration (NF)	1.7	1.9	2.1	2.3	2.6	10.1%
Total	13.7	14.8	16.0	17.3	18.7	8.0%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 483 AFRICA: MEMBRANE FILTRATION MARKET FOR DRINKS & CONCENTRATES, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	7.5	7.9	8.3	8.7	9.2	9.7	5.4%
Ultrafiltration (UF)	7.6	8.3	9.1	10.0	10.9	12.0	9.6%
Microfiltration (MF)	2.2	2.3	2.5	2.7	3.0	3.2	8.1%
Nanofiltration (NF)	2.8	3.1	3.4	3.8	4.2	4.7	10.7%
Total	20.1	21.7	23.4	25.3	27.4	29.7	8.1%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 484 AFRICA: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	2.74	2.87	3.01	3.17	3.33	5.0%
Ultrafiltration (UF)	2.45	2.62	2.82	3.03	3.27	7.5%
Microfiltration (MF)	0.75	0.79	0.84	0.89	0.94	6.0%
Nanofiltration (NF)	0.86	0.94	1.01	1.10	1.20	8.6%
Total	6.80	7.22	7.68	8.19	8.75	6.5%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 485 AFRICA: MEMBRANE FILTRATION MARKET FOR WINE & BEER, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	3.45	3.58	3.72	3.86	4.01	4.17	3.9%
Ultrafiltration (UF)	3.51	3.78	4.08	4.41	4.78	5.19	8.1%
Microfiltration (MF)	1.00	1.06	1.13	1.21	1.29	1.38	6.6%
Nanofiltration (NF)	1.30	1.42	1.55	1.69	1.85	2.03	9.2%
Total	9.27	9.85	10.48	11.17	11.93	12.76	6.6%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 486 AFRICA: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2018–2022 (USD MILLION)

Type	2018	2019	2020	2021	2022	CAGR (2018–2022)
Reverse Osmosis (RO)	4.23	4.48	4.76	5.06	5.38	6.2%
Ultrafiltration (UF)	3.78	4.09	4.45	4.84	5.27	8.7%
Microfiltration (MF)	1.15	1.23	1.32	1.42	1.52	7.2%
Nanofiltration (NF)	1.33	1.46	1.60	1.76	1.94	9.8%
Total	10.49	11.27	12.12	13.07	14.12	7.7%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

TABLE 487 AFRICA: MEMBRANE FILTRATION MARKET FOR OTHER FOOD & BEVERAGE APPLICATIONS, BY TYPE, 2023–2028 (USD MILLION)

Type	2023	2024	2025	2026	2027	2028	CAGR (2023–2028)
Reverse Osmosis (RO)	5.6	5.9	6.2	6.6	6.9	7.3	5.2%
Ultrafiltration (UF)	5.7	6.3	6.8	7.5	8.2	9.0	9.4%
Microfiltration (MF)	1.6	1.8	1.9	2.0	2.2	2.4	7.9%
Nanofiltration (NF)	2.1	2.3	2.6	2.9	3.2	3.5	10.5%
Total	15.1	16.3	17.5	18.9	20.5	22.2	7.9%

Source: Related Research Publications, Government Publications, Company Press Releases, Company Annual Reports, Company Websites, Company Publications, and MarketsandMarkets Analysis

12 COMPETITIVE LANDSCAPE

12.1 OVERVIEW

The competitive landscape provides an overview of the relative market position of major players operating in the membrane filtration market based on the strength of their product offerings and business strategies analyzed based on a proprietary model.

The relative robustness of product offerings has been analyzed objectively using the information available in the public domain pertaining to portfolio strength and geographical reach. An equal weightage is assigned to the factors mentioned above to ascertain an overall score for the selected players in the membrane filtration market.

Similarly, the relative robustness of business strategies has been analyzed objectively using the information available in the public domain pertaining to industry coverage, operating and financial strength, and growth attempt endeavors. An equal weightage is assigned to the factors mentioned above to ascertain an overall score for the selected players in the membrane filtration market.

A competitive leadership mapping is prepared based on the ascertained scores on these parameters, which depicts the differentiation of selected players as stars, pervasive players, emerging leaders, and participants.

The key players in this market include Alfa Laval (Sweden), GEA Group Aktiengesellschaft (Germany), DuPont (US), MMS Membrane Systems (Switzerland), Pall Corporation (US), 3M (US), Koch Separation Solutions (US), Veolia (France), ProMinent (Germany), Pentair (US), SPX Flow (US), Porvair Filtration Group (UK), TORAY INDUSTRIES, INC. (Japan), Hydranautics- A Nitto Group Company (Japan), Donaldson Company, Inc. (US), and Synder Filtration Inc. (US).

MAJOR STRATEGIES IDENTIFIED INCLUDE THE FOLLOWING:

- Product launches
- Deals (agreements, collaborations, partnerships, and acquisitions)
- Others (expansions, investments)

12.2 MARKET SHARE ANALYSIS

While studying any market, it is important to identify the key players. A company's market share helps analyze its share relative to the total market. The analysis related to the key players and their share in the market helps identify the extent to which they provide a premium-quality product, premium service, or price advantage. A company with a large market share is most likely to have higher profit margins. The market share explains the consumers' preference for a product over similar products. A larger market share also signifies that the company has achieved economies of scale in procurement, manufacturing, marketing, and other cost components.

Companies are focusing on expanding their production facilities by entering into partnerships and agreements and launching products to grow their businesses and market share. Product launches because of extensive research & development (R&D) initiatives, geographical expansion to tap the potential of emerging economies, and strategic acquisitions to gain a foothold over the large extent of the supply chain are the key strategies adopted by companies in the membrane filtration market.

TABLE 488 MEMBRANE FILTRATION MARKET: INTENSITY OF COMPETITIVE RIVALRY

INTENSITY OF COMPETITIVE RIVALRY	COMPETITIVE
Alfa Laval	10–12%
GEA Group Aktiengesellschaft	8–10%
DuPont	5–7%
Pall Corporation	4–5%
3M	2–3%
Total	30–40%

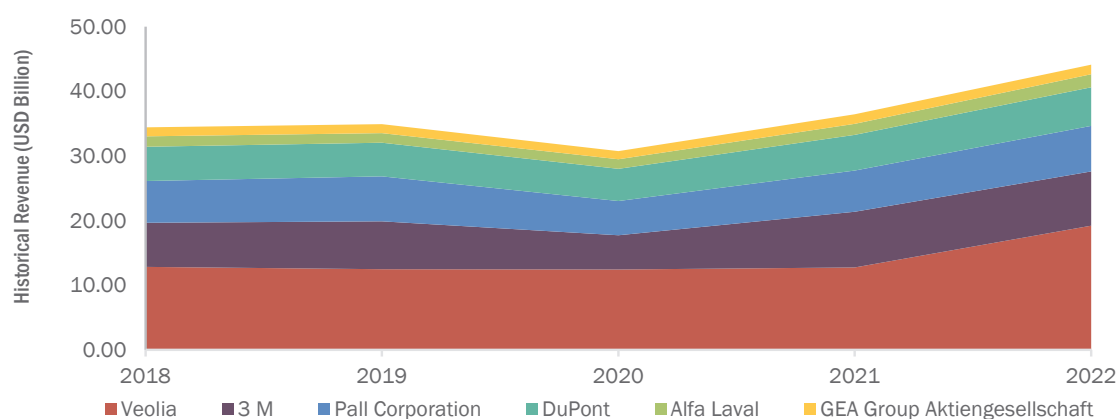
Note: The companies in the above table are ranked based on their revenue growth, segmental revenue growth, product portfolio, the number of developments (January 2018 to November 2021), geographical footprint, and product innovations.

INTENSITY OF COMPETITIVE RIVALRY IS DEFINED BELOW:

- Fragmented: When the top 5 players have a total market share = <25%.
- Competitive: When the top 5 players have a total of 25–50% of the market share.
- Consolidated: When the top 5 players have a total market share = >50%.
- Source: Annual Reports, Press Releases, Investor Presentations, Primary Interviews, and MarketsandMarkets Analysis

12.3 HISTORICAL REVENUE ANALYSIS FOR KEY PLAYERS

This section provides insights into key players' revenue in the membrane filtration market from 2018 to 2022.

FIGURE 53 HISTORICAL REVENUE ANALYSIS FOR KEY PLAYERS, 2018–2022 (USD MILLION)

Source: Company Websites, Annual Reports, Presentations, and MarketsandMarkets Analysis

The segmental revenue analysis of key players in the membrane filtration market indicates that Veolia (France) accounted for the largest share of the segmental revenue. The company focuses on key strategies such as partnerships and expansions to strengthen its position in the membrane filtration market.

This is followed by 3M (US), which is another top player in the market. The company is strongly focused on innovation, which has helped it compete with the key players in the industry. The company spends a significant portion of its total revenue on research and development every year.

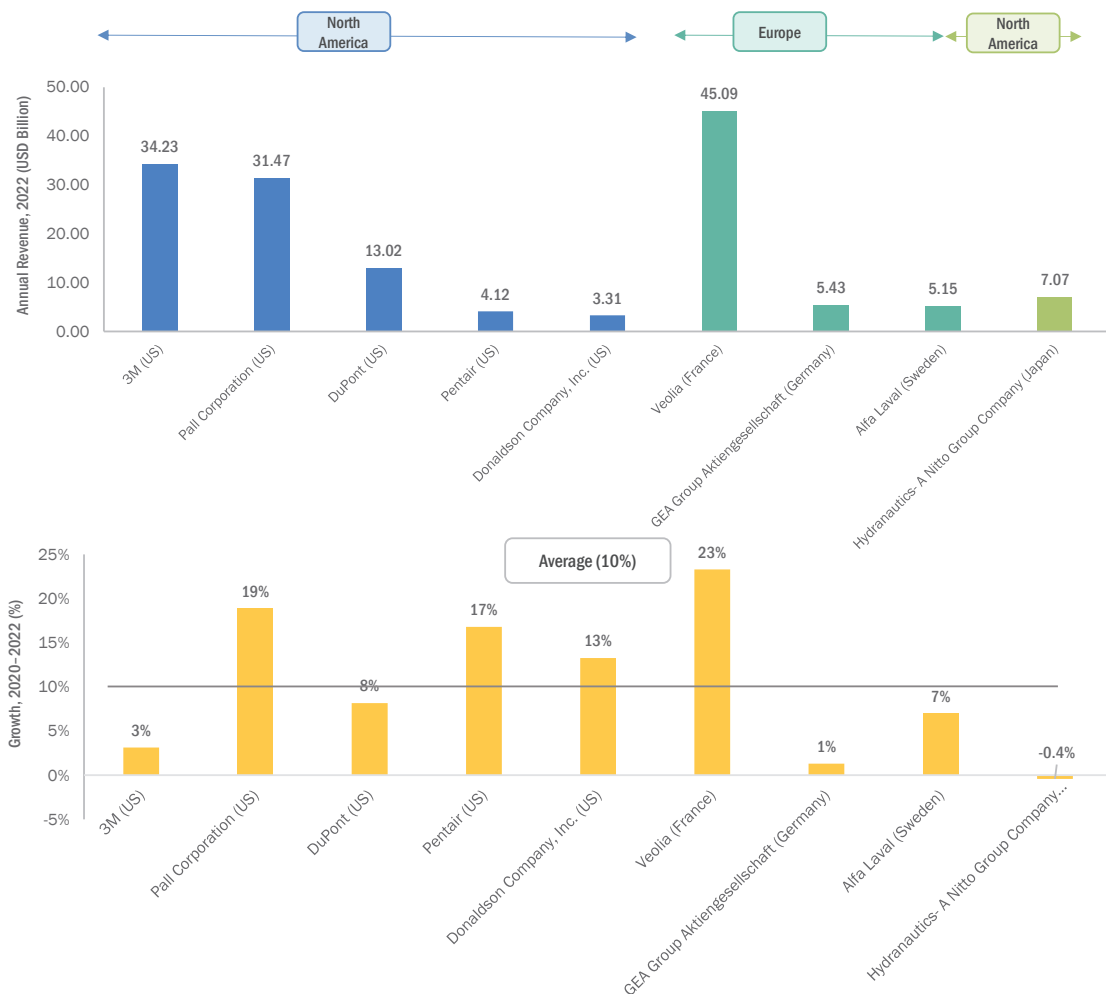
Pall Corporation (US) has been expanding its business to produce and cater to more consumers, which has helped it strengthen its position in the market.

Dupont (US) strongly focuses on product launches to increase its market share and hold a leading position in the membrane filtration market.

Alfa Laval (Sweden) & GEA Group Aktiengesellschaft (Germany) have also been expanding their global reach through mergers and acquisitions, which have helped the company sustain its position in such a competitive market.

12.4 ANNUAL REVENUE VS. REVENUE GROWTH FOR KEY PLAYERS

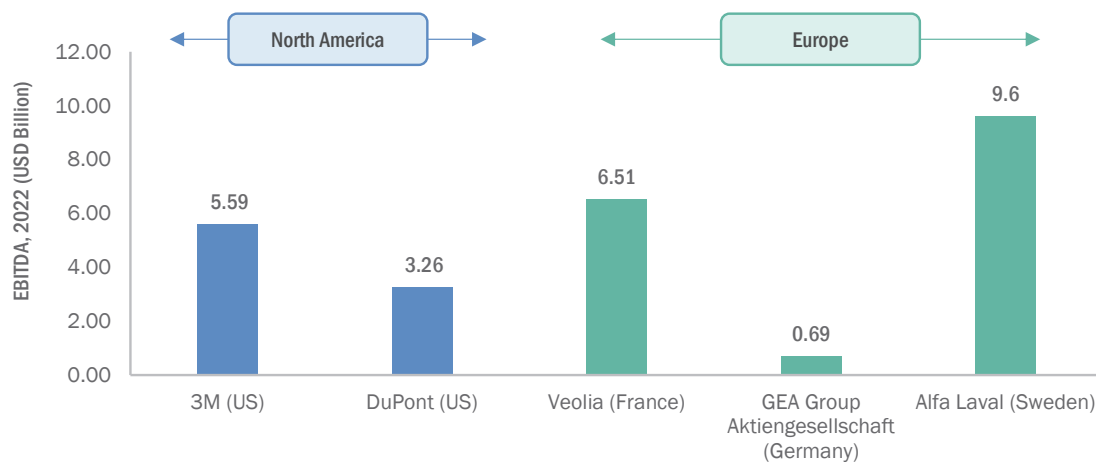
FIGURE 54 ANNUAL REVENUE, 2022 (USD BILLION) VS. REVENUE GROWTH, 2020-2022



Source: Company Websites, Annual Reports, Presentations, and MarketsandMarkets Analysis

12.5 EBITDA OF KEY PLAYERS, 2022 (USD BILLION)

FIGURE 55 EBITDA OF KEY PLAYERS, 2022 (USD BILLION)



Source: Company Websites, Annual Reports, Presentations, and MarketsandMarkets Analysis

12.6 STRATEGIES ADOPTED BY KEY PLAYERS

Alfa Laval (Sweden), GEA Group Aktiengesellschaft (Germany), DuPont (USA), Veolia (US), and Pall Corporation (US) are among the key players in the global membrane filtration market. To strengthen their market position in the global membrane filtration market, companies are now focusing on strategies such as mergers & acquisitions, product innovations, joint ventures, collaborations, and partnerships. Consumer awareness regarding safety and the filtration process will allow market participants to capitalize on the unrealized potential.

TABLE 489 STRATEGIES ADOPTED BY KEY PLAYERS

KEY PLAYER	PRODUCT TYPE	STRATEGIC DEVELOPMENT/ PARTNERSHIP	MERGER & ACQUISITION/ PRODUCT LAUNCH	REGION
Alfa Laval	<ul style="list-style-type: none"> ▪ Flat Sheet Membranes ▪ Spiral Membranes ▪ LabStak ▪ Lab Or Pilot Units ▪ Modules ▪ Membrane Filtration Systems 	NA	Sandymount is a US-based company specializing in beverage technologies and uses a novel, patented membrane technique to concentrate beer. Alfa Laval's wide array of products and technologies will allow beer makers to distribute high-quality beer in a concentrated form, creating new business prospects for the organization and enabling a more sustainable beer delivery supply chain. The recently purchased	The company has 42 significant manufacturing facilities (22 in Europe, 10 in Asia, 8 in the US, and 2 in Latin America) and over 100 service centers. More than 100 nations sell Alfa Laval's products, systems, and services, with 50 of them having their own sales teams.

				business will be incorporated into the Food Systems Business Unit of Alfa Laval's Food & Water Division. The technology, combined with Alfa Laval's wide product range, will open interesting business opportunities for the company and enable a more sustainable beer-delivery supply chain.	
GEA Group Aktiengesellschaft	<ul style="list-style-type: none"> ▪ Membrane Plants & Solutions ▪ Replacement Membranes 	NA		<p>GEA Group Aktiengesellschaft launched the new 'EasyCon Filtration Unit,' which uses crossflow filtration technology with nanofiltration or reverse osmosis spiral wound membranes. It has a standardized modular design that reduces investment costs and improves returns on investment.</p>	The company has a presence in more than 50 countries across the globe, spanning North America, South America, Europe, Africa, and the Asia Pacific.
DuPont	<ul style="list-style-type: none"> ▪ Dizzer ▪ IntegraFlo ▪ IntegraFlux ▪ IntegraPac ▪ MEMCOR ▪ Multibore ▪ T-Rack ▪ DesaliTec ▪ DuPont Specialty Membranes ▪ FilmTec ▪ FilmTec Fortilife ▪ FilmTec HyperShell ▪ FilmTec iLEC ▪ FilmTec Prime RO ▪ TapTec ▪ FilmTec ▪ FilmTec Fortilife ▪ FilmTechHyperShell ▪ FilmTec iLEC ▪ DesaliTec 	NA		<p>DuPont acquired Desali Tech Ltd., a closed-circuit reverse osmosis (CCRO) company. This acquisition in the rapidly expanding market for water purification underlines its strategic goal of offering a broad range of technologies to address current and future customer challenges while improving the organization's commitment to sustainability.</p>	By reportable segment and geographic region, the number of manufacturing and other significant locations worldwide is as follows: EMEA (22), Asia Pacific (54), US and Canada (55), and Latin America (3).

Veolia	<ul style="list-style-type: none"> ▪ Reverse Osmosis ▪ Nurion ▪ Sensa 	NA	NA	the company operates in 108 countries across Latin America, North America, the Middle East, and the Asia Pacific.
Pall Corporation	<ul style="list-style-type: none"> ▪ Seitz Filter Sheets ▪ Oenoflow ▪ Supor ▪ MEMBRACart ▪ Oenopure ▪ PROFi ▪ CFS NEO Systems ▪ Keraflux ▪ SUPRADisc SD II ▪ SUPRApak ▪ Seitz ▪ Profile ▪ Ultipleat ▪ PREcart ▪ PSS Plus Series ▪ PMM ▪ Emflon ▪ Claris Series ▪ Pall Aria ▪ VFK Series ▪ Microflow XL 	NA	Pall Corporation finalized a shareholding acquisition of Pall-Austar Lifesciences Limited, a joint venture (JV) established by Pall and Austar. This acquisition will expand its manufacturing capacity to primarily support China's single-use technology supply chain demand driven by COVID-19.	The company has a presence in North America, Western Europe, and other high-growth and developed markets.

Source: Company Websites, Annual Reports, Presentations, and MarketsandMarkets Analysis

12.7 GLOBAL SNAPSHOT OF KEY PARTICIPANTS

FIGURE 56 GLOBAL SNAPSHOT OF KEY PARTICIPANTS, 2022



Note: This is not an extensive list of companies.

Source: Company Websites, Annual Reports, Presentations, and MarketsandMarkets Analysis

12.8 COMPANY EVALUATION MATRIX FOR KEY PLAYERS

12.8.1 STARS

Stars include the leading market players in terms of the strength of their product portfolios and business strategies. These players focus on new product & technology launches as well as acquiring a leading market position by providing broad portfolios, catering to the varied requirements of the market, and focusing on diverse end-user segments. They are also focused on innovation and are geographically diversified. They have broad industry coverage and strong operational & financial strength.

Alfa Laval (Sweden), GEA Group Aktiengesellschaft (Germany), DuPont (US), Veolia (France), TORAY INDUSTRIES, INC. (Japan), and Pall Corporation (US) are some of the star companies identified in the membrane filtration market.

12.8.2 EMERGING LEADERS

Emerging leaders are players with a strong focus on innovation and invest strongly in their R&D endeavors. These players hold market-specific technology developments and have launched new products in the recent past.

3M (US), Koch Separation Solutions (US), Hydranautics- A Nitto Group Company (Japan), and Pentair (US) are the major emerging leaders in the membrane filtration market.

12.8.3 PERVASIVE PLAYERS

Pervasive players have a relatively high score on the business strategy robustness criteria compared with their peers.

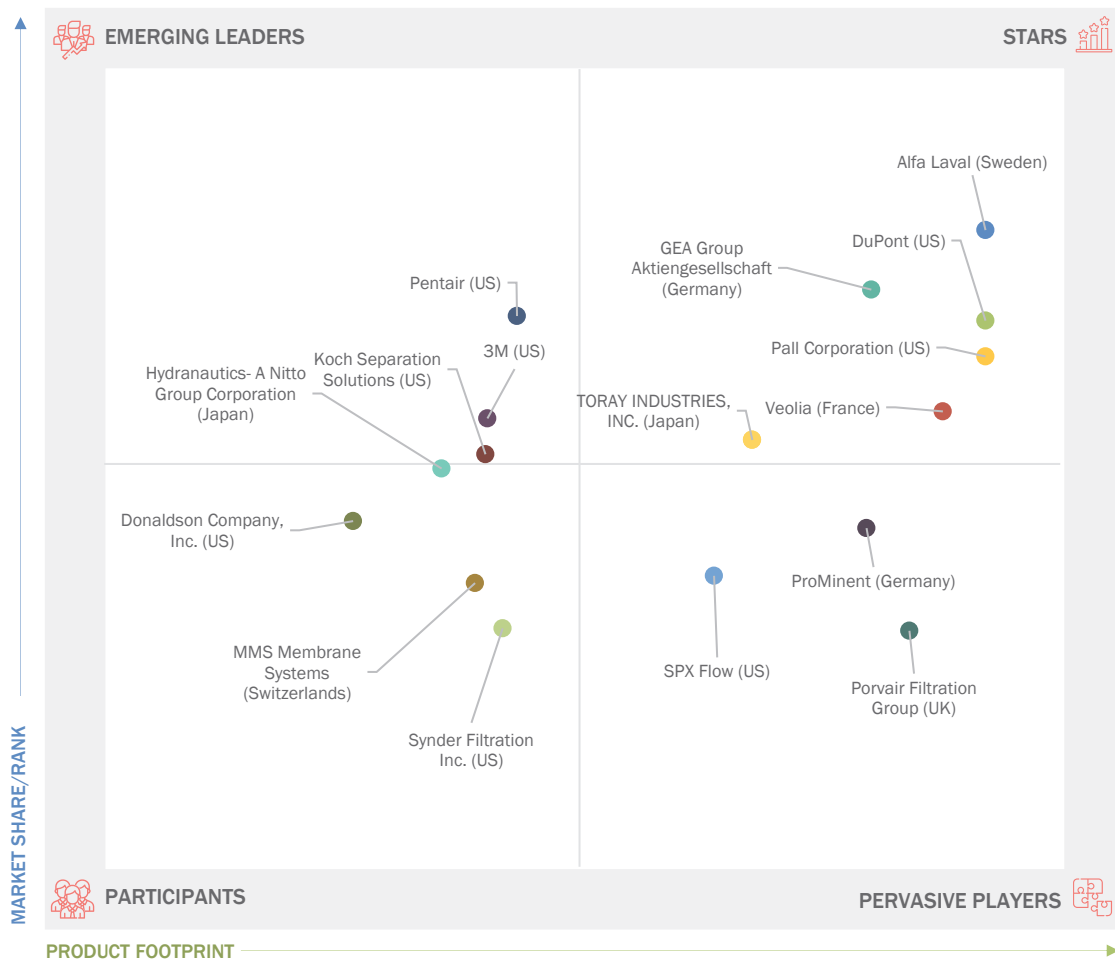
SPX Flow (US), Porvair Filtration Group (UK), and ProMinent (Germany) are pervasive players in the membrane filtration market.

12.8.4 PARTICIPANTS

The membrane filtration market also includes some participants who have recently included market-related services in their portfolios, have a limited product portfolio catering to the market, or are comparatively small in operations. In terms of geographical reach as well, they have a limited footprint. However, their operational & financial strength is comparatively limited.

MMS Membrane Systems (Switzerland), Donaldson Company, Inc. (US), and Synder Filtration Inc. (US) are the major participants in the membrane filtration market.

FIGURE 57 COMPANY EVALUATION MATRIX FOR KEY PLAYERS, 2022



Source: Company Websites, Annual Reports, Presentations, and MarketsandMarkets Analysis

12.8.5 PRODUCT FOOTPRINT

TABLE 490 COMPANY FOOTPRINT, BY TYPE

COMPANY	REVERSE OSMOSIS	ULTRAFILTRATION	MICROFILTRATION	NANOFILTRATION	SCORE
Alfa Laval (Sweden)	Y	Y	Y	Y	4.00
GEA Group Aktiengesellschaft (Germany)	Y	Y	Y	Y	4.00
DuPont (US)	Y	Y	Y	Y	4.00
Pall Corporation (US)	Y	Y	Y	Y	4.00
Veolia (France)	Y	Y	Y	Y	4.00
3M (US)	Y	Y	Y	Y	4.00
Pentair (US)	Y	N	Y	N	2.00
Porvair Filtration Group (UK)	N	N	Y	N	1.00
Donaldson Company, Inc. (US)	N	N	Y	N	1.00
MMS Membrane Systems (Switzerland)	Y	Y	Y	Y	4.00
Koch Separation Solutions (US)	Y	Y	Y	Y	4.00
ProMinent (Germany)	Y	Y	Y	Y	4.00
SPX Flow (US)	Y	Y	Y	Y	4.00
Hydranautics- A Nitto Group Company (Japan)	Y	Y	Y	Y	4.00
Synder Filtration Inc. (US)	N	Y	Y	Y	3.00
TORAY INDUSTRIES, INC. (Japan)	Y	Y	Y	Y	4.00

Source: Company Websites, Annual Reports, Presentations, and MarketsandMarkets Analysis

TABLE 491 COMPANY FOOTPRINT, BY APPLICATION

COMPANY	DAIRY PRODUCTS	WINE & BEER	DRINKS & CONCENTRATES	OTHER FOOD & BEVERAGE APPLICATIONS	SCORE
Alfa Laval (Sweden)	Y	Y	Y	Y	4.00
GEA Group Aktiengesellschaft (Germany)	Y	N	Y	Y	3.00
DuPont (US)	Y	N	N	N	1.00
Pall Corporation (US)	Y	Y	Y	Y	4.00
Veolia (France)	Y	Y	Y	Y	4.00
3M (US)	Y	Y	Y	Y	4.00
Pentair (US)	N	Y	Y	Y	3.00
Porvair Filtration Group (UK)	Y	N	N	N	1.00

Donaldson Company, Inc. (US)	N	N	N	N	0.00
MMS Membrane Systems (Switzerland)	Y	Y	Y	N	3.00
Koch Separation Solutions (US)	Y	Y	N	N	2.00
ProMinent (Germany)	Y	Y	Y	Y	4.00
SPX Flow (US)	Y	Y	Y	N	3.00
Hydranautics- A Nitto Group Company (Japan)	Y	Y	Y	Y	4.00
Synder Filtration Inc. (US)	Y	Y	Y	N	3.00
TORAY INDUSTRIES, INC. (Japan)	Y	Y	N	N	2.00

Source: Company Websites, Annual Reports, Presentations, and MarketsandMarkets Analysis

TABLE 492 COMPANY FOOTPRINT, BY REGION

COMPANY	NORTH AMERICA	EUROPE	ASIA PACIFIC	SOUTH AMERICA	ROW	OVERALL REGION FOOTPRINT
Alfa Laval (Sweden)	Y	Y	Y	Y	Y	4.00
GEA Group Aktiengesellschaft (Germany)	Y	Y	Y	Y	Y	4.00
DuPont (US)	Y	Y	Y	Y	Y	4.00
Pall Corporation (US)	Y	Y	Y	Y	Y	4.00
Veolia (France)	Y	Y	Y	Y	Y	4.00
3M (US)	Y	Y	Y	Y	Y	4.00
Pentair (US)	Y	Y	Y	Y	Y	4.00
Porvair Filtration Group (UK)	N	Y	Y	Y	Y	3.20
Donaldson Company, Inc. (US)	Y	Y	Y	Y	Y	4.00
MMS Membrane Systems (Switzerland)	Y	Y	Y	Y	Y	4.00
Koch Separation Solutions (US)	Y	Y	Y	Y	Y	4.00
ProMinent (Germany)	Y	Y	Y	Y	Y	4.00
SPX Flow (US)	Y	Y	Y	Y	Y	4.00
Hydranautics- A Nitto Group Company (Japan)	Y	Y	Y	Y	Y	4.00
Synder Filtration Inc. (US)	Y	N	N	N	N	0.80
TORAY INDUSTRIES, INC. (Japan)	Y	Y	Y	Y	Y	4.00

Source: Company Websites, Annual Reports, Presentations, and MarketsandMarkets Analysis

TABLE 493 OVERALL COMPANY FOOTPRINT

COMPANY	FOOTPRINT, BY TYPE	FOOTPRINT, BY APPLICATION	FOOTPRINT, BY REGION	TOTAL SCORE
Weightage	33%	33%	33%	100%
Alfa Laval (Sweden)	4.00	4.00	4.00	3.99
GEA Group Aktiengesellschaft (Germany)	4.00	3.00	4.00	3.65
DuPont (US)	4.00	1.00	4.00	2.99
Pall Corporation (US)	4.00	4.00	4.00	3.99
Veolia (France)	4.00	4.00	4.00	3.99
3M (US)	4.00	4.00	4.00	3.99
Pentair (US)	2.00	3.00	4.00	2.99
Porvair Filtration Group (UK)	1.00	1.00	3.20	1.72
Donaldson Company, Inc. (US)	1.00	0.00	4.00	1.65
MMS Membrane Systems (Switzerland)	2.00	3.00	4.00	2.99
Koch Separation Solutions (US)	4.00	2.00	4.00	3.32
ProMinent (Germany)	4.00	4.00	4.00	3.99
SPX Flow (US)	4.00	3.00	4.00	3.65
Hydranautics- A Nitto Group Company (Japan)	4.00	4.00	4.00	3.99
Synder Filtration Inc. (US)	3.00	3.00	0.80	2.26
TORAY INDUSTRIES, INC. (Japan)	4.00	2.00	4.00	3.32

Source: Company Websites, Annual Reports, Presentations, and MarketsandMarkets Analysis

12.9 COMPANY EVALUATION MATRIX FOR STARTUPS/SMES

12.9.1 PROGRESSIVE COMPANIES

The membrane filtration market includes certain progressive companies, which, though they are in the initial stages of development, have done exceedingly well in terms of product portfolios and business strategies. These companies have well-developed marketing channels and extensive funding to build their product portfolios. These companies are instrumental in achieving high-growth prospects and gaining higher partner attractiveness.

MANN+HUMMEL (Germany), Graver Technologies (US), and Critical Process Filtration Inc. (US)

are progressive companies operating in the membrane filtration market.

12.9.2 STARTING BLOCKS

These companies are start-ups with niche offerings. They still focus on gaining a leading position in the market. Unlike other start-ups, they do not have strong business strategies or product portfolios. They constantly seek to tap growth opportunities in the market.

Imemflo (Germany) and Applied Membranes Inc. (US) are the starting blocks in the membrane filtration market.

12.9.3 RESPONSIVE COMPANIES

These companies are technology disruptors offering innovative products. They constantly work on developing their product portfolios. However, they do not have a strong business strategy and can be responsive if backed by appropriate marketing techniques, suitable partnerships, and VC funding.

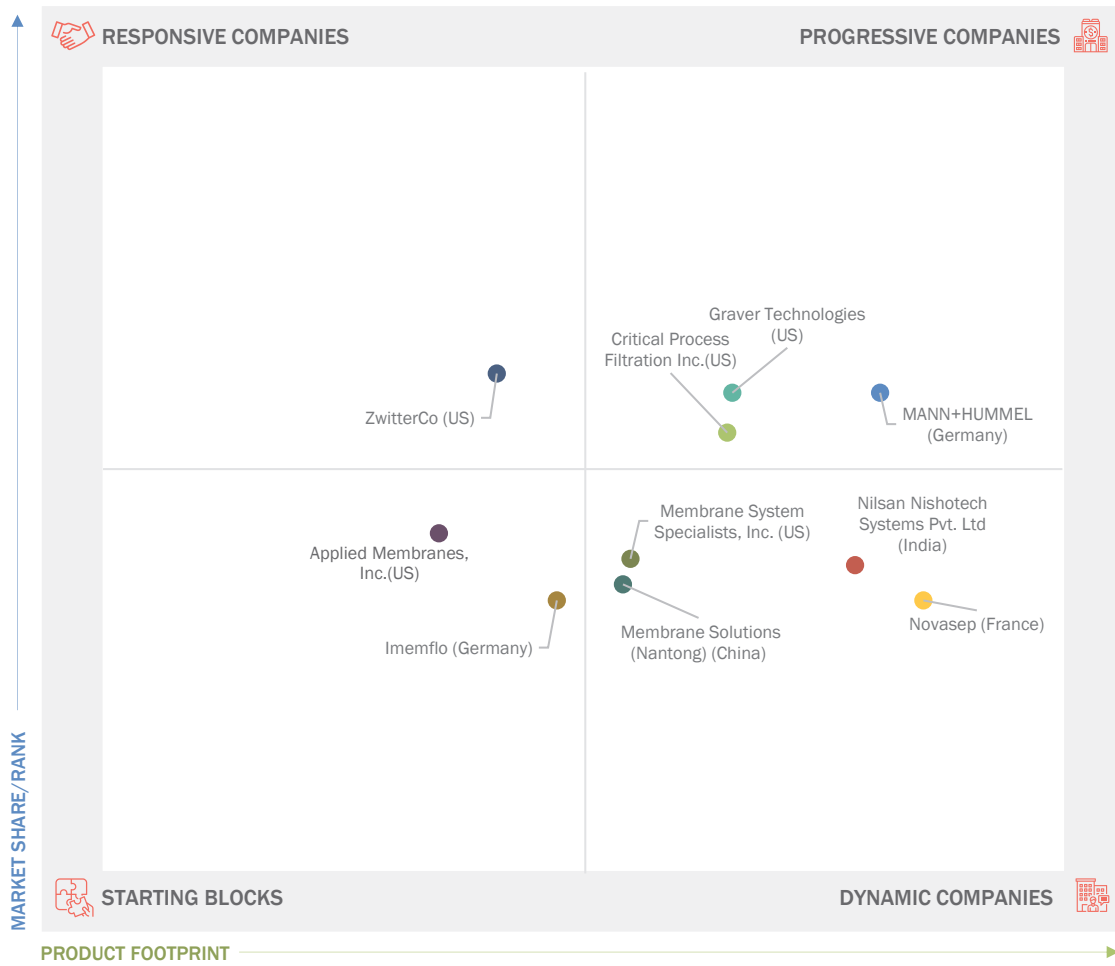
ZwitterCo (US) is the key responsive company in the market.

12.9.4 DYNAMIC COMPANIES

These startups perform substantially in the business excellence parameter. They generally focus on a specific type of technology related to their product offerings.

Novasep (France), Nilsan Nishotech Systems Pvt. Ltd (India), Membrane Solutions (Nantong) (China), and Membrane System Specialists, Inc. (US) are considered dynamic companies in the membrane filtration market.

FIGURE 58 COMPANY EVALUATION MATRIX FOR STARTUPS/SMES, 2022



Source: Company Websites, Annual Reports, Presentations, and MarketsandMarkets Analysis

12.9.5 COMPETITIVE BENCHMARKING

TABLE 494 DETAILED LIST OF STARTUPS/SMES

COMPANY NAME	CATEGORY	OWNERSHIP STATUS	HQ LOCATION	YEAR FOUNDED	NO. OF EMPLOYEES	FINANCING STATUS	LATEST FUNDING ROUND	TOTAL FUNDING (\$ MN)
MANN+HUMMEL (Germany)	Manufacturer	Private	Ludwigsburg, Germany	1941	21,000	NA	NA	NA
Graver Technologies (US)	Manufacturer	Private	Glasgow, Delaware (US)	1866	20,000	NA	NA	NA
Critical Process Filtration Inc. (US)	Manufacturer	Private	Nashua, New Hampshire	1998	NA	NA	NA	NA
Novasep (France)	Manufacturer	Private	Lyon, France	1995	1,250	Private Equity Backed	-	-
Nilsan Nishotech Systems Pvt. Ltd (India)	Manufacturer	Private	Navi Mumbai, India	1995	NA	NA	NA	NA
Applied Membranes, Inc. (US)	Manufacturer	Private	Vista, California	1983	NA	NA	NA	NA
ZwitterCo (US)	Manufacturer	Private	Cambridge, Massachusetts	2018	33	Venture Capital Backed	Series A	USD 33.4 Million
Membrane Solutions (Nantong) (China)	Manufacturer	Private	Shanghai	2006	NA	NA	NA	NA
Membrane System Specialists, Inc. (US)	Manufacturer	Private	Wisconsin Rapids, Wisconsin	2006	NA	NA	NA	NA
Imemflo (Germany)	Manufacturer	Private	Germany	2018	NA	NA	NA	NA

Source: Company Websites and MarketsandMarkets Analysis

TABLE 495 OVERALL COMPETITIVE BENCHMARKING OF STARTUPS/SMES

COMPANY NAME	TYPE				APPLICATION						REGION				
	REVERSE OSMOSIS	ULTRAFILTRATION	MICROFILTRATION	NANOFILTRATION	FOOD & BEVERAGES	DAIRY	WINE	BEER	DRINKS & CONCENTRATES	OTHERS	NORTH AMERICA	EUROPE	ASIA PACIFIC	SOUTH AMERICA	ROW
MANN+HUMMEL (Germany)	Y	Y	Y	Y	Y	Y	N	N	N	N	Y	Y	Y	Y	Y
Graver Technologies (US)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N
Critical Process Filtration Inc. (US)	Y	Y	Y	Y	N	N	Y	Y	Y	N	Y	N	N	N	N
Novasep (France)	N	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	N	N
Nilsan Nishotech Systems Pvt. Ltd (India)	Y	Y	Y	Y	Y	Y	N	N	N	N	N	N	Y	N	N
Applied Membranes, Inc. (US)	Y	Y	Y	Y	Y	Y	N	N	N	N	Y	N	N	N	N
ZwitterCo (US)	Y	Y	Y	Y	Y	Y	Y	N	N	N	Y	N	N	N	N
Membrane Solutions (Nantong) (China)	Y	Y	Y	Y	Y	Y	Y	Y	N	N	Y	N	Y	N	N
Membrane System Specialists, Inc. (US)	Y	Y	Y	Y	Y	N	N	N	N	N	Y	Y	N	Y	N
Imemflo (Germany)	Y	Y	Y	Y	Y	Y	N	N	N	N	Y	N	N	N	N

Source: Company Websites and MarketsandMarkets Analysis

12.10 COMPETITIVE SCENARIO

12.10.1 PRODUCT LAUNCHES

Adopting this strategy ensured the development of products and helped strengthen companies' product portfolios.

TABLE 496 PRODUCT LAUNCHES, 2020-2023

MONTH & YEAR	COMPANY NAME	PRODUCT NAME	PRODUCT TYPE	PRODUCT DESCRIPTION
February 2023	SPX Flow (US)	Membrane Filtration	APV membrane filtration	The APV membrane filtration technology features various solutions designed to fit various plant sources, including soy, oats, nuts, rice, peas, and more. The solutions, designed based on processing needs, include process filtration like microfiltration and ultrafiltration for fractionation, concentration, and standardization of plant protein. Additionally, nanofiltration and reverse osmosis systems are available for solids concentration, valorization of subproducts, and water recovery.
September 2022	GEA Group Aktiengesellschaft (Germany)	software solution	GEA Smart Filtration	GEA introduced the intelligent software solution GEA Smart Filtration for membrane filtration plants, which monitors the plant status remotely via app. This tool is another cornerstone in GEA's software portfolio that leverages the power of cloud connectivity and real-time analytics to increase plant availability and performance.
February 2021	TORAY INDUSTRIES, INC. (Japan)	Ultrafiltration Membrane	PVDF UF membrane	Polyvinylidene fluoride (PVDF) ultrafiltration (UF) membrane with virus removal capabilities and high water permeability. This innovation targets safe and economical water supplies treated with minimal energy for various applications, from food and beverages to wastewater reuse.
June 2021	Porvair Filtration Group (US)	String Wound Cartridge Filters	TekfilSW	Available in a variety of media types. This product has a wide range of chemical compatibility with either polypropylene or steel cores. The use of glass fibers on a steel core enables a wide range of solvents and operating temperatures up to 400 °C. The Tekfil SW range is suitable for many filtration applications.
September 2020	MMS Membrane Systems (Switzerland)	Membrane Filtration	BeerMAX	The BeerMAX technology, developed by MMS, offers a solution for creating low-alcohol beer while preserving its genuine taste and aroma. This innovation employs a gentle, cold process to remove alcohol from fully fermented beverages, ensuring that original flavor, aroma, and body are retained. The BeerMAX system has a capacity of 50 - 100 hl/day, making it suitable for small and medium-sized breweries.

June 2020	GEA Group Aktiengesellschaft AG (Germany)	Crossfiltration System	EasyCon	GEA Group Aktiengesellschaft launched the new 'EasyCon Filtration Unit,' which uses crossflow filtration with nanofiltration or reverse osmosis spiral-wound membranes. It has a standardized modular design that reduces investment costs and improves returns on investment.
June 2020	Porvair Filtration Group (US)	Polypropylene Guard Filters	Trapfil	This pleated all-polypropylene filter cartridge has been specially developed to retain yeast cells and powder released downstream of the centrifuge or crossflow/cake filtration. The unique structure was designed to resist repetitive backwashing cycles, CIP, and SIP processes.

Source: Company Websites, Company Publications, and Press Releases

12.10.2 DEALS

Companies adopted this strategy to expand their product range and geographical presence in developing markets.

TABLE 497 DEALS, 2020–2022

MONTH & YEAR	DEAL TYPE	COMPANY 1 NAME	COMPANY 2 NAME	DESCRIPTION	DEAL SIZE
July 2022	Acquisition	Pentair (US)	Manitowoc Ice (US)	Pentair, a prominent player in the field of water treatment and fluid solutions, has concluded the process of acquiring Manitowoc Ice, a reputable company renowned for its ice-making equipment. This strategic move bolsters Pentair's product portfolio by integrating Manitowoc Ice's profound proficiency in ice production technology. The acquisition fortifies Pentair's market presence within the commercial ice-making sector, facilitating its continued expansion in the broader water solutions industry.	USD 1.6 Billion
July 2022	Partnership	MMS Membrane Systems (Switzerland)	AFRY AB (Sweden)	In collaboration with AFRY, MMS Nordic has secured significant orders for dairy projects in Sweden and Germany. The partnership between MMS Nordic and AFRY involves the integration of MMS's key components and solutions into engineering projects. This achievement reflects MMS's commitment to delivering advanced membrane solutions for various industrial applications.	NA

April 2022	Acquisition	SPX Flow (US)	Lone Star (US)	An affiliate of Lone Star Funds has successfully acquired SPX Flow, a leading provider of process solutions for the nutrition, health, and industrial markets ("Lone Star"). This transaction is the best strategy and achieves the company's desire to maximize value for SPX FLOW shareholders.	NA
May 2021	Acquisition	Pentair (US)	Ken's Beverage, Inc. (US)	Pentair, a company specializing in water solutions, has announced its definitive agreement to acquire certain Ken's Beverage Inc. assets. This strategic step aims to enhance Pentair's beverage dispensing offerings, allowing them to provide more comprehensive solutions to their customers.	USD 80 Million
March 2021	Acquisition	Pall Corporation (US)	Pall-Austar JV (China)	Pall Corporation has finalized a shareholding acquisition of Pall-Austar Lifesciences Limited, a joint venture (JV) established by Pall and Austar. This acquisition will expand manufacturing capacities to primarily support China's single-use technology supply chain demand driven by COVID-19.	NA
December 2020	Acquisition	Alfa Laval (Sweden)	Sandymount (US)	Sandymount is a US-based company specializing in beverage technologies. It uses a novel, patented membrane technique to concentrate beer. Alfa Laval's wide array of products and technologies will allow beer makers to distribute high-quality beer in concentrated forms, creating new business prospects and enabling a more sustainable beer delivery supply chain. The recently purchased business will be incorporated into the Food Systems Business Unit of Alfa Laval's Food & Water division. The technology, in combination with Alfa Laval's wide variety of products, will open interesting business opportunities for the company and enable a more sustainable beer-delivery supply chain.	NA

November 2020	Acquisition	SUEZ Water Technologies and Solutions (US)	RELCO (US)	Koch Separation Solutions, an entity in the separation technology sector, successfully acquired Relco. This acquisition reinforces Koch Separation Solutions' position in the industry by integrating Relco's expertise in dairy technology. The move highlights Koch Separation Solutions' dedication to broadening its capabilities and presence within the dairy technology domain.	NA
September 2020	Acquisition	MANN+HUMMEL (Germany)	Helsa Functional Coating (Germany)	MANN+HUMMEL acquired Helsa Functional Coating to establish itself as a technological leader in the expanding market and further position the business for future growth. This is a step toward attaining the company's vision of 'Leadership in filtration.'	NA
June 2020	Synder Filtration, Inc. (US)	Membrane Filtration	Optima Flow Series Elements	Synder Filtration launched the optima Flow Series Elements. This new product range is accessible in the same standard element sizes and models for all existing MAX membrane types and ultrafiltration and microfiltration standards. The addition of the Optima Flow Series to Synder's membrane offering shows Synder's commitment to addressing the specific application needs of consumers by providing a wide range of products, upholding a high standard of quality, being responsive, and offering industry delivery times.	NA

Source: Company Websites, Company Publications, and Press Releases

12.10.3 OTHERS

Companies undertook expansions through the establishment of R&D, innovation centres, and production facilities in various regions to meet the increasing customer demands.

TABLE 498 OTHERS, 2022-2023

MONTH & YEAR	COMPANY NAME	DEVELOPMENT TYPE	DEVELOPMENT	DESCRIPTION
March 2023	ProMinent (Germany)	Expansion	New Office	ProMinent, a renowned company, officially opened new office facilities in Thailand. This expansion reflected ProMinent's commitment to the Thailand market and its desire to provide enhanced services and support to its customers in the region. The inauguration of these new offices signifies ProMinent's dedication to strengthening its presence and operations in Thailand.
August 2022	Pall Corporation (US)	Expansion	Manufacturing Facility	Pall Corporation (US) announced the launch of a manufacturing facility in Singapore. This aims to meet the increasing demand for membrane filtration in industries like food and beverages, dairy, wineries, and breweries.

Source: Company Websites, Company Publications, and Press Releases

13 COMPANY PROFILES

13.1 KEY PLAYERS

13.1.1 ALFA LAVAL

13.1.1.1 Business overview

Alfa Laval, formerly known as AB Separator, was founded by Gustaf de Laval and his partner Oscar Lamm Jr. in Sweden in 1883. Alfa Laval is a world-leading, global provider of high-quality products in 3 primary business divisions: energy, food & water, and marine. The company uses 3 key technologies: heat transfer, separation, and fluid handling. Through an extensive range of innovative equipment, the company makes significant contributions to various industries, such as energy & utilities, home & personal care, food, dairy & beverage, marine & transportation, pharma & biotech, and water & wastewater.

Through its food & water division, the company offers food, pharmaceuticals, biotech, vegetable oils, breweries, dairy, and personal care products. It also focuses on public and industrial water treatment and wastewater and waste treatment, including several UF, MF, NF, and RO products that serve the food, beverage, and water industries.

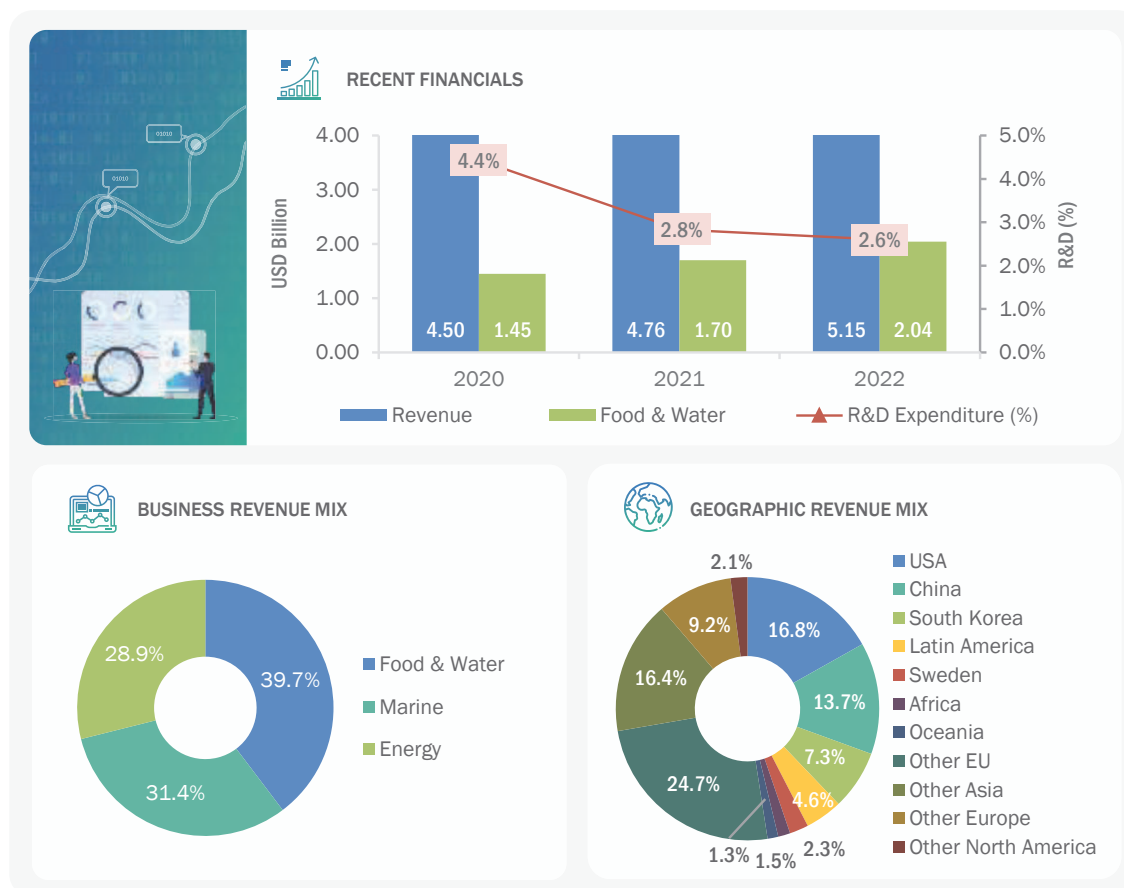
The membrane filtration systems manufactured by Alfa Laval involve all types of membrane filtration processes, including reverse osmosis, nanofiltration, ultrafiltration, and microfiltration. The company offers a wide selection of flat sheet membranes and spiral elements. It also offers pilot laboratory tools. The modular architecture of the company's membrane filtration equipment allows for a high degree of flexibility as membranes are built into modules, modules into loops, and loops into systems. Thus, a system's design may be altered to suit any process requirements, and it is simple to expand if production needs to rise.

More than 100 nations sell Alfa Laval's products, systems, and services, with 50 of them having their own sales teams. The company has 42 significant manufacturing facilities (22 in Europe, 10 in Asia, 8 in the US, and 2 in Latin America) and over 100 service centers. At present, the company employs around ~20,300 people worldwide, with the largest nations in terms of employee numbers being Sweden, China, Denmark, the US, and India.

TABLE 499 ALFA LAVAL: BUSINESS OVERVIEW

Founded	1883
Country	Sweden
City	Lund
No. of Employees	~20,300
Annual Revenue	USD 5.15 Billion
Segmental Revenue	USD 2.04 Billion
R&D Expenditure	USD 0.13 Billion
Ownership	Public (STO: ALFA)

Source: Company Websites, Company Publications, and Press Releases

FIGURE 59 ALFA LAVAL: COMPANY SNAPSHOT

Source: Company Website, Company Publications, Annual Reports, and Press Releases

13.1.1.2 Products offered

TABLE 500 ALFA LAVAL: PRODUCTS OFFERED

PRODUCT TYPE	PRODUCT	DESCRIPTION	APPLICATION
Flat Sheet Membranes	NF Flat Sheet	These membranes have pore sizes of 300 Dalton, which allow the passage of small ions at 55 bar pressure and withhold larger ions and most organic components.	
	RO Flat Sheet	These membranes have minute pores, which allow the passage of only small fractions of salts and deficient molecular compounds, along with the water that is the prime component of the permeate.	<ul style="list-style-type: none"> ▪ Wine ▪ Beer ▪ Dairy ▪ Juices
	UF Flat Sheet	These membranes are based on polypropylene (PP) support material, permitting an extended pH and temperature range.	
Spiral Membranes	NF Spiral	These membranes have pore sizes of 300 Dalton, which allow the passage of small ions at 55 bar pressure and withhold larger ions and most organic components.	<ul style="list-style-type: none"> ▪ Wine ▪ Beer

	RO Spiral	These membranes have minute pores, which allow the passage of only small fractions of salts and deficient molecular compounds, along with the water that is the prime component of the permeate.	<ul style="list-style-type: none"> ▪ Dairy ▪ Juices
	UF Spiral	These membranes have a sanitary and compact full-fit design, which allows salts, sugars, organic acids, and smaller peptides to pass through the membrane's pores through ultrafiltration. In contrast, proteins, fats, and polysaccharides are retained.	
LabStak	LabStak M10	These are used for crossflow membrane filtration.	<ul style="list-style-type: none"> ▪ Juice production ▪ Wine and distilled alcohol production ▪ Dairy processing ▪ Others
	LabStak M39 L/H	These are used for ultrafiltration and microfiltration of highly viscous products and fermentation broths.	
	LabStak M20	These are flexible plate-and-frame testing equipment for membrane filtration processes and flat sheet membranes and can be equipped with any Alfa Laval RO, NF, UF, or MF flat sheet membrane.	
	LabStak M37/38	These are flexible plate-and-frame test units utilized for UF and MF membrane processes.	
Lab or Pilot Units	LabUnit M37/38	These are plate-and-frame systems for ultrafiltration and microfiltration membrane processes.	<ul style="list-style-type: none"> ▪ NA
	TestUnit M20	These can be fitted with any flat sheet or spiral membrane for microfiltration, nanofiltration, ultrafiltration, and reverse osmosis.	
	LabUnit M10	These are crossflow membrane filtration plants offered for ultrafiltration and microfiltration.	
Modules	PilotUnit Multi	These are manufactured based on the unique LabStak (plate-and-frame) modules, full-fit sanitary spiral membranes, or even a combination of both.	<ul style="list-style-type: none"> ▪ Food ▪ Dairy ▪ Beverages
	Module M30	These are developed for reverse osmosis (RO) and nanofiltration (NF) tasks.	
	Module M37	These are designed for ultrafiltration (UF) and microfiltration (MF) of high-viscosity products (50–250 cP) and fermentation broths.	
	Module M38L/H	These are manufactured to treat all low- to medium-viscosity products (1–25 cP) and fermentation broths through ultrafiltration and microfiltration.	
Membrane Filtration Systems	Module M39L/H	These are used for ultrafiltration and microfiltration of highly viscous products (1–30 cP) and fermentation broths.	<ul style="list-style-type: none"> ▪ Others
	AL-mem	These ultrafiltration systems with crossflow are used to continuously operate automatically controlled product concentrations.	

Lowal De Alcoholizer	These systems dealcoholize all beer and fermented low-alcohol drinks and provide more energy-efficient production of higher quality low-alcohol or non-alcoholic beer.	▪ Beer
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Source: Company Website

13.1.1.3 Recent developments

TABLE 501 ALFA LAVAL: DEALS

MONTH & YEAR	DEAL TYPE	COMPANY NAME 1	COMPANY NAME 2	DESCRIPTION	DEAL SIZE
December 2020	Acquisition	Alfa Laval (Sweden)	Sandymount (US)	Sandymount is a US-based company specializing in beverage technologies. It uses a novel, patented membrane technique to concentrate beer. Alfa Laval's wide array of products and technologies will allow beer makers to distribute high-quality beer in concentrated forms, creating new business prospects and enabling a more sustainable beer delivery supply chain. The recently purchased business will be incorporated into the Food Systems Business Unit of Alfa Laval's Food & Water division. The technology, in combination with Alfa Laval's wide variety of products, will open interesting business opportunities for the company and enable a more sustainable beer-delivery supply chain.	NA

Source: Company Website, Press Releases, and Company Publications

13.1.1.4 MnM view

13.1.1.4.1 Right to win

Alfa Laval offers a wide array of membrane filtration systems that have varied applications in dairy processing, coffee and tea production, and non-alcoholic and alcoholic drink production. The company has a robust global presence, with major customers located in the US and China. Tapping the Middle Eastern and African markets for membrane filtration would create promising opportunities for Alfa Laval. The solutions offered by the company are energy-efficient and advantageous to its customers.

The company is increasingly shifting toward sustainable manufacturing of first-rate products using the most recent technologies with minimum energy and water consumption. Developing a sustainable and competitive product line and investing in technological innovations have resulted in better performance.

13.1.1.4.2 Strategic choices made

The company is highly dependent on inorganic growth strategies, such as acquisitions, to increase its market share. Due to this strategy, the company has maintained its leading position in the membrane filtration market.

In 2021, the company introduced and endorsed a new sustainability strategy. The most important topics the company will concentrate on by 2030 are included in the strategy. Four key areas make up the strategy: care, commitment, circularity, and climate. These sectors reflect the most pressing environmental, social, and governance (ESG) challenges. The company has also established long-term and short-term goals in various areas, which will be monitored by KPIs to guarantee ongoing progress and prepare for potential obstacles.

13.1.1.4.3 Weaknesses and competitive threats

The company's products are quite expensive compared to other smaller competitors. Constant fluctuations in the cost of raw materials could also serve as a threat. Strategies are to be adopted to expand businesses in all the regions to strengthen the company's geographical expansion.

13.1.2 GEA GROUP AKTIENGESELLSCHAFT

13.1.2.1 Business overview

GEA Group Aktiengesellschaft is one of the leading technology suppliers for the food processing industry. The company provides customized solutions to the food, dairy processing, dairy farming, beverage processing, pharma, chemical, marine, leisure & sport, land-based transportation, and utility industries. The company has 5 technological divisions: separation & flow technologies, liquid & powder technologies, food & healthcare technologies, farm technologies, and heating & refrigeration technologies.

The company's separation & flow technologies business division offers process-related components and machinery, notably separators, decanters, homogenizers, valves, and pumps. The company offers membrane filtration under this segment.

The liquid & powder technologies business division offers processing equipment and integrated solutions for the dairy, food (including new food), beverage, chemical, and home & personal care industries. Brewing systems, liquid processing and filling, concentration, precise fermentation, crystallization, purification, drying, powder handling, packaging, and emission control systems are all included in the range.

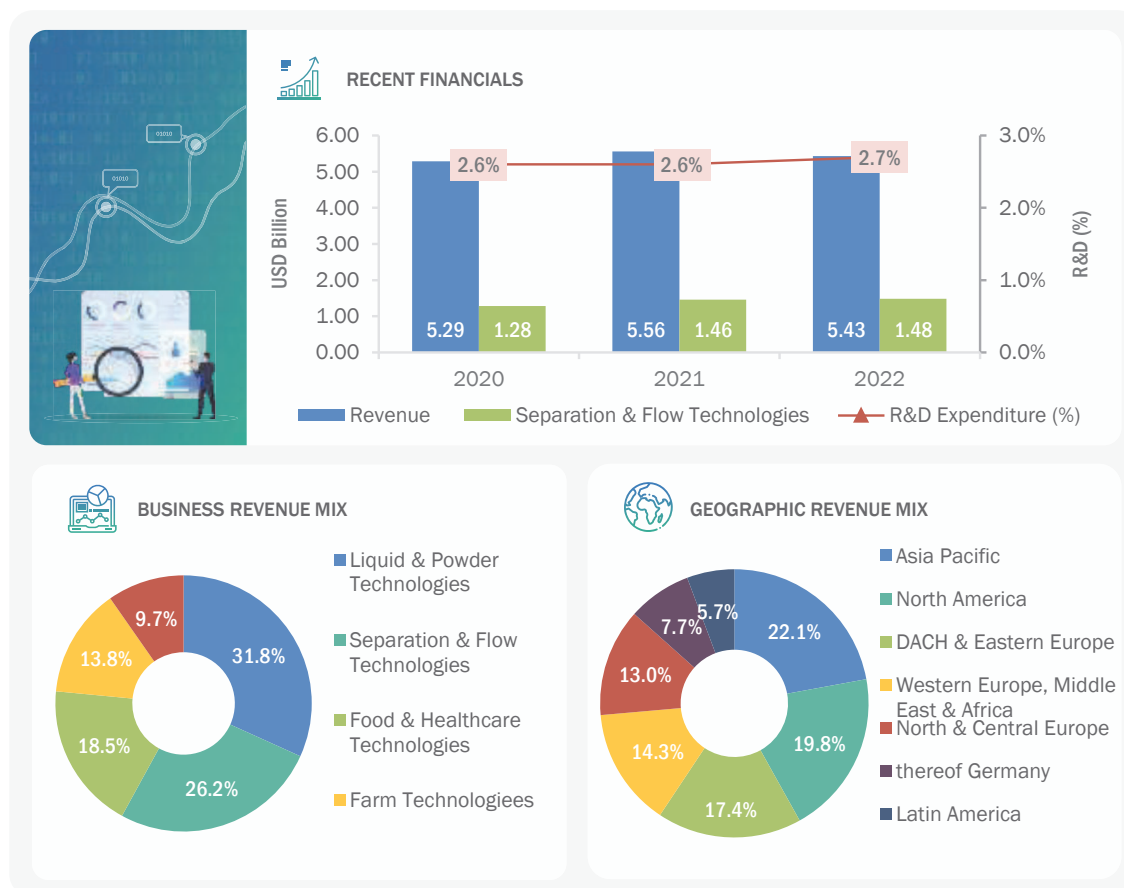
GEA provides crossflow membrane filtration to industrial processes requiring product separation or concentration without applying heat. Various applications of these crossflow membranes exist throughout the food, dairy, pharmaceutical, biotechnology, and starch & sweetener industries.

The company has a strong presence in more than 50 countries across North America, South America, Europe, Africa, and Asia Pacific. The group operates through its subsidiaries, including GEA Procomac S.p.A (Italy), GEA Process Engineering Private Limited (India), GEA Food Solutions (Brazil), GEA Food Solutions North America, Inc. (US), and GEA Food Solutions UK & Ireland Limited (UK). The major competitors of GEA Group Aktiengesellschaft include Pall Corporation (US), Koch Membrane Systems Inc. (US), and Alfa Laval (Sweden).

TABLE 502 GEA GROUP AKTIENGESELLSCHAFT: BUSINESS OVERVIEW

Founded	1881
Country	Germany
City	Düsseldorf
No. of Employees	~18,236
Annual Revenue	USD 5.43 Billion
Segmental Revenue	USD 1.48 Billion
R&D Expenditure	USD 0.14 Billion
Ownership	Public (ETR: G1A)

Source: Company Websites, Company Publications, and Press Releases

FIGURE 60 GEA GROUP AKTIENGESELLSCHAFT: COMPANY SNAPSHOT

Source: Company Website, Company Publications, and Company Annual Reports

13.1.2.2 Products offered

TABLE 503 GEA GROUP AKTIENGESELLSCHAFT: PRODUCTS OFFERED

PRODUCT TYPE	PRODUCTS	DESCRIPTION	APPLICATION
Membrane Plants & Solutions	Beer Recovery Unit	These are used for crossflow filtration with robust ceramic membranes.	Beer
	CIP Recovery Unit	These are pH-resistant nanofiltration (NF) membranes.	Others
	Ceramic Beer Filtration	These are used for waste-free beer filtration with ceramic crossflow membranes.	Beer
	COLDSAN - Cold Sanitation of Cheese Brine	These are brine sanitation units fitted with polymeric microfiltration membrane elements.	Dairy and dairy products
	Condensate Polisher	These are membrane filtration systems that use reverse osmosis.	Dairy and dairy products

	Dealcoholization Membrane Unit	These units are built on reverse osmosis membrane filtration technologies.	Wine and beer
	Membrane Unit to Produce FAB	These membrane filtration systems produce malt bases for flavored alcoholic beverages (FAB).	Beer
	EasyCon Filtration Unit	These units use crossflow filtration with nanofiltration or reverse osmosis spiral-wound membranes.	Others
	Membrane Unit to Produce Hard Seltzer	Crossflow membrane filtration units are designed to deliver a clear, colorless, tasteless, and aroma-free neutral alcoholic base.	Others
Replacement Membranes	Ceramic Membranes	These membranes are developed using a support made of pure α -Al ₂ O ₃ with a microporous structure. The membrane is applied to this support material and consists of several layers of highly porous ceramic with a defined texture. The layer with the finest porosity determines the filtration characteristics.	Others
	Spiral Membranes	These spiral membranes have a compact layout and high membrane area per element.	Others

Source: Company Website

13.1.2.3 Recent developments

TABLE 504 GEA GROUP AKTIENGESELLSCHAFT: PRODUCT LAUNCHES

MONTH & YEAR	COMPANY NAME	PRODUCT TYPE	PRODUCT NAME	PRODUCT DESCRIPTION
September 2022	GEA Group Aktiengesellschaft (Germany)	software solution	GEA Smart Filtration	GEA introduced the intelligent software solution GEA Smart Filtration for membrane filtration plants, which monitors the plant status remotely via app. This tool is another cornerstone in GEA's software portfolio that leverages the power of cloud connectivity and real-time analytics to increase plant availability and performance.
June 2020	GEA Group Aktiengesellschaft AG (Germany)	Crossfiltration System	EasyCon	GEA Group Aktiengesellschaft launched the new 'EasyCon Filtration Unit,' which uses crossflow filtration with nanofiltration or reverse osmosis spiral-wound membranes. It has a standardized modular design that reduces investment costs and improves returns on investment.

Source: Company Website and Press Releases

13.1.2.4 MnM view

13.1.2.4.1 Right to win

The group has been expanding organically in Western Europe, the Middle East, Africa, and Latin America. The availability of energy-efficient technologies and products helps it meet the constantly changing consumer preferences. The company's core technologies allow it to hold a leading position worldwide. The company's membrane filtration systems help end users get an integrated, technologically advanced, energy-efficient solution based on their requirements. This gives the company a competitive edge in the market.

13.1.2.4.2 Strategic choices made

The company is highly dependent on organic growth strategies, such as product developments, to increase its market share. Due to this strategy, the company has widened its product line and maintained its leading position in the membrane filtration market.

13.1.2.4.3 Weaknesses and competitive threats

Strategies are to be adopted to expand businesses in Western Europe, the Middle East & Africa to strengthen the company's geographical expansion. Stiff competition from local and regional players could also act as a threat to the company.

13.1.3 DUPONT

13.1.3.1 Business overview

DuPont is an American conglomerate that was formed by the merger of Dow Chemical and DuPont. The company later split into 3 divisions: DuPont, Dow Chemicals, and Corteva, with each company focusing on specific areas, such as agriculture, materials science, and specialty products. DuPont, as an organization, serves a diverse array of products and has 15 product lines. These product lines include adhesives, advanced printing solutions, biomaterials, clean technologies, construction materials, consumer products, electronic solutions, fabric fibers and nonwovens, home garden and car care, industrial films, medical devices and materials, personal protective equipment, resins, solar, and water solutions. DuPont holds 176 brands under one umbrella.

The company operates through 4 major segments: electronics & industrial, water & protection, mobility & materials, and corporate. The corporate segment includes business activities to be divested and those that have already been divested, as well as a reconciliation of the totals for the reportable segments and the company's totals. Membrane filters are a part of its water & protection segment. Membrane filters are used in various industrial applications, such as municipal, power, electronics, pharmaceuticals, food & beverage, mining, and oil & gas. DuPont now operates with greater agility, a clearer focus, and an enhanced ability to bring more and better solutions to customers. As one of the global leaders in purification and specialty separation technologies, the company provides quality membrane science and ion exchange solutions that produce safe drinking water for homes and communities; help industries and markets operate more effectively, efficiently, and sustainably; and make water-scarcity challenges more manageable in the food and beverages industry.

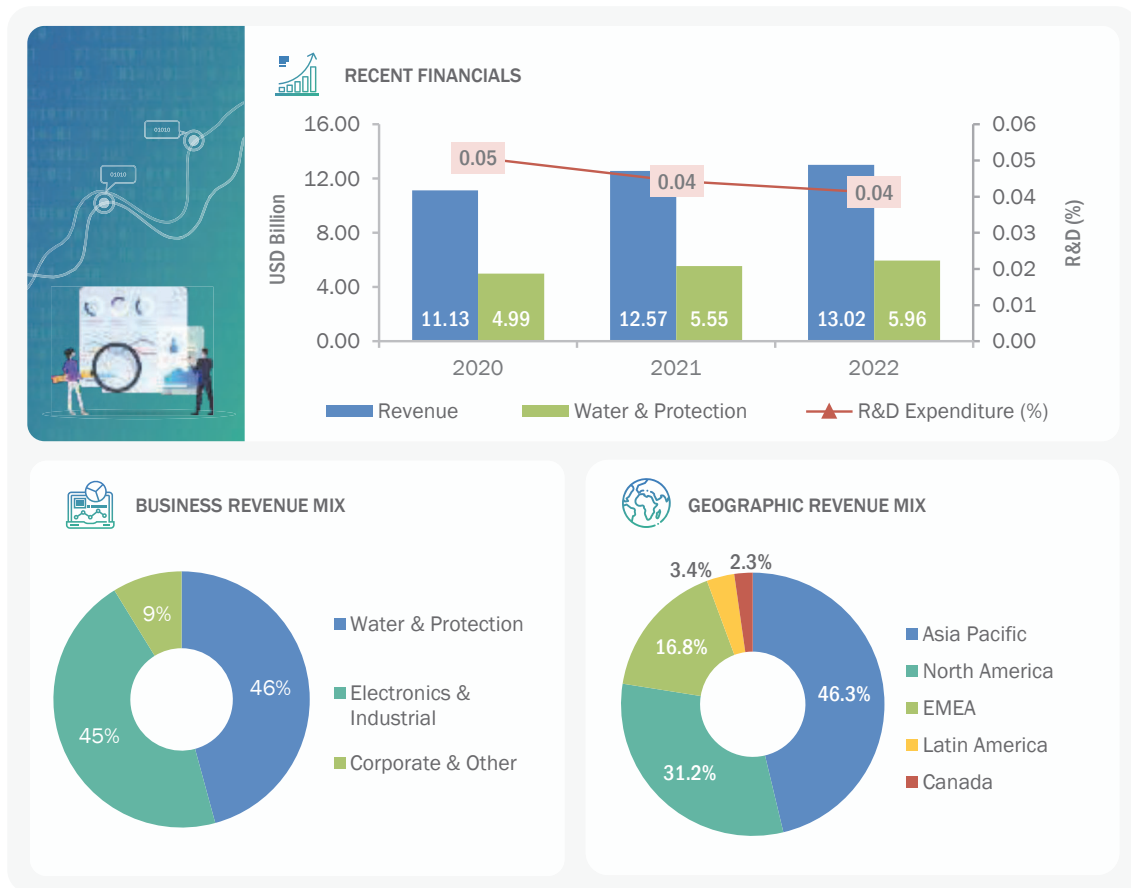
By reportable segment and geographic region, the number of manufacturing and other significant locations worldwide is as follows: EMEA (22), Asia Pacific (54), US and Canada (55), and Latin America (3).

TABLE 505 DUPONT: BUSINESS OVERVIEW

Founded	2015
Country	US
City	Delaware
No. of Employees	23,000
Annual Revenue	USD 13.02 Billion
Segmental Revenue	USD 5.96 Billion
R&D Expenditure	USD 0.54 Billion
Ownership	Public (NYSE: DD)

Source: Company Websites, Company Publications, and Press Releases

FIGURE 61 DUPONT: COMPANY SNAPSHOT



Source: Company Websites, Annual Reports, and Press Releases.

13.1.3.2 Products offered

TABLE 506 DUPONT: PRODUCTS OFFERED

PRODUCT TYPE	PRODUCTS	DESCRIPTION	APPLICATION
Ultrafiltration Membranes	<ul style="list-style-type: none"> dizzer L Series dizzer P dizzer XL DuPont IntegraFlo Filter DuPont IntegraFlux SFD-2880XP DuPont IntegraFlux SFP-2860XP DuPont IntegraFlux SFP-2880XP DuPont IntegraPac IP-51 Module DuPont IntegraPac IP-51 Skid DuPont IntegraPac IP-77 Module DuPont IntegraPac IP-77 Skid DuPont IntegraPac IPD-51XP Module DuPont IntegraPac IPD-51XP Skid 	<p>DuPont's IntegraFlo Filter integrates multiple filtration technologies into one solution by using advanced ultrafiltration and Multi-Element Vessel (MEV) technologies.</p>	Others

	<ul style="list-style-type: none"> ▪ DuPont IntegraPac IPD-77XP Module ▪ DuPont IntegraPac IPD-77XP Skid ▪ MEMCOR CP Pressurized Ultrafiltration Systems ▪ MEMCOR CPII Ultrafiltration System ▪ MEMCOR CS Submerged Membrane Systems ▪ MEMCOR CSII Ultrafiltration System ▪ MEMCOR XP Pressurized Membrane System ▪ MEMCOR XS Submerged Membrane System ▪ Multibore Membranes ▪ SFP-2660 and SFD-2660 ▪ T-Rack Rack System 		
Reverse Osmosis Elements	<ul style="list-style-type: none"> ▪ DesaliTec CCRO High-Efficiency Smart Reverse Osmosis Systems ▪ DesaliTec SOAR CCRO ▪ DesaliTec SOAR Max CCRO ▪ DuPont Specialty Membranes XUS180804 and XUS180802 Ultra-High Pressure RO Element ▪ DuPont Specialty Membranes XUS180808 Ultra-High Pressure RO Element ▪ DuPont TapTec LC HF-4040 ▪ DuPont TapTec TT Plus HF ▪ DuPont TapTec TT-3012-600G 	<p>The Specialty Membranes Element is an ultra-high-pressure element for industrial water filtration that offers a unique combination of distinct features across the industry.</p>	Dairy Others
NF 245	<ul style="list-style-type: none"> ▪ FilmTecc Hypershel NF245-8038-FF ▪ FilmTec Hypershel NF245-8038/48-FF ▪ FilmTec Hypershell NF245-390-FF ▪ FilmTec NF245-3838/30 ▪ FilmTec Hypershell NF245-3838/48-FF ▪ FilmTec NF245-3840/30-FF 		Dairy Others

Source: Company Website

13.1.3.3 MnM view

13.1.3.3.1 Right to win

DuPont is one of the top membrane filtration equipment manufacturing companies in the world. Its strong global presence, with a significant focus on the US, Canada, and the Asia Pacific, has helped the company strengthen its position in the market. Constant investments in R&D activities, collaborations with newer technologies, and adaptation of renewable energy to produce sustainable, greener, and safer products all help the company retain its position as a market leader.

13.1.3.3.2 Strategic choices made

The company offers a wide array of innovative products for each type of filtration technology. The company has focused on adopting inorganic strategies, such as acquisitions, to cement its position as the market leader in the membrane filtration market.

13.1.3.3.3 Weaknesses and competitive threats

Competition from other key players in the membrane filtration market and a weak market presence in Latin America, Europe, and the Middle East & Africa might threaten the company. DuPont operates in highly competitive industries where innovation and market share are critical.

13.1.4 PALL CORPORATION

13.1.4.1 Business overview

Pall Corporation is one of the leading companies in the global filtration, separation, and purification industry. This company manufactures and distributes filtration, separation, and purification products and integrated systems and solutions worldwide. It is a subsidiary of Danaher Corporation (US), which designs, manufactures, and markets healthcare, environmental, and industrial equipment. The company conducts its worldwide operations through global business divisions, which are reported in 3 operating segments—Life Sciences, Diagnostics, and Environmental & Applied Solutions. The company offers membrane filtration products under the Life Sciences and Environmental & Applied Solutions business divisions. The membrane filtration products offered by Pall Corporation serve the beer, wine, dairy, alcohol-free beverages, bottled water, and food ingredient industries.

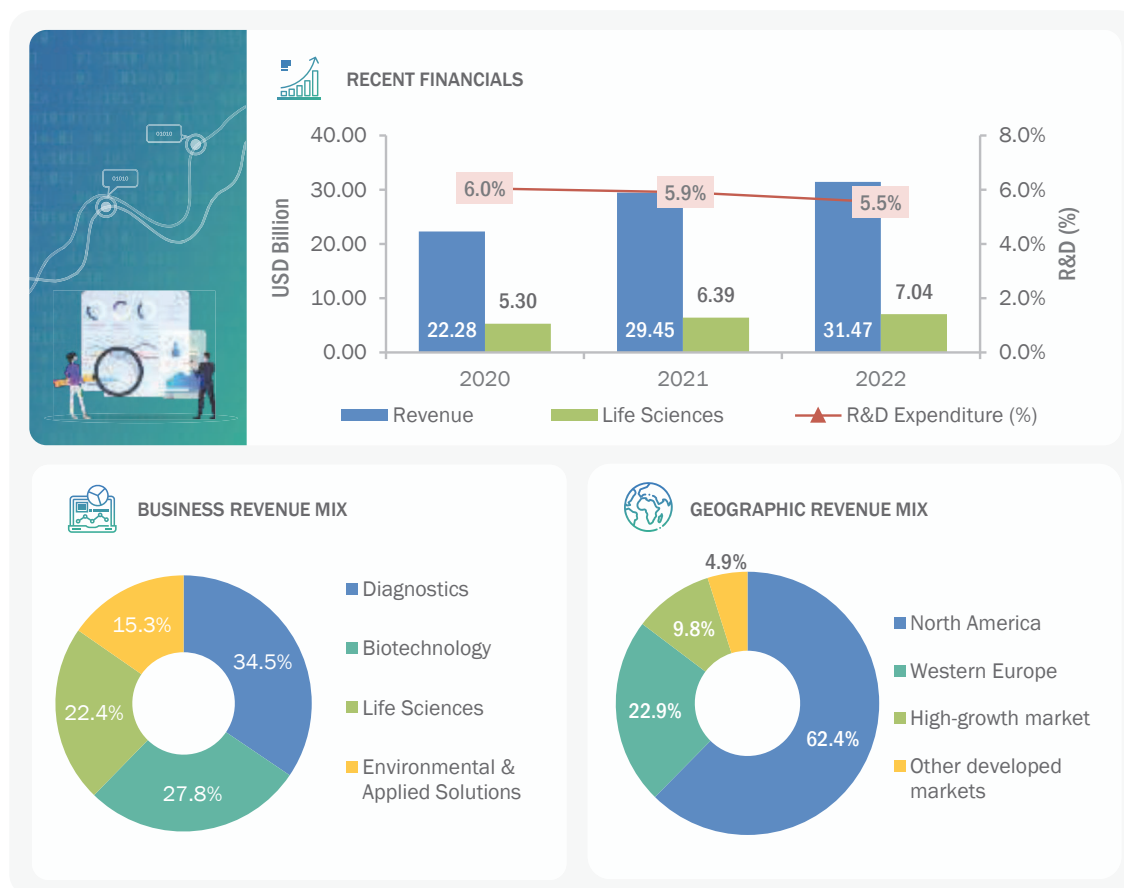
Pall joined Danaher in 2015 and has continued to push innovation since joining Danaher, creating anything from a portfolio of mobile water treatment systems to a cutting-edge filtration membrane for wet chemical processing.

The company has its presence in North America, Western Europe, and other high-growth and developed markets.

TABLE 507 PALL CORPORATION: BUSINESS OVERVIEW

Founded	1946
Country	US
City	New York
No. of Employees	81,000
Annual Revenue	USD 31.47 Billion
Segmental Revenue	USD 7.04 Billion
R&D Expenditure	USD 1.75 Billion
Ownership	Public (NYSE: DHR)

Source: Company Websites, Company Publications, and Press Releases

FIGURE 62 PALL CORPORATION: COMPANY SNAPSHOT

Note: Since Pall Corporation is a part of Danaher Corporation (US), financials for Danaher Corporation have been provided.

The high-growth markets include Eastern Europe, the Middle East, Africa, Latin America (including Mexico), and Asia (apart from Japan, Australia, and New Zealand).

The company defines developed markets as all markets of the world that are not high-growth markets.

Source: Company Website, Company Publications, Annual Reports, and Press Releases

13.1.4.2 Products offered

TABLE 508 PALL CORPORATION: PRODUCTS OFFERED

PRODUCT TYPE	PRODUCTS	DESCRIPTION	APPLICATION
Seitz Filter Sheets	<ul style="list-style-type: none"> Seitz ZD Series Depth Filter Sheets Seitz HR Series Depth Filter Sheets Seitz AKS4 Series Depth Filter Sheets Seitz K Series Depth Filter Sheets Seitz IR Series Depth Filter Sheets Seitz T Series Depth Filter Sheets 	These sheets include various coarse filtration options, making it possible to utilize them to remove the largest impurities.	Food and beverages

Oenoflow	<ul style="list-style-type: none"> Oenoflow HS Filtration System 	<p>This is a crossflow filtering system specifically created for lees processing. The hollow fiber membrane technology overcomes the common problems associated with Diatomaceous Earth (DE)-based lees filters now in use, generating higher-quality goods more effectively and cheaply.</p>	Food and beverage
	<ul style="list-style-type: none"> Oenoflow FIT System 	<p>Two hollow fiber microfiltration membranes with high flow and high area are used in the base system, which is made of stainless steel.</p> <p>The completely automated device has “Cycle” programming, allowing for the operation and cleaning of systems with minimum operator involvement. Additional modular building components can be added to the main system to customize it to winemaking conditions.</p>	Food and beverage
	<ul style="list-style-type: none"> Oenoflow PRO XL-S Crossflow Microfiltration System Oenoflow XL-E Crossflow Microfiltration System for Wine Clarification Oenoflow PRO XL-A Crossflow Microfiltration System 	<p>The completely automated system provides post-fermentation clarifying of wine in a dependable, cost-effective, and single-process step. Clarification can be accomplished without the use of centrifugation, filter aids, or having a substantial negative impact on the wine’s organoleptic properties. The technology uses hollow fiber membranes with a high surface area that Pall has proved to have exceptional chemical resistance, excellent mechanical strength, and high productivity.</p>	Food and beverage
Supor	<ul style="list-style-type: none"> Supor Beverage Filter Cartridges 	<p>These are hydrophilic membrane filters.</p>	Food and beverage
MEMBRACart	<ul style="list-style-type: none"> Membracart XL II filter 	<p>The MEMBRACart XL II filter uses a highly effective polyethersulfone membrane as the filter medium, offering excellent service life and filtration outcomes.</p>	Food and beverage
Oenopure	<ul style="list-style-type: none"> Oenopure Filter Cartridges 	<p>The cartridge is made of a highly inert medium, with minimal organoleptic and colloidal interference. To maximize mechanical strength, filter area, and exposure to repeated hot water and steam sanitization cycles for extended service life, the polyethersulfone membrane is set up in a “laid over” pleat arrangement.</p>	Food and beverage

PROFi	<ul style="list-style-type: none"> Profi Membrane System 	<p>The system combines a high-performance centrifuge with a “zero retentate” crossflow membrane filter unit for effective DE-free beer clarification. The PROFi system technology was developed through a partnership between GEA Westfalia Separator GmbH and Pall Food & Beverage.</p>	Beer
CFS NEO Systems	<ul style="list-style-type: none"> CFS NEO System for cold filtration of Beer 	<p>The CFS NEO is a self-contained, fully automated membrane filter system.</p>	Beer
Tangential Flow Filtration (TFF) System	<ul style="list-style-type: none"> Keraflux Tangential Flow Filtration (TFF) System 	<p>The system uses contemporary crossflow technology to concentrate the yeast to recover a sizeable proportion of extract that is present in the surplus yeast. The yield can potentially be increased by combining crossflow technology with controlled diafiltration. The taste of the recovered extract is not adversely affected when mixed with the original beer up to a volume of 5%.</p>	Beer
SUPRADisc II	<ul style="list-style-type: none"> SUPRADisc II ZD Series Depth Filter Modules SUPRADisc II Depth Filter Modules Craft Breweries - SUPRADisc II Depth Filter Modules Supradisc Depth Filter Modules Supradisc II Modules Supradisc HP Depth Filter Modules 	<p>The SUPRADisc module design concept combines the benefits of enclosed filters with the advantages of traditional depth filter sheets.</p>	Food and beverage
SUPRApak	<ul style="list-style-type: none"> SUPRApak ZD Series Depth Filter Modules SUPRApak Depth Filter Modules SUPRApak SH Series Modules SUPRApak SW Series Modules SUPRApak L-Series-WA Housings SUPRApak Plus PW Series Modules 	<p>To maximize product and operator protection while minimizing product losses, SUPRApak offers a closed-system approach to depth filtration.</p>	Food and beverage

Profile	<ul style="list-style-type: none"> ▪ Profile star filters ▪ Profile coreless filter elements ▪ Profile up filter cartridges ▪ Profile II depth filter cartridge ▪ Filter cartridges, removal rating 0.5 µm, polypropylene, length 30 inches, silicone, polypropylene cage ▪ Filter cartridges, ab4y0057wh4 ▪ Filter cartridges, r1f010w ▪ Filter cartridges, rf-style 30 in, 10 µm w option ▪ Filter cartridge 20 in, 5 µm 	<p>The Profile Coreless elements have a fixed fiber matrix with a graded pore structure and are made of melt-blown polypropylene media. Pre-filtration and fine filtration can occur within the same cartridge, with the coarsest pore sizes in the outermost layers and decreasing pore sizes within the innermost layers of the cartridge. These characteristics are essential to these filters' high pollutant retention capacity and outstanding removal efficiency. Compared to traditional melt-blown cartridges, the large diameter filter components allow for reduced size for a given flow rate. Accordingly, filter vessels are smaller, lowering capital and installation expenses and operational costs.</p>	Food and beverages
Ultipleat	<ul style="list-style-type: none"> ▪ Ultipleat High Flow Technology ▪ Ultipleat SP DR Filters and Ultipleat SP DR KC Assemblies ▪ Ultipleat G2 SP DR Filters and Ultipleat G2 SP DR KC Assemblies ▪ Ultipleat PK Gas Filter ▪ Ultipleat PK Filter ▪ Ultipleat PK EL Filter ▪ Ultipleat High Flow Filter System ▪ Ultipleat High Flow Series Filter Cartridges 	<p>The Ultipleat High Flow filter elements are made to handle large flow rates in a single 1,524-mm (60 inches) cartridge, up to 113 m³/hour (500 US gal/min). They use Profile UP materials with a special geometry of laid-over pleats. The Ultipleat High Flow element is a single, open-ended, pleated cartridge with a large diameter, inside-to-outside flow pattern, and no core.</p>	Food and beverages
PREcart	<ul style="list-style-type: none"> ▪ PREcart PP II Filter Cartridges 	<p>The PREcart PP II filter element is designed to meet the high mechanical resistance and compatibility requirements of typical food and beverage production cycles of filtration, sanitization, regeneration, and steam sterilization.</p>	Food and beverages
VFK Series	<ul style="list-style-type: none"> ▪ VFK Series Filter Housings 	<p>VFK housing's in-line flow pattern guarantees minimal pressure drop and convenient filter cartridge replacements. To meet the varied needs of the industry, they can be fitted with a range of air/gas filter cartridges, effectively shielding products, and processes from airborne contaminants.</p>	Food and beverages

Microflow XL	<ul style="list-style-type: none"> Microflow XL Brine Crossflow Microfiltration Systems Microflow XL M Brine Crossflow Microfiltration Systems Microflow XL E Brine Crossflow Microfiltration Systems 	<p>The Microflow XL-Brine system incorporates special features that enable dairies to perform clarification at low operating costs while providing consistent and high brine filtrate quality, owing to Pall's extensive experience in crossflow filtration of food and dairy streams and dedication to simplified process design and control logic.</p>	Dairy and dairy products
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Source: Company Website

13.1.4.3 Recent developments

TABLE 509 PALL CORPORATION: DEALS

MONTH & YEAR	DEAL TYPE	COMPANY NAME 1	COMPANY NAME 2	DESCRIPTION	DEAL SIZE
March 2021	Acquisition	Pall Corporation (US)	Pall-Austar JV (China)	Pall Corporation has finalized a shareholding acquisition of Pall-Austar Lifesciences Limited, a joint venture (JV) established by Pall and Austar. This acquisition will expand manufacturing capacities to primarily support China's single-use technology supply chain demand driven by COVID-19.	NA

Source: Company Website and Press Releases

TABLE 510 PALL CORPORATION: OTHERS

MONTH & YEAR	COMPANY NAME	DEVELOPMENT TYPE	DEVELOPMENT	DESCRIPTION
August 2022	Pall Corporation (US)	Expansion	Manufacturing Facility	Pall Corporation (US) announced the launch of a manufacturing facility in Singapore. This aims to meet the increasing demand for membrane filtration in industries like food and beverages, dairy, wineries, and breweries.

Source: Company Website, Company Publications, and Press Releases

13.1.4.4 MnM view

13.1.4.4.1 Right to win

Pall Corporation offers a wide array of cutting-edge membrane filtration devices. The devices are designed to perform many functions in every sector of the food & beverage industry; they cater to the beer, wine, juices, bottled water, and dairy industries. The company has created a strong market presence through its global presence and acquisitions.

13.1.4.4.2 Strategic choices made

Constant innovations and upgrades to existing devices to meet customer requirements are key strategies the company adopts to gain a competitive edge in the market. The company also focuses on increasing its geographical presence to be a key player in the market. For instance, in August 2022, the company opened a new manufacturing in Singapore, strengthening its position in Asia Pacific.

13.1.4.4.3 Weaknesses and competitive threats

Widening its focus may provide more growth opportunities for the company in the market. The growing number of local and global competitors in the membrane filtration market also threatens the company.

13.1.5 VEOLIA

13.1.5.1 Business overview

Veolia Water Technologies, a part of the Veolia Group, specializes in technological solutions and designs. The company undertakes water and wastewater treatment projects, serving industrial and municipal clients. Veolia manages its operations through 3 segments: water, energy, and waste.

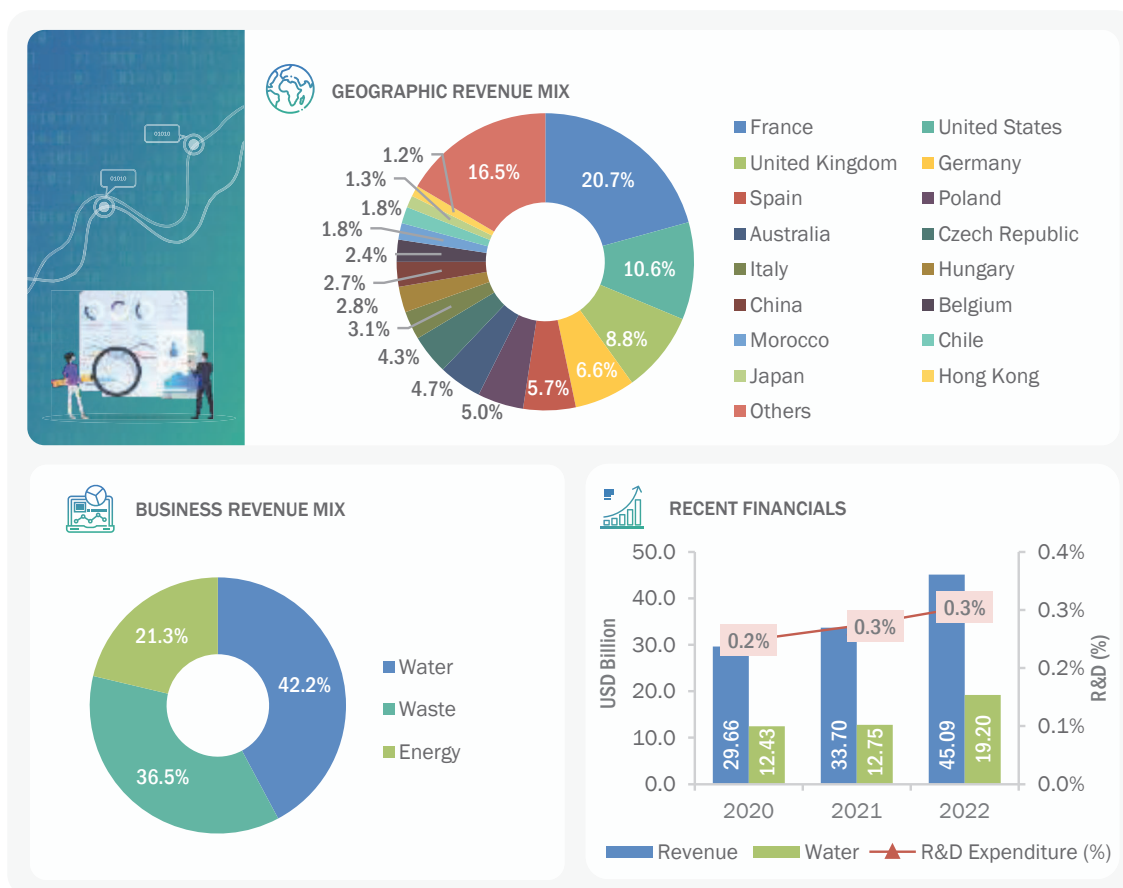
Veolia offers several membrane filtration products for various industries, such as treating drinking water, industrial process water, ultrapure water, wastewater, seawater, and food & beverages under the water segment. The company operates in 108 countries and has a considerable presence in the global membrane filtration market.

TABLE 511 VEOLIA: BUSINESS OVERVIEW

Founded	1853
Country	France
City/State	Aubervilliers
No. of Employees	220,000
Annual Revenue	USD 45.09 Billion
Segmental Revenue	USD 19.20 Billion
R&D Expenditure	USD 0.14 Billion
Ownership	Public (EPA: VIE)

Source: Company Websites, Company Publications, and Press Releases

FIGURE 63 VEOLIA: COMPANY SNAPSHOT



Source: Company Website, Company Publications, Annual Reports, and Press Releases

13.1.5.2 Products offered

TABLE 512 VEOLIA: PRODUCTS OFFERED

PRODUCT TYPE	PRODUCT	DESCRIPTION	APPLICATION
Reverse Osmosis Systems	Nurion	Nurion reverse osmosis system produces high-purity ingredient water for the food & beverage industry.	Food & beverage
	Sensa	SENSA double pass reverse osmosis system produces demineralized water for the cosmetics industry. It is designed for low conductivity (5 µS/cm) and low bacteria (10 cfu/ 100ml) product outlets.	Others

Source: Company Website

13.1.5.3 MnM view

13.1.5.3.1 Right to win

Veolia Water Technologies is one of the leading companies in the global membrane filtration market, with a significant membrane filtration product portfolio. The company has created a strong market presence through its global presence and acquisitions.

13.1.5.3.2 Strategic choices made

The company's key approach to securing a competitive edge in the market involves innovating and improving existing devices to cater to customer demands. It develops adaptation strategies to deal with climate change, such as seawater desalination and reusing wastewater.

13.1.5.3.3 Weaknesses and competitive threats

The company offers limited membrane filtration products, which can threaten the company from the big players in the market. The growing number of local and global competitors in the membrane filtration market also threatens the company.

13.1.6 3M

13.1.6.1 Business overview

3M conducts its worldwide operations through 4 operating segments: Safety and Industrial, Transportation and Electronics, Health Care, and Consumer. The company develops, manufactures, and markets its membrane filtration products under the healthcare division. It offers many capillary and flat sheet membranes and membrane modules. The membrane filtration products this company offers find application in the water, food, and beverage industries.

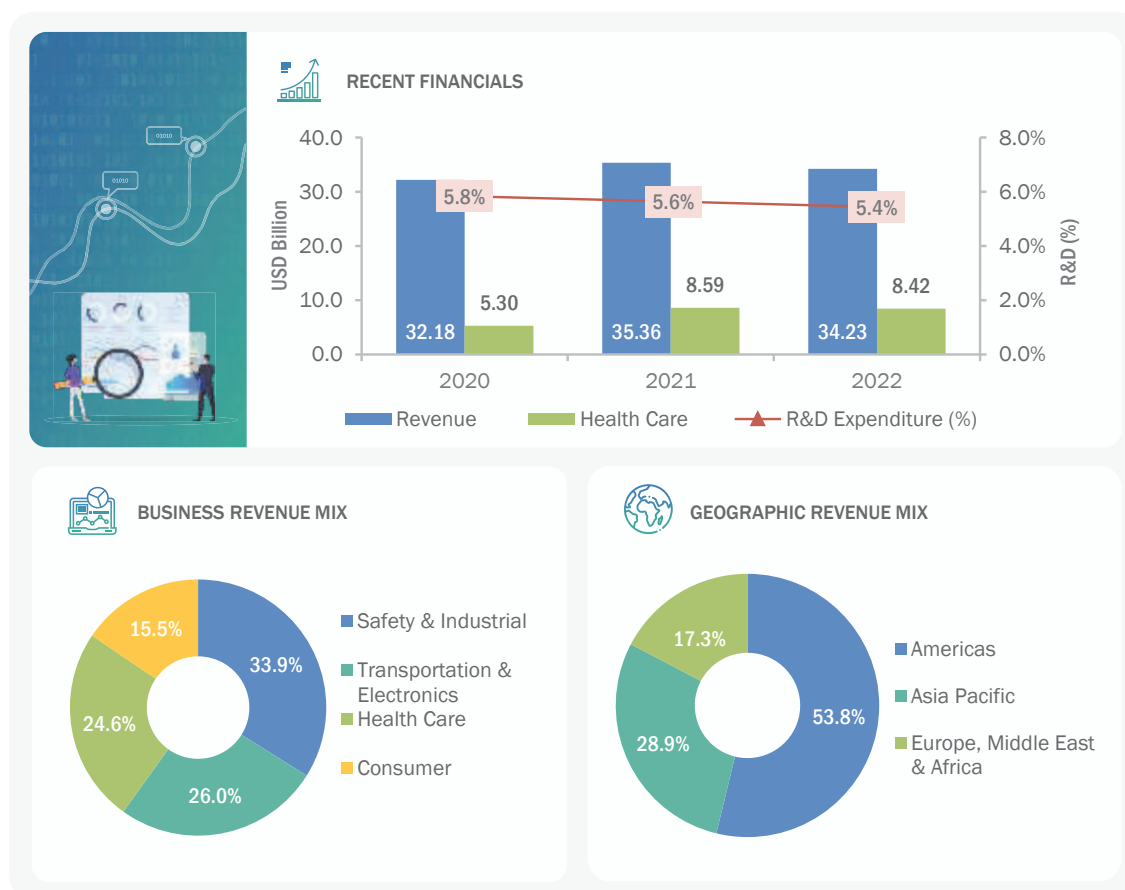
3M has a significant global footprint and is recognized for its innovations in abrasives, adhesive tape, electronics components, and other diverse industry and consumer goods manufacturing areas. 3M operates in 70 countries across North America, Europe, Asia Pacific, the Middle East & Africa, and Latin America. The company owns advanced R&D facilities and invested 5.4% of its total sales in R&D activities in 2022.

TABLE 513 3M: BUSINESS OVERVIEW

Founded	1902
Country	US
City/State	Minnesota
No. of Employees	~92,000
Annual Revenue	USD 34.23 Billion
Segmental Revenue	USD 8.42 billion
R&D Expenditure	USD 1.86 Billion
Ownership	Public (NYSE: MMM)

Source: Company Websites, Company Publications, and Press Releases

FIGURE 64 3M: COMPANY SNAPSHOT



Source: Company Website and Press Releases

13.1.6.2 Products offered

TABLE 514 3M: PRODUCTS OFFERED

PRODUCT TYPE	PRODUCT	DESCRIPTION	APPLICATION
Zeta Plus	<ul style="list-style-type: none"> 3M Zeta Plus H 3M Zeta Plus MH 	Wines are improved and safeguarded by 3M Zeta Plus technology's efficient clarification and significantly lower levels of contaminated yeast and bacteria.	Wine
LifeASSURE	<ul style="list-style-type: none"> 3M LifeASSURE BLA Series Filter Cartridge 3M LifeASSURE BNA Series Filter Cartridge 3M LifeASSURE BA Series Filter Cartridge 3M LifeASSURE BNA Series Media Disc 3M LifeASSURE PFS Series Filter Cartridge 	These are cost-effective solutions to achieve microbiological stability for non-pasteurized beer.	Beer

	<ul style="list-style-type: none"> 3M LifeASSURE PFS Series Filter Capsule 		
Liqui-Cel	<ul style="list-style-type: none"> 3M Liqui-Cel EXF Series Membrane Contactor Cartridge 3M Liqui-Cel SP Series Membrane Contactor 3M Liqui-Cel SP Series Membrane Contactor Cartridge 3M Liqui-Cel MM Series Membrane Contactor 3M Liqui-Cel EXF Series Membrane Contactor 	The 3MTM Liqui-Cel™ membrane contactors offer an adaptable, small-footprint in-line solution for quickly deoxygenating, decarbonating, carbonating, and nitrogenating liquids to precise concentration levels.	Wine and beer
Betapure	<ul style="list-style-type: none"> 3M Betapure AUL Series Filter Cartridge 3M Betapure NT-T Series Filter Cartridge 3M Betapure AU Series Filter Cartridge 3M Betapure CMP Series Filter Cartridge 3M Betapure NT-T Series Filter Cartridge 3M Betapure AUL Series Filter Cartridge 	3M provides particle control filters in several configurations. Betapure's rigid filter structure retains consistent pore sizes even under severe process conditions.	Wine
Betafine	<ul style="list-style-type: none"> 3M Betafine PPG Series Filter Mini-Cartridge 3M Betafine PPG Series Filter Cartridge 3M Betafine PEG Series Filter Cartridge 3M Betafine DP Series Filter Capsule 3M Betafine PPG Series Filter Capsule 3M Betafine DP Series Filter Cartridge 	These absolute-rated pleated filters offer reliable, repeatable filtration performance.	Food and beverage
Flat Sheet and Capillary Membranes	<ul style="list-style-type: none"> MicroPES Membrane DuraPES Membrane MF-PP 	To meet the highly varied market requirements, capillary and flat sheet hydrophobic and hydrophilic membranes are made from various materials, including polyethersulfone and polypropylene. These membranes are provided by 3M to manufacturers of filtration modules or cartridges for incorporation into their finished products.	Food and beverage
High Flow	<ul style="list-style-type: none"> 3M High Flow 	These systems help with prefiltration.	Wine and beer

Source: Company Website

13.1.6.3 MnM view

3M holds a strong position in the global membrane filtration market, offering a broad product line of membrane filtration systems. The company is more focused on the US market. Increasing its operations in Latin America and Asia Pacific, considering the increase in net sales in these regions, could aid the company in achieving more growth.

13.1.7 PENTAIR

13.1.7.1 Business overview

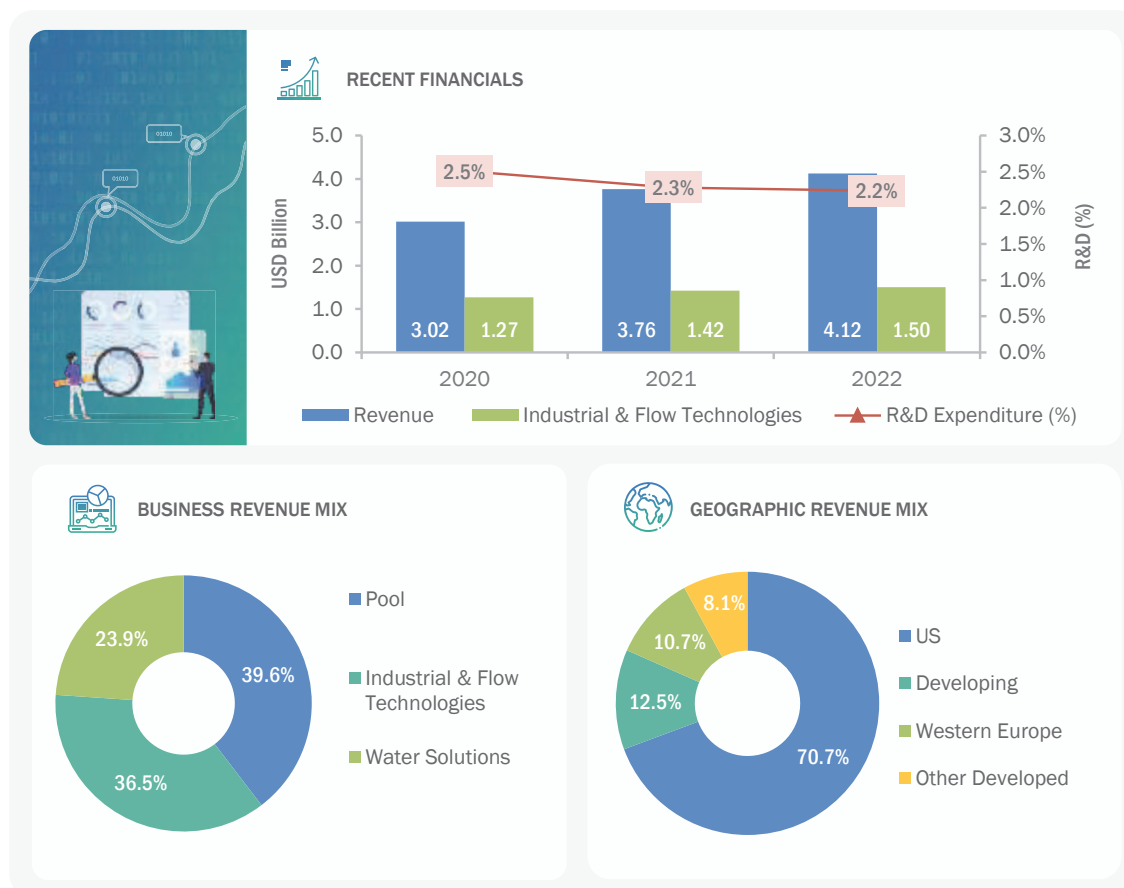
Pentair is among the largest global equipment providers. The company has a presence in around 130 locations across 34 countries. It offers a comprehensive range of products and services for various water treatment equipment and food & beverages equipment for commercial, residential, and industrial applications. It also supplies accessories, such as pumps and valves.

The company operates in 3 business segments: pool, consumer solutions, and industrial & flow technologies. The company manufactures and markets its membrane filters through its industrial and flow technologies segment. The company offers various membrane filters with RO and MF technologies.

TABLE 515 PENTAIR: BUSINESS OVERVIEW

Founded	1966
Country	US
City/State	Minneapolis, Minnesota
No. of Employees	11,250
Annual Revenue	USD 4.12 Billion
Segmental Revenue	USD 1.50 Billion
R&D Expenditure	USD 0.09 Billion
Ownership	Public (NYSE: PNR)

Source: Company Websites, Company Publications, and Press Releases

FIGURE 65 PENTAIR: COMPANY SNAPSHOT

Developing includes China, Eastern Europe, Latin America, the Middle East, and Southeast Asia.

Other Developed includes Australia, Canada, and Japan.

Source: Company Website, Company Publications, Annual Reports, and Press Releases

13.1.7.2 Products offered

TABLE 516 PENTAIR: PRODUCTS OFFERED

PRODUCT TYPE	PRODUCT	DESCRIPTION	APPLICATION
Membrane Filtration	<ul style="list-style-type: none"> BMF +FLUX COMPACT 2 BMF +FLUX COMPACT S4 BMF +FLUX S6 BMF +FLUX SMART S8 BMF COMPACT 2 BMF Direct 	NA	Beer
	<ul style="list-style-type: none"> Haffmans activated carbon filters Coalescence filters Haffmans Pre-filters CPM – PVF Haffmans Activated Carbon Filter CPM – PAK 	Haffmans Coalescence Filter CPM - PSMF is a validated submicron filter that removes particles, aerosol, water and oil droplets from the gas. It offers the most advanced pretreatment of compressed air, CO2 and other	Food & beverages

- Pentair Haffmans MK-3 CPM FilterTester gases for food, beverage, biogas, and other industries.

Source: Company Website

13.1.7.3 Recent developments

TABLE 517 PENTAIR: DEALS

MONTH & YEAR	DEAL TYPE	COMPANY NAME 1	COMPANY NAME 2	DESCRIPTION	DEAL SIZE
July 2022	Acquisition	Pentair (US)	Manitowoc Ice (US)	Pentair, a prominent player in the field of water treatment and fluid solutions, has concluded the process of acquiring Manitowoc Ice, a reputable company renowned for its ice-making equipment. This strategic move bolsters Pentair's product portfolio by integrating Manitowoc Ice's profound proficiency in ice production technology. The acquisition fortifies Pentair's market presence within the commercial ice-making sector, facilitating its continued expansion in the broader water solutions industry.	USD 1.6 Billion
May 2021	Acquisition	Pentair (US)	Ken's Beverage, Inc. (US)	Pentair, a company specializing in water solutions, has announced its definitive agreement to acquire certain Ken's Beverage Inc. assets. This strategic step aims to enhance Pentair's beverage dispensing offerings, allowing them to provide more comprehensive solutions to their customers.	USD 80 Million

Source: Company Website and Press Releases

13.1.7.4 MnM view

Pentair is an established organization offering machinery and equipment for various residential, commercial, and industrial applications. For filtration solutions, the company is operational across 14 cities in the US and 40 foreign countries with 19 manufacturing facilities and 8 sales & corporate offices. This shows its global presence and vast clientele. The company also owns 422 active US patents and 1,212 active international patents.

13.1.8 DONALDSON COMPANY, INC.

13.1.8.1 Business overview

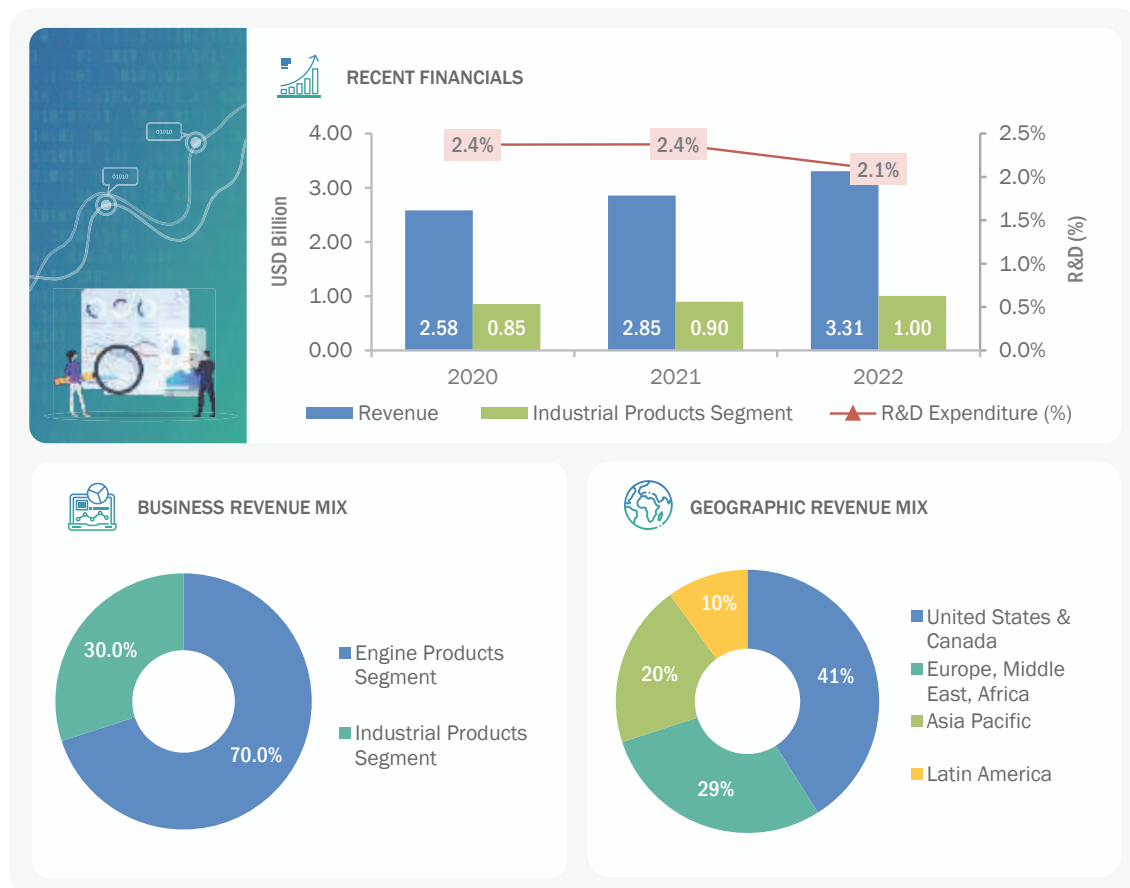
Donaldson Company, Inc. is a global leader in technology-driven filtration products and solutions. It serves a variety of industries and advanced markets and produces and distributes products globally. These products are sold directly to end customers, distributors, dealers, and original equipment manufacturers (OEMs). Donaldson's filtration technologies and products are used in various industries and environments, including aerospace, agriculture, construction, food & beverage, manufacturing, mining, power generation, transportation, and many more.

The company operates through 2 business segments: Engine Products and Industrial Products. Replacement filters for liquid and air filtration applications; air filtration systems; liquid filtration systems for fuel, lubricant, and hydraulic applications; exhaust and emission systems; and sensors, indicators, and monitoring systems are all included in the engine products segment. Dust, fume, and mist collectors; compressed air purification systems; gas and liquid filtration for food, beverage, and industrial processes; air filtration systems for gas turbines; polytetrafluoroethylene (PTFE) membrane-based products; and specialized air and gas filtration systems for applications like hard disk manufacturing, semiconductor manufacturing, sensors, indicators, and monitoring systems are all included in the industrial products segment.

TABLE 518 DONALDSON COMPANY, INC.: BUSINESS OVERVIEW

Founded	1915
Country	US
City/State	Minneapolis, Minnesota
No. of Employees	10,000+
Annual Revenue	USD 3.31 Billion
Segmental Revenue	USD 1.00 Billion
R&D Expenditure	USD 0.07 Billion
Ownership	Public (NYSE: DCI)

Source: Company Websites, Company Publications, and Press Releases

FIGURE 66 DONALDSON COMPANY, INC.: COMPANY SNAPSHOT

Source: Company Website, Company Publications, Annual Reports, and Press Releases

13.1.8.2 Products offered

TABLE 519 DONALDSON COMPANY, INC.: PRODUCTS OFFERED

PRODUCT TYPE	PRODUCT	DESCRIPTION	APPLICATION
Membranes	Tetratex	Tetratex is an expanded microporous PTFE (polytetrafluoroethylene) membrane that is exclusively produced by Donaldson Membranes. It is laminated to several different base substrates to provide a full range of media, including woven and felted textile media for conversion into various filter bag types and pleatable media for cartridge-style elements.	<ul style="list-style-type: none"> Food and beverage Others

Source: Company Press Releases, Company Website, and Company Publications

13.1.8.3 MnM view

The company's key strengths include its filtration products, strong customer relationships, and its global presence. The US represents the largest individual market for the company's products. The company's businesses and product lines are very competitive. Still, they are at risk of running at a loss for various reasons, including price, technology, performance, reliability and availability, and customer service.

13.1.9 PORVAIR FILTRATION GROUP

13.1.9.1 Business overview

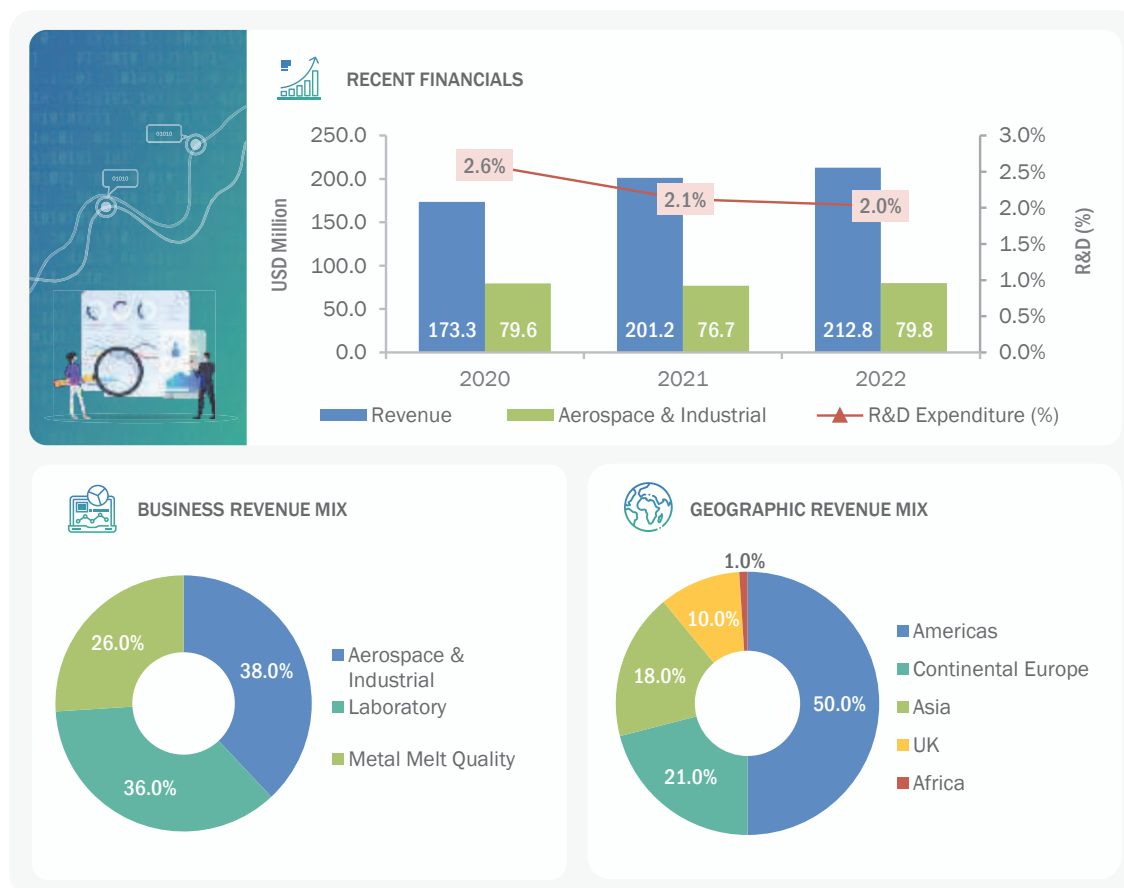
Porvair Filtration Group designs, manufactures, and supplies innovative and high-performance materials and solutions for applications in filtration and separation. Although the company's manufacturing facilities are restricted to the US and the UK, it has many sales and distribution centers in many other countries across the globe.

The company serves various industries, including aerospace & defense, food & beverage, nuclear, and pharmaceutical. It operates through 3 business segments: Aerospace & Industrial, Metal Melt Quality, and Laboratory. Membrane filters are supplied through its aerospace & industrial segment.

TABLE 520 PORVAIR FILTRATION GROUP: BUSINESS OVERVIEW

Founded	1974
Country	UK
City/State	Fareham, Hampshire
No. of Employees	910
Annual Revenue	USD 212.8 Million
Segmental Revenue	USD 79.8 Million
R&D Expenditure	USD 4.3 Million
Ownership	Public (LON: PRV)

Source: Company Websites, Company Publications, and Press Releases

FIGURE 67 PORVAIR FILTRATION GROUP: COMPANY SNAPSHOT

Source: Company Website, Company Publications, Annual Reports, and Press Releases

13.1.9.2 Products offered

TABLE 521 PORVAIR FILTRATION GROUP: PRODUCTS OFFERED

PRODUCT TYPE	PRODUCT	DESCRIPTION	APPLICATION
Microfiltration	Microfil Junior Filters for Small-Scale Applications	Microfil Junior cartridges can be used as prefilters for membrane filters and for the complete removal of undesirable particles. The Microfil Junior cartridges feature a polypropylene prefiltration layer and a glass fiber media with a high dirt capacity. They also exhibit good chemical compatibility properties and are highly resistant to integrity loss brought on by steam sterilization.	Dairy Wine Beverages
	Vinofil Double Layer Membrane Filter for Wine and Beer Filtration	Porvair Filtration Group has created the Vinofil membrane cartridges specifically for wine and beer filtration as a last filter for cold biological stabilization. Vinofil cartridges use a double layer of naturally hydrophilic polyethersulfone (PES) membrane with an asymmetric mirrored pore structure to achieve faster throughputs and longer service life.	Dairy Wine Beverages

Tekfil A Polypropylene Depth Filter Cartridges	The high-flow, graded depth Tekfil filter has a high contaminant capacity and a long lifespan.	Dairy Wine Beverages
Aquafl Single Layer Polyethersulphone Membrane Cartridge Filters	Aquafl cartridges benefit from the low non-specific protein-binding properties of polyethersulfone membranes. Additionally, they offer excellent chemical compatibility characteristics and are resistant to steam sterilization. Aquafl cartridges are perfect for use in ultra-pure water supply systems because they do not hydrolyze.	Dairy Wine Beverages
Fluorofil Plus High- flow Sterile Gas Filter with ePTFE Membrane Fluorofil ePTFE Membrane Cartridge Filters	ePTFE membranes with high hydrophobicity are used in the production of Fluorofil cartridges. High gas flow rates are possible with the improved ePTFE membrane, even at small pressure differences. Due to the ePTFE membrane's hydrophobic properties, the Fluorofil filter cartridge is especially well suited for wet gas sterilizing applications, such as fermenter air feed.	Dairy Wine Beverages
Polyfil Absolute Rated Pleated Polypropylene Cartridge Filters	The polypropylene-only Polyfil II cartridges have a sturdy design and can remove particles as small as 0.5 microns up to 105 microns in absolute size. The Polyfil II cartridges can be used as prefilters for membrane filters and for the complete removal of undesirable particles. Additionally, it exhibits outstanding chemical compatibility properties and is highly resistant to integrity breakdown brought on by steam sterilization.	Dairy Wine Beverages
Klearfil Absolute Rated Pleated Depth Filters	Klearfil cartridges are based on a sturdy all-polypropylene construction and offer removal ratings from 0.5 to 75 microns absolute. They feature the most recent advancements in melt-blown polypropylene filter media technology. Combining up to eight different filtering layers within a pleated cartridge design offers genuine depth filtration. The filtering of process fluids, which may contain pollutants with various particle sizes, is best handled by Klearfil cartridges. Prior to the absolute rated final layer, the process fluid is prefiltered using the graded multi-layer polypropylene media. Additionally, Klearfil exhibits outstanding chemical compatibility properties and is highly resistant to integrity breakdown brought on by steam sterilization.	Dairy Wine Beverages

Source: Company Website

13.1.9.3 Recent developments

TABLE 522 PORVAIR FILTRATION GROUP: PRODUCT LAUNCHES

MONTH & YEAR	COMPANY NAME	PRODUCT TYPE	PRODUCT NAME	PRODUCT DESCRIPTION
June 2021	Porvair Filtration Group (US)	String Wound Cartridge Filters	TekfilSW	Available in a variety of media types. This product has a wide range of chemical compatibility with either polypropylene or steel cores. The use of glass fibers on a steel core enables a wide range of solvents and operating temperatures up to 400 °C. The Tekfil SW range is suitable for many filtration applications.
June 2020	Porvair Filtration Group (US)	Polypropylene Guard Filters	Trapfil	This pleated all-polypropylene filter cartridge has been specially developed to retain yeast cells and powder released downstream of the centrifuge or crossflow/cake filtration. The unique structure was designed to resist repetitive backwashing cycles, CIP, and SIP processes.

Source: Company Website, Press Releases and Company Publications

13.1.9.4 MnM view

Porvair Filtration Group is a leading manufacturer of separation equipment. The company has focused on adopting organic strategies, such as product launches, to cement its position as the market leader in the membrane filtration market. It also focuses on R&D to manufacture new products and meet consumer expectations.

13.1.10 TORAY INDUSTRIES, INC.

13.1.10.1 Business overview

Toray Industries, Inc. is a global conglomerate producing, processing, and distributing fibers and textiles, plastics, chemicals, and related products. Additionally, it specializes in carbon fiber composite materials, environmental and engineering solutions, and life science products on a global scale. The company operates across 6 key business segments: Fiber and Textiles, Performance Chemicals, Carbon Fiber Composite Materials, Environment and Engineering, Life Science, and Other Diverse Businesses. Toray offers an array of membrane products within its environment and engineering sector, encompassing RO and nanofiltration membranes, ultrafiltration and microfiltration membranes, and membrane bioreactors.

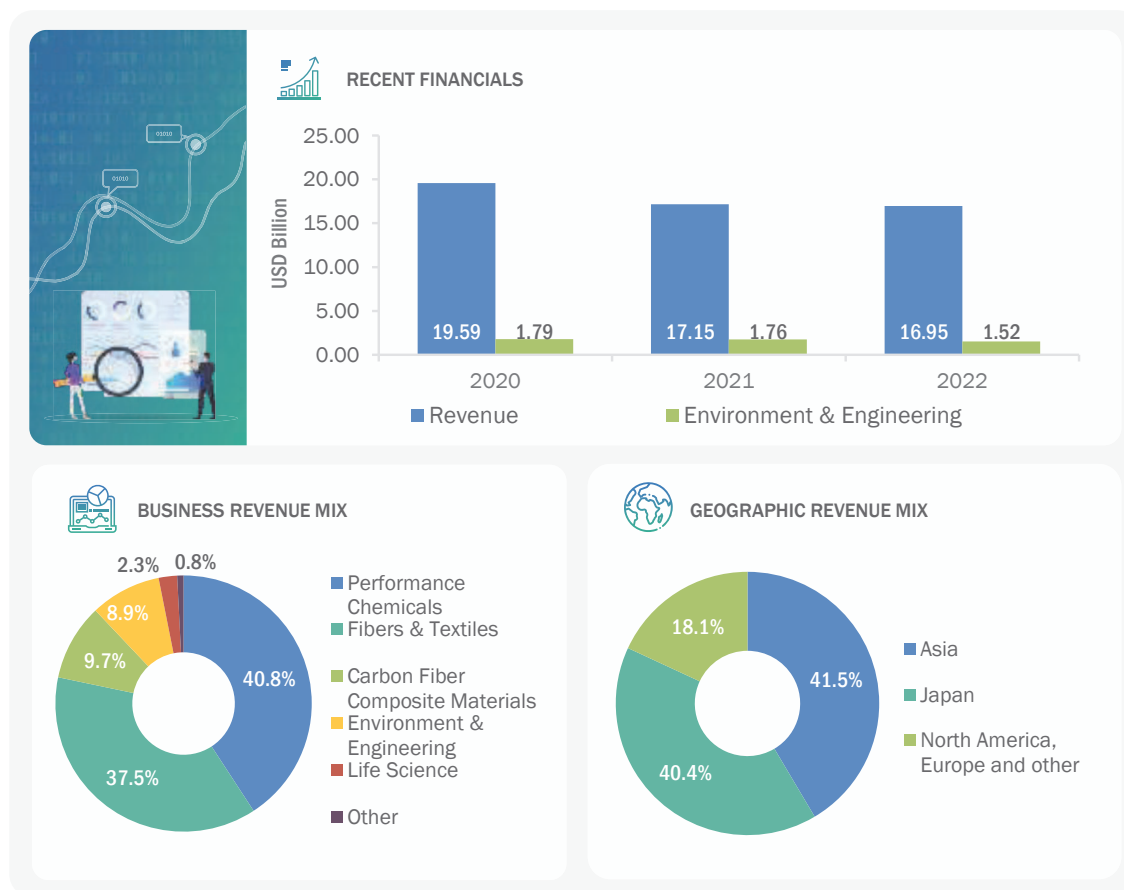
With a broad international presence, Toray Industries operates in 29 countries worldwide. The company has seven water treatment solutions manufacturing facilities strategically located across the Asia Pacific, North America, and the Middle East regions. Its water treatment and food & beverages product manufacturing units are situated in the United States, China, Japan, and South Korea.

TABLE 523 TORAY INDUSTRIES, INC.: BUSINESS OVERVIEW

Founded	1926
Country	Japan
City/State	Tokyo
No. of Employees	48,682
Annual Revenue	USD 16.95 Billion
Segmental Revenue	USD 1.52 Million
Ownership	Public (TYO: 3402)

Source: Company Websites, Company Publications, and Press Releases

FIGURE 68 TORAY INDUSTRIES, INC.: COMPANY SNAPSHOT



Source: Company Website, Company Publications, Annual Reports, and Press Releases

13.1.10.2 Products offered

TABLE 524 TORAY INDUSTRIES, INC.: PRODUCTS OFFERED

PRODUCT TYPE	PRODUCT	DESCRIPTION	APPLICATION
Reverse Osmosis	TRO-series	TRO-series elements are used to retain valuable milk solids and COD/BOD contributing compounds.	<ul style="list-style-type: none"> ▪ Dairy ▪ Wine ▪ Beer
	TMRO-series	D-family polyamide composite membranes incorporate membrane chemistry, offering extra durability against foulants and chemical cleaning.	
Nanofiltration Membrane	TNF-series	TRO-series HP elements are high-rejection.	<ul style="list-style-type: none"> ▪ Dairy ▪ Wine ▪ Beer
	TMNF-series	These (TNF-series & TMNF-series) membrane elements incorporate a piperazine amide composite membrane specifically designed for maximum retention of sugars and proteins and high passage of monovalent salt ions.	

Ultrafiltration Membrane	10K Ultrafiltration Membrane (TUF-series)	TUF-series 10K membranes offer high flux and protein retention ideal for whey processing at all concentrations and milk protein concentration (MPC) applications. TUF-series 10K HR (High-Rejection) membranes yield high protein retention for high concentration end of whey and whey protein isolate (WPI) plants.	<ul style="list-style-type: none"> ▪ Lactose-free milk ▪ Milk protein isolate ▪ White cheese ▪ Soft cheese ▪ Whey protein concentrate ▪ Whey protein isolate ▪ Whey permeate concentrate
	5K Ultrafiltration Membrane (TUF-series)	TUF-series 5K membranes offer extra high retention of proteins, fats, and polysaccharides. TUF-series 5K HR (HighRejection) membranes are used for maximum retention of organic molecules for special applications in dairy production, gelatin, sugar, and more.	<ul style="list-style-type: none"> ▪ Lactose-free milk ▪ Milk protein isolate ▪ White cheese ▪ Soft cheese ▪ Whey protein concentrate ▪ Whey protein isolate
Microfiltration Membrane	(TMF-series)	TMF-series models are net-wrapped (no tail) spiral-wound elements incorporating a polyvinylidene fluoride (PVDF) asymmetric membrane. They are used to remove residual fat from whey and whey protein concentrate and maximizing whey protein transmission.	<ul style="list-style-type: none"> ▪ Whey defatting ▪ Whey protein isolate

Source: Company Website

13.1.10.3 Recent developments

TABLE 525 TORAY INDUSTRIES, INC.: PRODUCT LAUNCHES

MONTH & YEAR	COMPANY NAME	PRODUCT TYPE	PRODUCT NAME	PRODUCT DESCRIPTION
February 2021	TORAY INDUSTRIES, INC. (Japan)	Ultrafiltration Membrane	PVDF UF membrane	Polyvinylidene fluoride (PVDF) ultrafiltration (UF) membrane with virus removal capabilities and high water permeability. This innovation targets safe and economical water supplies treated with minimal energy for various applications, from food and beverages to wastewater reuse.

Source: Company Website, Press Releases and Company Publications

13.1.10.4 MnM view

TORAY INDUSTRIES, INC. stands as a prominent leader in the realm of membrane filtration manufacturing. The company strategically emphasizes organic initiatives, including impactful product introductions, to fortify its pivotal role within the membrane filtration market. A noteworthy instance is the successful launch of the PVDF UF membrane in 2021, notable for its elevated virus removal capacity. The company's unwavering dedication extends to robust research and development endeavors, geared towards innovating novel products that align with evolving consumer demands and industry standards.

13.1.11 HYDRANAUTICS - A NITTO GROUP COMPANY

13.1.11.1 Business overview

Japan-based Hydranautics, a Nitto Group Company, is primarily involved in the industrial tape, optronics, and life science industries. The company operates through 4 business segments: Industrial Tapes, Optronics, Human Life, and Others. The industrial tapes segment produces and sells Automotive, bonding materials, protection materials, and other fundamental functional materials. The optronics segment is involved in producing and marketing printed circuits, process materials, and information functional materials. The human life segment comprises life sciences, membranes, and personal care components. The company offers membrane filtration products through the human life segment.

The company offers a variety of membrane filtration products under the human life segment. It has a strong world presence with production facilities across North America, Europe, Asia Pacific, and the rest of the world.

TABLE 526 HYDRANAUTICS - A NITTO GROUP COMPANY: BUSINESS OVERVIEW

Founded	1918
Country	Japan
City/State	Osaka
No. of Employees	28,438
Annual Revenue	USD 7.07 Billion
Segmental	USD 0.20 Billion
R&D Expenditure	USD 0.34 Billion
Ownership	Public (TYO:6988)

Source: Company Websites, Company Publications, and Press Releases

FIGURE 69 HYDRANAUTICS - A NITTO GROUP COMPANY: COMPANY SNAPSHOT

Source: Company Website, Company Publications, Annual Reports, and Press Releases

13.1.11.2 Products offered

TABLE 527 HYDRANAUTICS - A NITTO GROUP COMPANY: PRODUCTS OFFERED

PRODUCT TYPE	PRODUCT	DESCRIPTION	APPLICATION
Process Separation	<ul style="list-style-type: none"> ▪ DairyRO and HYDRAPolish ▪ DairyNF ▪ SuPRO ▪ SanRO ▪ HYDRACoRe 	Membranes are utilized in process separation for various unique liquid-liquid separation applications other than wastewater treatment and desalination.	<ul style="list-style-type: none"> ▪ Dairy ▪ food and beverage

Source: Company Website

13.1.11.3 MnM view

The firm has a significant global presence, which is a valuable advantage. Furthermore, it offers a comprehensive range of membrane filtering devices across sectors, giving it a competitive advantage over competitors. The firm prioritizes strategic mergers and acquisitions to stay ahead of the competition, strengthening its market position and development potential. This strategy assures that it remains at the forefront of industry change and retains its competitive edge.

13.1.12 SPXFLOW

13.1.12.1 Business overview

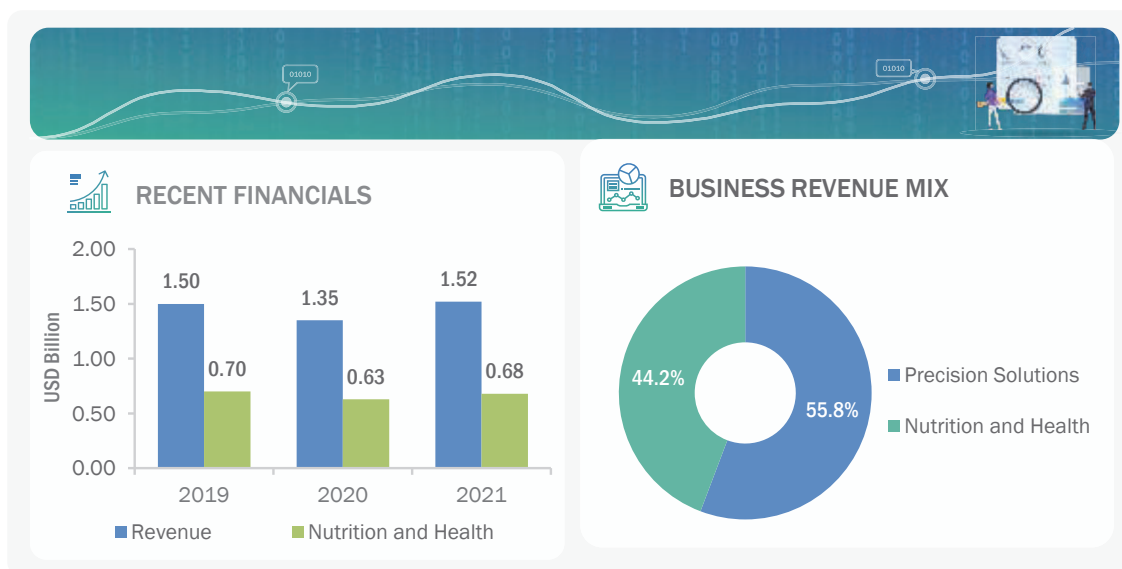
Spxflow is an engineering products and solutions provider. The company has a comprehensive product portfolio, including pumps, valves, mixers, filters, air dryers, hydraulic tools, homogenizers, separators, heat exchangers, and related aftermarket parts and services. The products manufactured by the company serve various industries, including food & beverage, oil & gas, power generation (including nuclear and conventional), chemical processing, compressed air, and mining.

Spxflow maintains a prominent global footprint, spanning operations across 25 countries and securing sales in 140 nations. The company's manufacturing facilities, innovation hubs, and service centers are strategically positioned throughout the Americas, Europe, Middle East, and Asia Pacific regions. The company operates in 2 business segments: Food and Beverage and Industrial. Through its industrial segment, the company offers filtration products. The company has a strong presence in North America and Europe.

TABLE 528 **SPXFLOW: BUSINESS OVERVIEW**

Founded	2015
Country	US
City/State	Charlotte, North Carolina
No. of Employees	4,500
Annual Revenue	USD 1.52 Billion
Segmental Revenue	USD 0.68 Billion
Ownership	Public (NYSE: FLOW)

Source: Company Websites, Company Publications, and Press Releases

FIGURE 70 SPXFLOW: COMPANY SNAPSHOT

Note: The financials are given for 2021, as financials for 2022 are not available.

Source: Company Website, Company Publications, Annual Reports, and Press Releases

13.1.12.2 Products offered

TABLE 529 SPXFLOW: PRODUCTS OFFERED

PRODUCT TYPE	PRODUCT	DESCRIPTION	APPLICATION
Microfiltration	Microfiltration System (MF)	<ul style="list-style-type: none"> This is a robust ceramic membrane. 	Dairy and dairy products
Nanofiltration	Nanofiltration System (NF)	<ul style="list-style-type: none"> In-line UF, NF, RO polisher High-quality engineering, standardized system Optimized utility consumption 	
Reverse Osmosis	Reverse osmosis (RO) – GoldStream	<ul style="list-style-type: none"> Membranes for RO dairy applications High performance and long membrane lifetime In-line process: UF, RO, RO polisher High-quality engineering, standardized system Optimized utility consumption 	
Ultrafiltration	Ultrafiltration (UF) - SepStream	<ul style="list-style-type: none"> Membranes for any dairy application High performance and long membrane lifetime High-quality engineering, standardized system Speed controllers on all motors Optimized utility consumption 	

Source: Company Website

13.1.12.3 Recent developments

TABLE 530 SPXFLOW: PRODUCT LAUNCHES

MONTH & YEAR	COMPANY NAME	PRODUCT TYPE	PRODUCT NAME	PRODUCT DESCRIPTION
February 2023	SPX Flow (US)	Membrane Filtration	APV membrane filtration	The APV membrane filtration technology features various solutions designed to fit various plant sources, including soy, oats, nuts, rice, peas, and more. The solutions, designed based on processing needs, include process filtration like microfiltration and ultrafiltration for fractionation, concentration, and standardization of plant protein. Additionally, nanofiltration and reverse osmosis systems are available for solids concentration, valorization of subproducts, and water recovery.

Source: Company Website, Press Releases and Company Publications

TABLE 531 SPXFLOW: DEALS

MONTH & YEAR	DEAL TYPE	COMPANY NAME 1	COMPANY NAME 2	DESCRIPTION	DEAL SIZE
April 2022	Acquisition	SPX Flow (US)	Lone Star (US)	An affiliate of Lone Star Funds has successfully acquired SPX Flow, a leading provider of process solutions for the nutrition, health, and industrial markets ("Lone Star"). This transaction is the best strategy and achieves the company's desire to maximize value for SPX FLOW shareholders.	NA

Source: Company Website, Press Releases and Company Publications

13.1.12.4 MnM view

Spxflow is a major supplier of membrane filters and systems for food & beverage, energy & power, and other industrial verticals. The membrane filtration systems offered by the company are mainly used in the dairy industry. The company mainly delivers high-quality filters and systems globally and targets all the major membrane filtration technologies. It also provides after-sales services to satisfy customer needs, which gives it a competitive edge. The company focuses on strategies, such as upgrading its existing product range to meet industry standards. Expanding into the Asian and African markets could be an opportunity for the company.

13.1.13 MMS MEMBRANE SYSTEMS

13.1.13.1 Business overview

MMS Membrane Systems is a prominent provider of comprehensive membrane systems and process solutions across various industries, including food and beverage, biopharma, extract, chemical, and water reuse applications. Founded in 1995 and based in Urdorf, Switzerland, MMS specializes in membrane technology, system integration, automation, research and development, and dairy technology.

The company offers membrane screening, selection, process development, and laboratory and pilot scale test systems. With a focus on separation technology, it facilitates new industrial processes and products for clients in industries, such as dairy, food, plant, biopharmaceuticals, and chemicals.

TABLE 532 MMS MEMBRANE SYSTEMS: BUSINESS OVERVIEW

Founded	1995
Country	Switzerland's
City	Zurich
Ownership	Private

Note: This is a privately held company; hence, no financial are provided in the public domain.

Source: Company website

13.1.13.2 Products offered

TABLE 533 MMS MEMBRANE SYSTEMS: PRODUCTS OFFERED

PRODUCT TYPE	PRODUCTS	DESCRIPTION	APPLICATION
Membrane Filtration	MemHPLC	The MemHPLC is a membrane cell for crossflow filtration, which is designed to be connected to standard HPLC units. This enables the testing of membrane-based applications such as fractionation, purification, and concentration of molecules.	Dairy and dairy products
	MemTester 50...300ml	The MemTester unit allows for quick and simple testing of all membrane processes, such as microfiltration, ultrafiltration, nanofiltration, and reverse osmosis applications.	Dairy and dairy products
	TripleSystem-200...700ml	The MMS Triple System is an easy-to-use batch laboratory membrane device for microfiltration, ultrafiltration, nanofiltration, and reverse osmosis operations.	Beer Wine Cider
	BeerMAX	BeerMAX is a standardized reverse osmosis system for alcohol reduction in beer, wine, and cider beverages. Batches of 10-100 hl/day can be treated, making it an ideal unit for small and medium-sized breweries.	
	MolkeMAX	MMS MolkeMAX is a unique reverse osmosis (RO) System for whey concentration of 5,000 - 20,000 liters of whey per day.	Dairy
Alpine SYSTEM	MMS Alpine Systems are unique reverse osmosis (RO) systems for whey concentrations of 15,000 - 150,000 liters of whey per day.	Dairy	

Source: Company Website

13.1.13.3 Recent developments

TABLE 534 MMS MEMBRANE SYSTEMS: PRODUCT LAUNCHES

MONTH & YEAR	COMPANY NAME	PRODUCT TYPE	PRODUCT NAME	PRODUCT DESCRIPTION
September 2020	MMS Membrane Systems (Switzerland)	Membrane Filtration	BeerMAX	The BeerMAX technology, developed by MMS, offers a solution for creating low-alcohol beer while preserving its genuine taste and aroma. This innovation employs a gentle, cold process to remove alcohol from fully fermented beverages, ensuring that original flavor, aroma, and body are retained. The BeerMAX system has a capacity of 50 - 100 hl/day, making it suitable for small and medium-sized breweries.

Source: Company Website, Press Releases and Company Publications

TABLE 535 MMS MEMBRANE SYSTEMS: DEALS

MONTH & YEAR	DEAL TYPE	COMPANY 1	COMPANY 2	DESCRIPTION
July 2022	Partnership	MMS Membrane Systems (Switzerland)	AFRY AB (Sweden)	In collaboration with AFRY, MMS Nordic has secured significant orders for dairy projects in Sweden and Germany. The partnership between MMS Nordic and AFRY involves the integration of MMS's key components and solutions into engineering projects. This achievement reflects MMS's commitment to delivering advanced membrane solutions for various industrial applications.

Source: Company Websites, Company Publications, and Press Releases

13.1.13.4 MnM view

In Switzerland, the company has built a strong foothold. It is working hard to strengthen its position in the membrane filtration industry by implementing various strategic initiatives. For instance, in 2022, the firm created a strategic collaboration with AFRY AB in Sweden. This alliance has greatly improved the company's position in the European market.

13.1.14 KOCH SEPARATION SOLUTIONS

13.1.14.1 Business overview

Koch Separation Solutions offers microfiltration, ultrafiltration, nanofiltration, and reverse osmosis membrane filtration technologies. This company is one of the leading manufacturers of membrane filtration systems and owns over 60 brands of membrane filtration products and technologies. These brands serve the water treatment, food, and beverage industries. It offers its products for water and wastewater, food, beverage, and dairy applications.

The company invests heavily in R&D, which has proven to be an excellent tool for developing its in-depth membrane filtration product portfolio. It has a 15,000-square-foot R&D facility in Wilmington, Massachusetts, US, which is a product development, life testing, and research complex.

Koch Membrane Systems officially changed its name to Koch Separation Solutions in January 2020 to better reflect a new and expanding vision to become the preferred partner for separation solutions by generating value and enhancing sustainability for clients in the food and beverage, life sciences, and industrial markets.

TABLE 536 KOCH SEPARATION SOLUTIONS: BUSINESS OVERVIEW

Founded	1963
Country	US
City/State	Washington, Massachusetts
No. of Employees	500
Ownership	Private

Note: This is a privately held company; hence, no financial are provided in the public domain.

Source: Company website

13.1.14.2 Products offered

TABLE 537 KOCH SEPARATION SOLUTIONS: PRODUCTS OFFERED

PRODUCT TYPE	PRODUCT	DESCRIPTION	APPLICATION
Hollow Fiber Membranes	<ul style="list-style-type: none"> ▪ PURON MBR and PULSION MBR Modules ▪ PURON HF and PURON MP Modules ▪ ROMICON and ROMIPRO Cartridge ▪ WINEFILTER and BEERFILTER 	<p>Hollow fiber configurations have a distinctive structure that makes it easier to control flux and rejection during production and cleaning. They are designed for applications with a modest number of suspended solids.</p> <p>They provide pressurized and submerged hollow fiber systems for ultrafiltration and microfiltration that operate in either an inside-out or outside-in direction and deliver energy-efficient, cost-effective performances for small and large filtration volumes.</p>	<ul style="list-style-type: none"> ▪ Dairy ▪ Food ▪ Beverage

Spiral Membranes	<ul style="list-style-type: none"> ▪ FLUID SYSTEMS Elements ▪ KPAK PLUS Potted Spiral and EDCORE Electrodialysis Cell ▪ High-performance Sanitary Spiral Filtration Sani-Pro Elements ▪ Silo 	Applications with comparatively little suspended particles use spiral-wound components. All membrane arrangements provide the highest packing density and are the most cost-effective option. Spiral-wound membranes are available across a full spectrum of pore diameters (reverse osmosis, nanofiltration, ultrafiltration, and microfiltration). The requisite separation qualities are used to choose a certain membrane.	<ul style="list-style-type: none"> ▪ Dairy ▪ Food ▪ Beverage
Tubular Membranes	<ul style="list-style-type: none"> ▪ SUPER-COR and SUPER-G Modules ▪ FEG PLUS and ULTRA-COR ▪ INDU-COR HD and INDU-COR Modules 	Tubular modules may concentrate up to 60% of solids and are intended for applications with high amounts of suspended particles. Although larger modules have been produced to accommodate higher feed volumes, tubular versions offer more moderate membrane areas.	<ul style="list-style-type: none"> ▪ Dairy ▪ Food ▪ Beverage
Ceramic Module Membranes	<ul style="list-style-type: none"> ▪ Microfiltration Modules ▪ Ultrafiltration Module 	Ceramic membranes exhibit outstanding thermal and chemical compatibility. Due to their long membrane life, they are the perfect, economical answer for many market applications.	<ul style="list-style-type: none"> ▪ Dairy ▪ Food ▪ Beverage

Source: Company Website

13.1.14.3 Recent developments

TABLE 538 KOCH SEPARATION SOLUTIONS: DEALS

MONTH & YEAR	DEAL TYPE	COMPANY 1	COMPANY 2	DESCRIPTION
November 2020	Acquisition	SUEZ Water Technologies and Solutions (US)	RELCO (US)	Koch Separation Solutions, an entity in the separation technology sector, successfully acquired Relco. This acquisition reinforces Koch Separation Solutions' position in the industry by integrating Relco's expertise in dairy technology. The move highlights Koch Separation Solutions' dedication to broadening its capabilities and presence within the dairy technology domain.

Source: Company Websites, Company Publications, and Press Releases

13.1.14.4 MnM view

The company's strong membrane filtration product portfolio has helped make Koch Separation Solutions one of the global market players. It works on R&D activities and has been developing and introducing a variety of membrane filtration products that are expected to enable the company to maintain its position as a global leader in the membrane filtration market in the future.

13.1.15 SYNDER FILTRATION, INC.

13.1.15.1 Business overview

Synder Filtration has unique expertise in the membrane market due to its history as both a buyer and a supplier of membrane technologies. Synder's original area of expertise was in the production of industrial enzymes. The company is currently developing new polymeric membrane technologies and applications to meet the needs of the dairy, food & beverage, biotech, pharmaceutical, automotive, and other industries that require cutting-edge liquid separation technologies.

Synder Filtration received the President's "E" Award in 2013, the highest national recognition given to businesses that succeed in encouraging US export growth over multiple consecutive years.

TABLE 539 SYNDER FILTRATION, INC.: BUSINESS OVERVIEW

Founded	1994
Country	US
City/State	Vacaville, California
No. of Employees	200
Ownership	Private

Note: This is a privately held company; hence, no financials are provided in the public domain.

Source: Company website

13.1.15.2 Products offered

TABLE 540 SYNDER FILTRATION, INC.: PRODUCTS OFFERED

PRODUCT TYPE	PRODUCT	DESCRIPTION	APPLICATION
Nanofiltration Membranes	▪ NFS	With pores between 0.1 and 10 nm in size, Synder Filtration's nanofiltration membranes retain multivalent ions, low molecular weight molecules, carbohydrates, proteins, and other organic substances while permitting water and some salts to pass through.	Dairy
	▪ NFX		
	▪ NFW		
	▪ NFG		
Ultrafiltration Membranes	▪ XT	Ultrafiltration membrane pore diameters vary between those of nanofiltration and microfiltration, with a range of 0.01 to 0.1 μ m. UF membranes depend on transmembrane pressure to fuel the separation process and typically function between 50 and 120 PSI (3.4 and 8.3 bar).	Dairy
	▪ VT		
	▪ MT		
	▪ ST		
	▪ SM		
	▪ MK		
	▪ MQ		
	▪ LY		
	▪ LV		
	▪ LX		
▪ PZ			
▪ PY			
▪ PX			

	<ul style="list-style-type: none"> ▪ V3 ▪ V4 ▪ V5 ▪ V6 ▪ V7 ▪ BN ▪ BY ▪ BX ▪ A6 		
Microfiltration (MF) Membranes	<ul style="list-style-type: none"> ▪ FR ▪ VO.1 ▪ VO.2 	To address difficult process issues like microbial removal, protein separation, and pretreatment to other membrane processes, Synder Filtration offers a large variety of microfiltration (MF) membranes.	Diary

Source: Company Website

13.1.15.3 Recent developments

TABLE 541 SYNDER FILTRATION, INC.: PRODUCT LAUNCHES

MONTH & YEAR	COMPANY NAME	PRODUCT TYPE	PRODUCT NAME	PRODUCT DESCRIPTION
June 2020	Synder Filtration, Inc. (US)	Membrane Filtration	Optima Flow Series Elements	Synder Filtration launched the optima Flow Series Elements. This new product range is accessible in the same standard element sizes and models for all existing MAX membrane types and ultrafiltration and microfiltration standards. The addition of the Optima Flow Series to Synder's membrane offering shows Synder's commitment to addressing the specific application needs of consumers by providing a wide range of products, upholding a high standard of quality, being responsive, and offering industry delivery times.

Source: Company Website, Press Releases and Company Publications

13.1.15.4 MnM view

The company offers a diverse range of spiral-wound nanofiltration, ultrafiltration, and microfiltration membranes, enabling clients to benefit from advanced membrane technologies. Synder Filtration, Inc. has a strong presence in the US, with its operations primarily focused on this region. This limited geographic reach may restrict the company's growth potential in other parts of the world.

13.1.16 PROMINENT

13.1.16.1 Business overview

ProMinent develops, manufactures, and supplies components and systems for water treatment and water disinfection. The company's products are used in water & wastewater treatment, cooling tower & boiler control, pharmaceutical processing, semiconductor, chemical processing, food & beverage processing, pulp & paper production, post-pelleting, power generation, and swimming pool treatment applications. Its membrane technology covers ultrafiltration, nanofiltration, and reverse osmosis, serving the water, food, and beverage industries.

ProMinent operates in more than 100 countries across Europe, North America, South America, the Middle East & Africa, and Asia Pacific. It has 12 production sites worldwide, with a high degree of vertical integration at each site.

TABLE 542 PROMINENT: BUSINESS OVERVIEW

Founded	1960
Country	Germany
City/State	Heidelberg
No. of Employees	95,000
Ownership	Private

Note: This is a privately held company; hence, no financials are provided in the public domain.

Source: Company website

13.1.16.2 Products offered

TABLE 543 PROMINENT: PRODUCTS OFFERED

PRODUCT TYPE	PRODUCT	DESCRIPTION	APPLICATION
Nanofiltration	Nanofiltration System Dulcosmose NF	This system delivers maximum permeated performance with low operating pressures and high outputs, lowering investments and operating costs. It is outfitted with the most recent generation of "ultra-low pressure" membranes. The complete system can be installed with low-cost PVC pipes operating at low operating pressures. It has a permeate and/or raw water flushing option and an integrated, semi-automated cleaning system.	Food and beverage
Reverse Osmosis Systems	Reverse Osmosis System Dulcosmose BW		
Ultrafiltration	Ultrafiltration System Dulcoclean UF	The Dulcoclean UF ultrafiltration system is used in water treatment to extract tiny particles and turbidity. Even when the water quality varies, as it sometimes does after a lot of rain, the membranes operate as a sterile barrier to safely eliminate bacteria, parasites, and viruses. The filtrate's quality has been consistently high. Before ultimate disinfection, the filtration procedure is ideal for treating drinkable water. Back washes are carried out on a regular cycle to avoid clogs in the modules. When necessary, cleaning is aided using chemicals that are tailored to the raw water quality on hand.	Food and beverage

Source: Company Website

13.1.16.3 Recent developments

TABLE 544 PROMINENT: OTHERS

MONTH & YEAR	COMPANY NAME	DEVELOPMENT TYPE	DEVELOPMENT	DESCRIPTION
March 2023	ProMinent (Germany)	Expansion	New Office	ProMinent, a renowned company, officially opened new office facilities in Thailand. This expansion reflected ProMinent's commitment to the Thailand market and its desire to provide enhanced services and support to its customers in the region. The inauguration of these new offices signifies ProMinent's dedication to strengthening its presence and operations in Thailand.

Source: Company Website, Company Publications, and Press Releases

13.1.16.4 MnM view

ProMinent offers innovative equipment and solutions for water treatment worldwide. With its effective product line and robust global network and supply chain, the company has proven to actively participate in the global membrane filtration market. The addition of microfiltration products and the increase in its membrane filtration product range may help strengthen its position in the membrane filtration market.

13.2 STARTUPS/SMES

13.2.1 MANN+HUMMEL

13.2.1.1 Business overview

MANN+HUMMEL is a leading global company that provides filtration technologies and products. Through its two business units, namely transportation and life sciences & environment, the Ludwigsburg-based Group develops intelligent solutions to enable cleaner mobility, cleaner air, and cleaner water. Thus, the business significantly contributes to a clean environment and the sustainable use of available resources.

Among the solutions offered by the company are filter media and simulation technologies, air filtration and intake systems for various mobility and industrial applications, liquid filters, and membrane technologies for municipal and industrial water and wastewater treatment. They are also used in sensitive process applications like food manufacturing or biotechnology.

TABLE 545 MANN+HUMMEL: BUSINESS OVERVIEW

Founded	1941
Country	Germany
City/State	Ludwigsburg
No. of Employees	21,000
Ownership	Private

Note: This is a privately held company; hence, no financials are provided in the public domain.

Source: Company website

13.2.1.2 Products offered

TABLE 546 MANN+HUMMEL: PRODUCTS OFFERED

PRODUCT TYPE	PRODUCT	DESCRIPTION	APPLICATION
TurboClean for Food Industry	<ul style="list-style-type: none"> TurboClean Sanitary Membrane Elements 	The patented hard-shell design of TurboClean elements offers a stronger, more rigid, and long-lasting element ideal for even the most challenging process applications.	Food and beverage
TurboClean for Food and Dairy Industry	<ul style="list-style-type: none"> TurboClean Food & Dairy RO Series TurboClean Brine MF TurboClean Food & Dairy UA60 NF Series TurboClean Food & Dairy TS40 NF Series TurboClean High-purity RO Elements 	TurboClean elements have a patented sanitary hard-shell design that improves system performance due to about 60% less bypass flow compared to other sanitary elements. As more feed runs across the membrane surface rather than around the outside of the element, lower bypass flow leads to energy savings and/or higher flux rates.	Dairy

Source: Company Website

13.2.1.3 Recent developments

TABLE 547 MANN+HUMMEL: DEALS

MONTH & YEAR	DEAL TYPE	COMPANY NAME 1	COMPANY NAME 2	DESCRIPTION	DEAL SIZE
September 2020	Acquisition	MANN+HUMMEL (Germany)	Helsa Functional Coating (Germany)	MANN+HUMMEL acquired Helsa Functional Coating to establish itself as a technological leader in the expanding market and further position the business for future growth. This is a step toward attaining the company's vision of 'Leadership in filtration.'	NA

Source: Company Press Releases, Company Website, and Company Publications

13.2.1.4 MnM view

MANN+HUMMEL is emerging as a global leader in the realm of filtration, encapsulating its corporate DNA with an exceptional fusion of employee expertise, cutting-edge technology, and a history of delivering outstanding products and services. With a sprawling presence across more than 80 locations worldwide, MANN+HUMMEL is strategically positioned to cater to customer needs on a global scale.

13.2.2 GRAVER TECHNOLOGIES

13.2.2.1 Business overview

Graver Technologies is a member of The Marmon Group (a Berkshire Hathaway Company), an international corporation. Companies worldwide turn to Graver Technologies for their industrial filtration, separation, and purification needs. The company provides a wide range of high-performance specialty ion exchange resins, unique adsorbents, and filtration products for the most demanding application environments. The company's products are effective at removing soluble and particulate contaminants from a variety of fluids and gases.

The company operates through 3 major divisions: Utilities Group - Ion Exchange Resins and Condensate Filter Elements, Adsorbent Products Group - Carbon & Adsorbent Products, Filtration and Separation - Liquid Filters & Filtration Products, Air & Gas Filters, and Systems.

Graver Technologies serves industries such as processing water, food & beverage, power generation, healthcare, drinking water, chemicals, and microelectronics. Graver's global reach includes Australia, Japan, and the Pacific Rim as well as North and South America, Europe, and the rest of Asia.

TABLE 548 GRAVER TECHNOLOGIES: BUSINESS OVERVIEW

Founded	1866
Country	US
City/State	Glasgow, Delaware
No. of Employees	20,000
Ownership	Private

Note: This is a privately held company; hence, no financial are provided in the public domain.

Source: Company website

13.2.2.2 Products offered

TABLE 549 GRAVER TECHNOLOGIES: PRODUCTS OFFERED

PRODUCT TYPE	PRODUCT	DESCRIPTION	APPLICATION		
Membrane Filtration	<ul style="list-style-type: none"> ▪ TefTEC ▪ QXL ▪ PMA ▪ QMC ▪ PMA ▪ PMC 	Breweries use a great deal of filtration to get rid of bacteria and microbes before bottling. Still, they also use it to capture DE released from filter sheets, let clean air into holding tanks, give clean wash water to clean bottles, and preserve membrane filters.	Beer		
	<ul style="list-style-type: none"> ▪ ZTEC WBI ▪ TefTEC ▪ GFC ▪ QMC ▪ PMC ▪ QXL 			These are used to remove yeast and other fermentation by-products before bottling.	Wine

Source: Company Website

13.2.2.3 MnM view

Graver Technologies, LLC serves the industrial filtration, separation, and purification needs of companies around the globe. They offer a broad selection of high-performance specialty ion exchange resins, proprietary adsorbents, and filtration products for the most demanding application environments. The company has a global presence in over 80 countries, extending from North and South America, Europe, and Asia, including the Pacific Rim, Japan, and Australia.

13.2.3 CRITICAL PROCESS FILTRATION, INC.

13.2.3.1 Business overview

Critical Process Filtration Inc. is a company specializing in the manufacturing and supply of process filtration products and services. It offers filtration products to various industries, including pharmaceutical and biotech manufacturing, food and beverage processing, electronics, and chemical processing. Critical Process Filtration's product line includes a variety of filtration solutions, such as capsule and cartridge filters, disc filter configurations, and filter membranes.

The company produces a comprehensive range of filtration cartridges, capsules, and laboratory disc filters, utilizing various media and membrane materials, including polyethersulfone, PVDF, Nylon 6,6, polypropylene, fiberglass, and PTFE.

TABLE 550 CRITICAL PROCESS FILTRATION INC.: BUSINESS OVERVIEW

Founded	1998
Country	US
City/State	Nashua, New Hampshire
Ownership	Private

Source: Company Websites, Company Publications, and Press Releases

13.2.3.2 Products offered

TABLE 551 CRITICAL PROCESS FILTRATION INC.: PRODUCTS OFFERED

PRODUCT TYPE	PRODUCT	DESCRIPTION	APPLICATION
Filter Cartridges	▪ FPS Filter	These filters are used for various applications requiring sub-micron retention ratings at varying flow rates, such as the filtration of acids and bases and food and beverages, chemicals, and paint.	<ul style="list-style-type: none"> ▪ Wine ▪ Beer others
	▪ VPS Filter		
	▪ FNM Filter		
	▪ FPD Filter		
	▪ FGD Filter		
	▪ FCWPS Filter		
	▪ FHLP Filter		
	▪ ETM Filter		
	▪ PTR Filter		
	▪ PTM Filter		
▪ BTM Filter			

Source: Company Website

13.2.3.3 MnM view

Critical Process Filtration Inc. offers various filter cartridges to various industries, including pharmaceutical and biotech manufacturing, food and beverage processing, electronics, and chemical processing. The limited geographical reach of Critical Process Filtration Inc. can potentially threaten the company when competing with rivals with a broader and more expansive market presence.

13.2.4 NOVASEP

13.2.4.1 Business overview

Novasep is a leading provider of services in the field of molecule production and purification for the life science industry. To increase customer loyalty and attract new clients, Novasep strictly adheres to regulatory standards, such as cGMP, for the pharmaceutical industry.

The company provides two solutions: Flexible Contract Development and Manufacturing (CDMO) solutions for small-molecule APIs & biopharmaceuticals, process engineering, and supply of purification equipment. An international corporation, Novasep has multiple R&D, engineering, and manufacturing sites worldwide.

TABLE 552 NOVASEP: BUSINESS OVERVIEW

Founded	1995
Country	France
City/State	Lyon
No. of Employees	1,250
Ownership	Private

Note: This is a privately held company; hence, no financials are provided in the public domain.

Source: Company website

13.2.4.2 Products offered

TABLE 553 NOVASEP: PRODUCTS OFFERED

PRODUCT TYPE	PRODUCT	DESCRIPTION	APPLICATION
Membrane Filtration	Kerasesep Membrane Filtration	The Kerasesep ceramic membranes are the leading choice for micro and ultrafiltration and have long been recognized for their robustness and high level of quality. High cleanability and excellent functioning are ensured by their optimized design.	Food and beverage
	Applexion NF Organic Nanofiltration Membranes	The Applexion NF 300 is a cost-effective organic spiral membrane designed explicitly for nanofiltration. The Applexion NF300, based on proven technology, is incredibly resistant and ideally suited for recovering caustic brine used to regenerate cane sugar decolorization operations by ion exchange.	Dairy

Source: Company Website

13.2.4.3 MnM view

Novasep is a major player in the life sciences and chemical industries, offering a wide range of services to support the development and manufacturing of pharmaceuticals, biopharmaceuticals, and specialty chemicals. Novasep's limited geographic reach. The company's operations primarily focus on Europe, the US, and India. It poses challenges when competing with key industry players with a larger global presence.

13.2.5 NILSAN NISHOTECH SYSTEMS PVT. LTD.

13.2.5.1 Business overview

Nilsan Nishotech Systems Pvt. Ltd. is a company that specializes in providing customized high-purity water systems, membrane filtration and separation, and chromatography purification systems. The company has been operating for more than 3 decades, serving various industrial sectors, including pharmaceutical, biopharmaceutical, industrial biotech, nutraceutical, and food & beverage industries. The company is headquartered in Navi Mumbai, Maharashtra, India.

TABLE 554 NILSAN NISHOTECH SYSTEMS PVT. LTD.: BUSINESS OVERVIEW

Founded	1995
Country	India
City/State	Navi Mumbai
Ownership	Private

Note: This is a privately held company; hence, no financials are provided in the public domain.

Source: Company website

13.2.5.2 Products offered

TABLE 555 NILSAN NISHOTECH SYSTEMS PVT. LTD.: PRODUCTS OFFERED

PRODUCT TYPE	PRODUCT	DESCRIPTION	APPLICATION
Membrane System	<ul style="list-style-type: none"> ▪ Microfiltration Ceramic ▪ Tangential Flow Filtration System (TFF) ▪ Ultrafiltration Spiral ▪ Nanofiltration Spiral ▪ Reverse Osmosis Spiral ▪ Ultrafiltration Hollow Fiber 	<p>These systems use porous films/materials with pores in the region of 0.1 to 0.6 microns.</p> <p>Microfiltration membrane is highly effective in separating material of colloidal size and larger than true solutions.</p>	<ul style="list-style-type: none"> ▪ Food and beverage ▪ Dairy

Source: Company Website

13.2.5.3 MnM view

The company offers various products to various industries, including pharmaceutical, biopharmaceutical, industrial biotech, nutraceutical, and food & beverage industries. Limited geographic reach could render the company vulnerable to challenges posed by major competitors.

13.2.6 APPLIED MEMBRANES, INC.

Founded	1983
Country	US
City/State	Vista, California
Ownership	Private
Business Overview	<p>Applied Membranes, Inc. manufactures and distributes reverse osmosis (ro) membranes, systems, and components for commercial and residential uses. The company produces various types of membrane-based water treatment solutions, including ultrafiltration, desalination, degasification, electrodeionization, and more, catering to both industrial and commercial applications. The company also offers solutions for special applications, including those related to food and beverage, industrial processes, wastewater treatment, and more.</p>
Products	<ul style="list-style-type: none"> ▪ RO Membranes for Dairy Processing ▪ NF Membranes for Dairy Processing ▪ UF Membranes for Dairy Processing ▪ MF Membranes for Dairy Processing
Geographic Presence	North America

Source: Company Website

13.2.7 ZWITTERCO

Founded	2018
Country	US
City/State	Cambridge, Massachusetts
Ownership	Private
Business Overview	<p>ZwitterCo's membrane technologies maintain unprecedented fouling resistance and chemical tolerance, operating for years in what have historically been unfilterable process waters and wastewaters. The company aims to use ground-breaking filtration advancements to enable industries to recycle water and improve product recovery. It provides water treatment and separation methods that reduce the need for chemicals, provide consistent performance, and last.</p>
Products	Superfiltration Membrane
Geographic Presence	North America

Source: Company Website

13.2.8 MEMBRANE SOLUTIONS (NANTONG)

Founded	2006
Country	China
City/State	Shanghai
Ownership	Private
Business Overview	<p>The company specializes in developing and manufacturing membrane filtration products designed to serve customers in biotechnology and laboratory-related industries. Its product range includes solutions for processes such as filtration, separation, and purification.</p> <p>Membrane Solutions develops and manufactures MF/UF/RO membranes, system components, and related equipment. The company also produces PES/PTFE/PVDF/Nylon filter cartridges and various other filter cartridges and membranes. These products have diverse applications, including laboratory filtration for tasks like chromatographic sample preparation, biological laboratory filtration, and microbial limit testing. Additionally, their product range finds utility in household water purification, air purification, outdoor applications, and more.</p>
Products	<ul style="list-style-type: none"> ▪ PolyPure-AB Series PP Pleated Filter Cartridge with Higher Removal Efficiency ▪ ProtecPure GlassFiber Pleated Filter Cartridge with High Retention Efficiency and High Dirt Holding Capacity ▪ FluorPure-G Series Hydrophobic PTFE Pleated Filter Cartridge with Extremely Strong Chemical Compatibility ▪ KynarPure-L Series Hydrophilic PVDF Pleated Filter Cartridge with Broad Chemical Compatibility ▪ SteriPure Series PES Pleated Filter Cartridge with High Flow Rate and Long Service Life ▪ CRDS Series Depth Filter Sheets and Modules ▪ FluorPure-SG Series PTFE Pleated Filter Cartridge for GMP Gas Sterile Filtration Requirements ▪ FluorPure-DG Series Double-layer PTFE Pleated Filter Cartridge for GMP Gas Sterile Filtration Requirements ▪ MicroPure Classic Series PP Melt Blown Filter Cartridge ▪ SteriPure-B Series Sterile-grade PES Pleated Filter Cartridge with High Flow Rate and High Efficiency ▪ SteriPure-D Series Sterile-grade Double-layer PES Pleated Filter Cartridge with Higher Removal Efficiency ▪ KynarPure-L Series Hydrophilic PVDF Pleated Filter Cartridge with Broad Chemical Compatibility
Geographic Presence	North America and Asia Pacific

Source: Company Website

13.2.9 MEMBRANE SYSTEM SPECIALISTS, INC.

Founded	2006
Country	US
City	Wisconsin Rapids, Wisconsin
Ownership	Private
Business Overview	<p>Membrane System Specialists, Inc. (MSS) is a private company that specializes in providing fluid separation systems, turn-key projects, equipment, and value-added services. The company offers custom-designed, skid-built processing systems, including various technologies such as membrane filtration (UF, RO, NF, MF), pasteurization (HTST), CIP systems, process piping, and process integration. MSS serves organizations in the food and dairy industry, helping them achieve operational flexibility and energy conservation while maintaining high product quality and safety standards. The company offers various services, from process design and engineering to equipment fabrication, installation, control integration, and operator training.</p>
Products	<ul style="list-style-type: none"> ▪ Microfiltration (MF) ▪ Ultrafiltration (UF) ▪ Reverse Osmosis (RO) ▪ Nanofiltration (NF)
Geographic Presence	North America, Europe, South America

Source: Company Website

13.2.10 IMEMFLO

Founded	2018
Country	Germany
City/State	NA
Ownership	Private
Business Overview	<p>Imemflo, incorporated in 2018, is a privately held company headquartered in Germany. It is a manufacturer of submerged membranes manufacturer used in wastewater treatment. It has expertise in submerged hollow fiber and flat sheet MBR constructed from PVDF. It provides its products to a wide range of end-use industries, including food & beverage, milk & dairy, pulp & paper, pharmaceutical, textile, oil & gas, and power.</p> <p>Imemflo has a strong business presence in Asia Pacific and Europe. The company has been successful in executing 100+ installations all over the world.</p>
Products	<ul style="list-style-type: none"> ▪ FPS Filter ▪ VPS Filter ▪ FNM Filter ▪ FPD Filter ▪ FGD Filter ▪ FCWPS Filter ▪ FHLP Filter ▪ ETM Filter ▪ PTR Filter ▪ PTM Filter ▪ BTM Filter
Geographic Presence	North America

Source: Company Website

14 ADJACENT & RELATED MARKETS

14.1 INTRODUCTION

This chapter explores the dynamics that impact the growth of the membrane filtration market. It demonstrates the scope and the growth of the related and interconnected markets.

The first section identifies some key markets related to the membrane filtration market, using MarketsandMarkets' Knowledge Store, and provides an overview of the interconnections. The subsequent sections provide a detailed and in-depth analysis of the major related markets.

MarketsandMarkets' studies, published separately, identified as related markets in this chapter, are given below.

TABLE 556 MARKETS ADJACENT TO MEMBRANE FILTRATION MARKET

Study Name	Publication Year	Base Year	Forecast Year
Microfiltration Membrane Market	2022	2021	2022-2027
Membrane Separation Technology Market	2017	2016	2017-2022

Source: MarketsandMarkets Analysis

14.2 LIMITATIONS

The market insights from adjacent markets are for reference only and may include the following:

- Market definitions different from the main market definition with one or more overlapping segments, leading to a difference in the market sizes
- Market sizes and growth rates assessed in the past, which may have changed since
- Market sizes and forecasts for years different from those of the main market
- Pre-COVID-19 and post-COVID-19 market sizes and forecasts

14.3 MICROFILTRATION MEMBRANE MARKET

14.3.1 MARKET DEFINITION

According to the Minnesota Rural Water Association, "Microfiltration is loosely defined as a membrane separation process done using membranes with a pore size of approximately 0.03 to 10 microns (1 micron = 0.0001 millimeters), a molecular weight cut-off (MWCO) of greater than 1,000,000 Daltons and relatively low feed water operating pressure of approximately 100–400 kPa (15–60 psi). Materials removed by microfiltration include sand, silt, clays, giardia lamblia and cryptosporidium cysts, algae, and some bacterial species. Microfiltration membranes are not an absolute barrier to viruses; however, when used in combination with disinfection, MF appears to control these microorganisms in water. There is a growing emphasis on limiting the concentrations and number of chemicals applied during water treatment. By physically removing the pathogens, membrane filtration can significantly reduce chemical addition, such as chlorination. Another application for the technology is to remove the natural-synthetic organic matter to reduce fouling potential. In its normal operation, MF removes little or no organic matter; however, when pre-treatment is applied, organic material can be removed. Microfiltration membrane is used as a pre-

treatment for Reverse Osmosis (RO) or Nanofiltration process (NF) to reduce fouling potential. Both RO and NF have been traditionally employed to desalt or remove hardness from groundwater.”

14.3.2 MARKET OVERVIEW

The microfiltration membrane market has a few leading players, such as Suez, Merck KGaA, Sartorius AG, and Koch Separation Solutions, catering to the majority of the demand from end users. The growing water scarcity and demand for clean water from municipalities and industries, coupled with the rising water usage norms and regulations set by governments of different countries, are expected to drive the microfiltration membranes market. The high growth potential and need for desalination in emerging markets provide new growth opportunities for market players. The market is also expected to be driven by the growing population and scarcity of fresh water.

Depleting freshwater resources, scarcity of clean water, and stringent environmental regulations on the discharge of wastewater into the environment are primarily contributing to the growth of the microfiltration membranes market. Additionally, rising industrialization, urbanization, and population are expected to increase the demand for clean water for drinking and domestic consumption. However, the high capital cost required for setting up new plants restrains the growth of the microfiltration membranes market.

14.3.3 MICROFILTRATION MEMBRANE MARKET, BY TYPE

Microfiltration membranes are divided into two main categories: organic and inorganic. Organic membranes are primarily made up of polymeric materials such as fluorinated polymers, polysulfone, cellulose, and others, including polyamides and polypropylene. Organic membranes have a larger share of the market compared to inorganic membranes. Inorganic membranes are also known as ceramic membranes and are made from alumina, zirconium, silicon carbide, and titania. Inorganic membranes have high heat and chemical resistance, withstand frequent backwashing, and have a long lifespan. However, they are expensive compared to organic membranes and are fragile and rigid in nature. Organic membranes, on the other hand, are cost-effective, easy to process, and available in a wide variety. The performance of membrane materials depends on two parameters, permeability, and selectivity, which are directly related to the applications where membranes are used.

TABLE 557 MICROFILTRATION MEMBRANE MARKET, BY TYPE, 2018–2021 (USD MILLION)

Type	2018	2019	2020	2021	CAGR (2018–2021)
Fluorinated Polymers	592.49	645.80	641.39	682.30	4.82%
Cellulosic	120.63	129.40	128.69	135.36	3.92%
Polysulfones	109.87	118.59	117.89	124.55	4.27%
Ceramic	73.10	76.28	76.03	78.40	2.36%
Others	72.82	78.79	78.31	82.88	4.41%
Total	968.90	1,048.87	1,042.30	1,103.49	4.43 %

Note: Others include Polypropylene, Polyamide, and Metals.

Source: Secondary Research, Primary Interviews, Industry Journals, Related Research Publications, Press Releases, and MarketsandMarkets Analysis

TABLE 558 MICROFILTRATION MEMBRANE MARKET, BY TYPE, 2022–2027 (USD MILLION)

Type	2022	2023	2024	2025	2026	2027	CAGR (2022–2027)
Fluorinated Polymers	733.71	795.10	869.66	956.54	1,055.17	1,167.04	9.73%
Cellulosic	143.85	153.88	165.93	179.93	195.39	212.55	8.12%
Polysulfones	132.94	142.70	154.20	167.07	181.54	197.69	8.26%
Ceramic	81.43	84.88	88.88	93.39	98.20	103.38	4.89%
Others	88.70	95.62	103.81	113.03	123.35	134.83	8.74%
Total	1,180.63	1,272.17	1,382.48	1,509.96	1,653.66	1,815.49	8.99%

Note: Others include Polypropylene, Polyamide, and Metals.

Source: Secondary Research, Primary Interviews, Industry Journals, Related Research Publications, Press Releases, and MarketsandMarkets Analysis

14.3.4 MICROFILTRATION MEMBRANE MARKET, BY REGION

For this study, the microfiltration membrane market has been segmented into five regions: Asia Pacific, North America, Europe, South America, and the Middle East & Africa. The global microfiltration membrane market is being driven by increasing demand for clean water, stringent regulations, population growth, urbanization, socio-economic development, and changing water consumption patterns. The United Nations' World Water Development Report 2020 predicts that global water demand will increase by 20-30% by 2050. This increase in demand for microfiltration membranes is being driven by factors such as water scarcity, stringent effluent quality regulations, governments focusing on green procurement policies, and an increased awareness of the need for water conservation.

In 2021, the microfiltration membrane market in Asia Pacific was the largest among the five regions. Rising population, urbanization, and rapid industrial and infrastructural development are increasing the demand for wastewater treatment plants and microfiltration membranes in the region.

TABLE 559 MICROFILTRATION MEMBRANE MARKET, BY REGION, 2018–2021 (USD MILLION)

Region	2018	2019	2020	2021	CAGR (2018–2021)
North America	243.90	264.50	263.39	279.37	4.63%
Europe	196.25	211.28	210.59	222.23	4.23%
Asia Pacific	342.36	373.12	369.75	393.08	4.71%
Middle East & Africa	126.74	136.33	135.29	142.52	3.99%
South America	59.65	63.64	63.29	66.30	3.58%
Total	968.90	1,048.87	1,042.30	1,103.49	4.43%

Source: Secondary Research, Primary Interviews, Industry Journals, Related Research Publications, Press Releases, and MarketsandMarkets Analysis

TABLE 560 MICROFILTRATION MEMBRANE MARKET, BY REGION, 2022–2027 (USD MILLION)

Region	2022	2023	2024	2025	2026	2027	CAGR (2022–2027)
North America	298.32	320.45	346.59	376.03	409.72	447.92	8.47%
Europe	236.53	253.06	272.48	294.31	318.67	345.77	7.89%
Asia Pacific	420.61	454.85	497.87	549.46	608.41	675.71	9.95%
Middle East & Africa	153.39	166.00	180.96	198.14	216.97	237.74	9.16%
South America	71.79	77.81	84.58	92.02	99.89	108.34	8.58%
Total	1,180.63	1,272.17	1,382.48	1,509.96	1,653.66	1,815.49	8.99%

Source: Secondary Research, Primary Interviews, Industry Journals, Related Research Publications, Press Releases, and MarketsandMarkets Analysis

14.4 MEMBRANE SEPARATION TECHNOLOGY MARKET

14.4.1 MARKET DEFINITION

Membrane separation technology is a method utilized to reduce the size of an aqueous waste stream and retrieve water from the waste stream through separation. This process separates materials through pores in the molecular structure of a continuous framework. This technology is extensively applied in commercial and industrial settings. There are numerous benefits to using membrane separation technology. These include the ability to separate components at a lower temperature and with less energy consumption. This technology provides cost-effective and energy-efficient solutions in various applications, including water and wastewater treatment, medical and pharmaceutical industries, food and beverage production, and others. Certain properties of membrane separation technology, such as durability, porosity, permeability, stability, and selectivity, make them essential components in various industrial applications.

14.4.2 MARKET OVERVIEW

The membrane separation technology market is segmented based on technology, application, and region. The global water and wastewater treatment market is growing at a fast pace, with significant new activities in developing economies. This is driving the global membrane separation technology market growth. The growth opportunities of the market are associated with the increasing demand for water desalination units and brackish water treatment facilities. The market players in emerging economies such as South America and the Middle East & Africa are establishing water desalination projects for the desalination of seawater and brackish water to combat water scarcity problems. The capital cost of membrane separation technology is the major restraint for the market. Municipalities in arid regions of the world look forward to buying brackish water and some seawater desalination units. The major challenge for the market is to address the problems associated with the short lifespan of membranes.

14.4.3 MEMBRANE SEPARATION TECHNOLOGY MARKET, BY TECHNOLOGY

Various types of membrane separation technologies are used in the market, depending on the size of the material that needs to be selectively separated during the processes. Membrane separation technologies are employed for liquid-liquid, liquid-solid, and gas separation, namely MF, RO, UF, NF, and others. The most widely used processes out of these are UF, MF, and RO. Other technologies include several industrial membrane processes categorized as to-be-developed or less-used technologies.

Each separation technique requires specific specifications, such as the type of material to be used in the membrane, pressure, pore size, and particle size. The pores in the membranes effectively remove solids, bacteria, viruses, and other unwanted molecules during the separation processes. Membranes are manufactured in a variety of configurations, such as hollow fiber, spiral, and tubular shapes, offering

varying degrees of separation. These different configurations and a variety of membrane technologies available in the marketplace provide certain advantages for specific process needs.

TABLE 561 MEMBRANE SEPARATION TECHNOLOGY MARKET, BY TECHNOLOGY, 2015–2022 (USD MILLION)

Technology	2015	2016	2017	2022	CAGR (2017–2022)
RO	6,543.5	7,009.3	7,494.1	10,566.2	7.1%
UF	4,464.5	4,800.4	5,151.6	7,394.9	7.5%
MF	3,283.3	3,496.9	3,717.6	5,059.9	6.4%
NF	1,329.9	1,453.8	1,585.6	2,508.2	9.6%
Others	1,684.4	1,791.2	1,901.4	2,573.1	6.2%
Total	17,305.6	18,551.6	19,850.3	28,102.2	7.2%

Note: Others include Forward Osmosis, Membrane Distillation, Ion Exchange, and Chromatography Technology.

Source: Secondary Research, Primary Interviews, Related Research Publications, Press Releases, Industry Journals, and MarketsandMarkets Analysis

14.4.4 MEMBRANE SEPARATION TECHNOLOGY MARKET, BY REGION

The market for membrane separation technology is divided into five regions: Asia Pacific, North America, Europe, the Middle East & Africa, and South America. The Asia Pacific region is the biggest and fastest-growing market for membrane separation technology, while North America is the second-largest market in terms of value. One of the primary reasons for the high demand in the Asia Pacific region is the continuously growing population, which is driving the demand for water and wastewater treatment. Additionally, the increasing usage of membrane separation technology in pharmaceutical and medical applications and industrial processing is boosting the market in the region.

TABLE 562 MEMBRANE SEPARATION TECHNOLOGY MARKET, BY REGION, 2015–2022 (USD MILLION)

Region	2015	2016	2017	2022	CAGR (2017–2022)
North America	4,528.7	4,804.9	5,088.6	6,766.4	5.9%
Europe	3,521.3	3,728.9	3,941.7	5,192.0	5.7%
Asia-Pacific	6,586.5	7,142.4	7,728.6	11,671.6	8.6%
Middle East & Africa	2,012.9	2,170.5	2,335.7	3,398.1	7.8%
South America	656.2	705.0	755.8	1,074.1	7.3%
Total	17,305.6	18,551.6	19,850.3	28,102.2	7.2%

Source: Secondary Research, Primary Interviews, Related Research Publications, Press Releases, Industry Journals, and MarketsandMarkets Analysis

15 APPENDIX

15.1 DISCUSSION GUIDE

Q. 1. How do you associate yourself with the membrane filtration market? Are you directly involved with the manufacturing/R&D/sales and marketing of membrane filtration technologies in your company?

Primary source's viewpoint: _____

Q. 2. What is the role of your company in the global membrane filtration market? Is it a manufacturer/supplier, distributor/end-user?

Primary source's viewpoint: _____

Q. 3. According to our research, the membrane filtration market has been segmented, as seen below. Validate the market segmentations.

TYPE	MODULE DESIGN	APPLICATION	REGION
<ul style="list-style-type: none"> ▪ Reverse Osmosis ▪ Ultrafiltration ▪ Microfiltration ▪ Nanofiltration 	<ul style="list-style-type: none"> ▪ Spiral Wound ▪ Tubular Systems ▪ Plate & Frame and Hollow Fiber 	<ul style="list-style-type: none"> • Dairy Products <ul style="list-style-type: none"> • Liquid Milk <ul style="list-style-type: none"> ▫ Milk Protein Fractionation ▫ Milk Concentration ▫ Milk Pre-Concentration ▫ Water recovery • Other Dairy Products <ul style="list-style-type: none"> ▫ Whey ▫ Milk & Whey-based Ingredients ▫ Cheese • Drinks & Concentrates • Wine & Beer • Other Food & Beverage Applications 	<ul style="list-style-type: none"> ▪ North America ▪ Europe ▪ Asia Pacific ▪ South America ▪ RoW

Primary source's viewpoint: _____

Q. 4. According to you, what was the global market size of the membrane filtration market in 2022, and what would be the CAGR for the next five years (2023–2028)?

REGION	MARKET SIZE (USD MILLION)/MARKET SHARE, 2022)	CAGR (2023–2028)
North America		
Europe		
Asia Pacific		
South America		
RoW		

Q. 5. What are your views on the membrane filtration market? What are the current trends, and how will they change in the future?

Primary's viewpoint: _____

Q. 6. What could be the values and market share of the following types of membranes in the membrane filtration market?

TYPE	MARKET SIZE (USD MILLION)/MARKET SHARE, 2022	CAGR (2023–2028)
Reverse Osmosis (RO)		
Ultrafiltration (UV)		
Microfiltration (MF)		
Nanofiltration (NF)		

Primary source's viewpoint: _____

Q. 7. Which type of membrane filtration (RO, UV, NF, MF) is used in the processing of food and beverage products?

Primary's viewpoint: _____

Q. 8. What is the percentage contribution of each of the following applications to the membrane filtration market? What are the key factors driving the growth of the various segments of the market in the next five years? Kindly validate the market segmentation.

APPLICATION	MARKET SHARE, 2022	CAGR (2023–2028)
Dairy Products		
<ul style="list-style-type: none"> ▪ Liquid Milk <ul style="list-style-type: none"> • Milk Protein Fractionation • Milk Concentration • Milk Pre-concentration • Water Recovery ▪ Other Dairy Products 		

- Whey
- Milk and Whey-based Ingredients.
- Cheese

Drinks & Concentrates

Wine & Beer

Other Food & Beverage Applications

Primary source's viewpoint: _____

Q. 9. What is the percentage contribution of each of the following segments to the membrane filtration market? What are the key factors driving the growth of the various segments of the market in the next five years? Kindly validate the market segmentation.

MODULE DESIGN	MARKET SHARE, 2022	CAGR (2023–2028)
Spiral Wound		
Tubular Systems		
Plate & Frame and Hollow Fiber		

Primary source's viewpoint: _____

Q. 10. What could be the values and market share of the following types of membrane materials in the membrane filtration market?

TYPE	MARKET SIZE (USD MILLION)/ MARKET SHARE, 2022	CAGR (2023–2028)
Polymeric		
Ceramic		

Primary source's viewpoint: _____

Q. 11. Please provide your insights on the membrane filtration market across different countries/regions mentioned below. Please add other key countries or regions to the list if you are of the opinion that they need to be included.

COUNTRY/REGION	MARKET SIZE, 2022 (USD MILLION/BILLION)
US	
Canada	
Mexico	
Spain	
Germany	

Italy
UK
France
Netherlands
Denmark
China
India
Japan
Australia
New Zealand
Brazil
Argentina
South Africa
Middle East

Primary source's viewpoint: _____

Q. 12. Are there any technological innovations specific to the membrane filtration market?

Primary's viewpoint: _____

Q. 13. What are the various upcoming products that are expected to impact the market significantly in the future?

Primary's viewpoint: _____

Q. 14. Please explain the value chain for the membrane filtration market.

Primary's viewpoint: _____

Q. 15. Kindly provide the drivers, restraints, opportunities, and challenges for the membrane filtration market.

MARKET DYNAMICS	PRIMARY VIEWPOINT
Drivers	
Restraints	
Opportunities	
Challenges	

Primary source's viewpoint: _____

Q. 16. What are the key revenue pockets for the market in the next five years?

Primary source's viewpoint: _____

Q. 17. Where do you see your company positioned in this market in the next five years and why? What strategies are being adopted by your company to gain a competitive advantage in the market?

Primary source's viewpoint: _____

Q. 18. What are the competitive strategies adopted by market players to survive in the market?

Primary's viewpoint: _____

Q. 19. What will be the impact of the recession on the market dynamics? According to you, which region/country will be most impacted by the recession in the global membrane filtration market & why?

Primary's viewpoint: _____

Q. 20. What are some of the regulations specific to the membrane filtration market that will affect the market in the future?

Primary's viewpoint: _____

Q. 21. What are some of the upcoming key conferences and events scheduled in the upcoming year (2023-2024)?

Primary's viewpoint: _____

Q. 22. According to you, who are the key players in the global membrane filtration market? Can you list a few and why?

Primary's viewpoint: _____

Q. 23. Please provide your insights on the key players in this market. According to you, which company is projected to dominate the membrane filtration market in the next five years, and why? Some of the market leaders are provided below:

COMPANY NAME	MARKET SHARE (%), 2022
Alfa Laval	
GEA Group Aktiengesellschaft	
DuPont	
Pall Corporation	
Veolia	
3M	
Pentair	
SPX Flow	
Donaldson Company, Inc	
Porvair Filtration Group	

Hydranautics - A Nitto Group Company.

TORAY INDUSTRIES, INC.

Koch Separation Solutions

Synder Filtration, INC

ProMinent

MANN+HUMMEL

Graver Technologies

Critical Process Filtration, INC

Novasep

Nilsan Nishotech Systems Pvt. Ltd.

Applied Membrane Inc

Zwitterco

Membrane Solution (Nantong)

Membrane System Specialist, Inc

Imemflow

Primary source's viewpoint: _____

15.2 KNOWLEDGESTORE: MARKETSandMARKETS' SUBSCRIPTION PORTAL

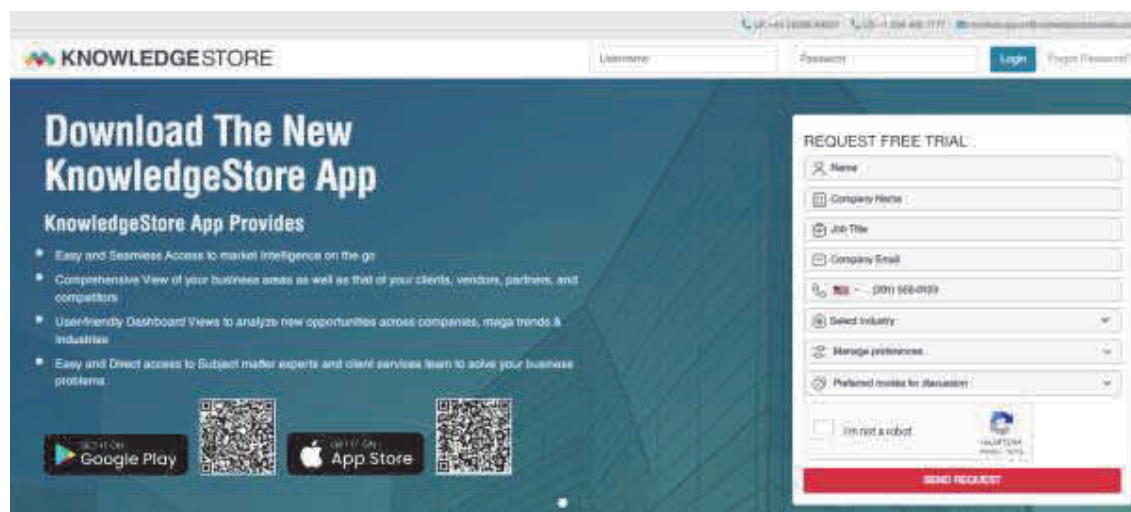
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 - F&B Processing and Technology (24)
 - Flavors, Colors and Fragrances (10)
 - Food safety & TC (11)
 - Free From and Clean Label (8)
- Healthcare
- Information & Communications Technology
- Packaging, Construction, Mining & Metals
- Retail & E-commerce
- Telecommunications & Electronics

Sub-Sector	Market Size (USD)
F&B Logistics, Cold Chain & Packaging	0.2%
Nutraceuticals and Dietary Supplements	1.8%
Food Safety & TC	1.1%
Free From and Clean Label	0.4%
Nutraceuticals and Dietary Supplements	0.9%
F&B Ingredients	0.3%
F&B Processing and Technology	0.2%
F&B Additives	0.4%
Flavors, Colors and Fragrances	1.1%
Consumer F&B	0.4%

Search Reports

REPORT TITLE	DOMAIN	MARKET SIZE 2022	CAGR %	PUBLISHED
3D Food Printing Market by Vertical (Government, Commercial, and Residential), Technique (Extrusion Based Printing, Selective Laser Sintering, Binder Jetting and Inkjet Printing), Ingredient and Geography / Global Forecast to 2027	Food & Beverage	0.2	37.8	May 2022

All market sizes are in USD bn

15.3 CUSTOMIZATION OPTIONS

MarketsandMarkets offers customizations according to client-specific scientific needs with the given market data.

The following customization options are available for the report:

PRODUCT ANALYSIS

- Product matrix, which gives a detailed comparison of the product portfolio of each company.

GEOGRAPHIC ANALYSIS

- Further breakdown of the Rest of Asia Pacific membrane filtration market into South Korea, Taiwan, Pakistan, and Bangladesh
- Further breakdown of the Rest of Europe membrane filtration market into Finland and Sweden.
- Further breakdown of the Rest of South America membrane filtration market into Bolivia and Ecuador.

COMPANY INFORMATION

- Detailed analyses and profiling of additional market players (up to 5)

15.4 RELATED REPORTS

SR. NO.	REPORT TITLE	PUBLISHED DATE
1.	<p>MICROFILTRATION MEMBRANE MARKET- GLOBAL FORECAST to 2027</p> <p>By Type (Fluorinated Polymers, Cellulosic, Polysulfones, Ceramic), Filtration Mode, Applications (Water Treatment, Food & beverage, Biopharmaceutical Processing, Chemical) & Region</p> <p>https://www.marketsandmarkets.com/Market-Reports/microfiltration-membranes-market-21698274.html</p>	May, 2022
2	<p>MEMBRANE SEPARATION TECHNOLOGY MARKET- GLOBAL FORECAST TO 2022</p> <p>By Application (Water & Wastewater Treatment, Food & Beverage, Medical & Pharmaceutical, Industrial Processing), Technology (RO, UF, MF, NF), and Region</p> <p>https://www.marketsandmarkets.com/Market-Reports/membrane-separation-technology-market-267308161.html</p>	May, 2017

15.5 AUTHOR DETAILS

Syed H. Rizvi

Associate-Director-Agriculture

Syed has more than 13+ years of rich experience in Food and Agriculture. He is actively involved in conducting strategic advisory research and spearheading turn-key projects for reputed international organizations in the agribusiness sector.

He has also been instrumental in providing solutions to clients pertaining to market sizing, supply chain analysis, competitive intelligence, and market entry strategies. Syed has worked on several key consulting projects sponsored by the USDA, European Export Councils, and Tier 1 Food and Agricultural Companies.

Contributors

Nishikant Yadav

Manager

Abhishek Dhar

Team lead

Vibhuti Gupta

Senior Research Analyst

Priyanka Fulzele

Research Associate

Saiprasad Kale

Research Associate

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