

FMX-Revolution for High Solids

HIGHER CONCENTRATION & HIGHER RECOVERY

Values & Benefits

Total solids too high for conventional membrane filtration?

Are you...?

Wondering if membrane can handle your waste stream?

Tired of frequent fouling problems?

Hoping to increase your concentration target?

FMX is your Answer!



What is FMX?

- FMX is a membrane filtration system specifically designed to prevent fouling, especially for high solids loading.
- FMX can be adapted to utilize any type of flat sheet membrane, created from any material (including ceramic and metal) and for any pore size (e.g. MF, UF, NF, LPRO).
- Originally developed for wastewater treatment, FMX is now applied more widely in production processes across a diverse range of industries, including chemical, biochemical, and food & beverage.

Your Challenges

- High-solids
- Frequent fouling
- Difficulty in extracting target material
- Complicated process train
- High surcharge & hauling costs

FMX Benefits

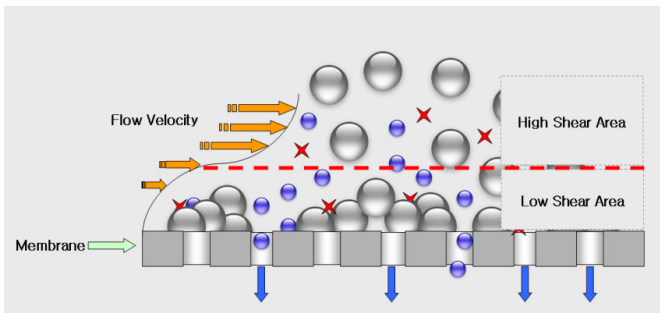
- Less downtime
- Higher concentration & recovery
- Replace steps to shorten process
- Reduce hauling costs & tipping fee
- Small footprint



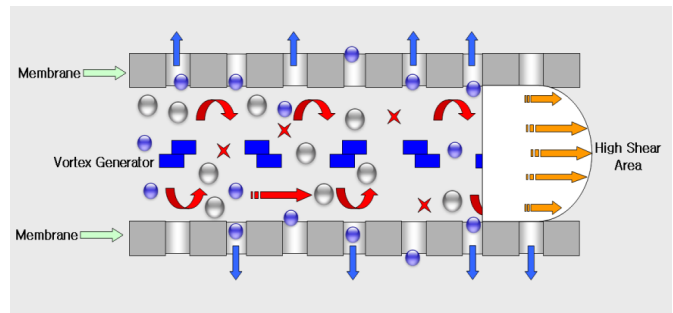
How FMX works

Technical Benefits & Strength

The technological strength of FMX membrane filtration technology is based on optimizing the von Karman Vortex Theory to produce powerful vortices that prevent solids from building up on the membrane surface. FMX's modular system uses specially designed and patented blades that rotate between membrane surfaces to generate turbulence up to 100 times stronger than conventional cross flow or vibration. This process prevents membrane fouling so effectively that FMX can handle high total dissolved and suspended solids, over 1.5%, without frequent fouling issue.



<Conventional high solid filtration>



<FMX Vortex generating filtration>

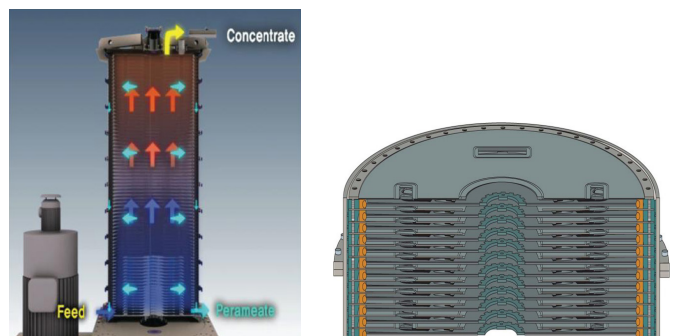
The Vortex Generator

The FMX maintains the integrity of its membranes using patented vortex-generating blades made with special lightweight engineering plastic resistant to corrosion, chemicals, and extreme temperatures. The resulting turbulent flow works continuously to prevent the buildup of solids on the membrane surface with minimum energy consumption.



How FMX Works

FMX's membrane modules are constructed with flat sheet, vertically stacked membrane trays, sandwiched by vortex-generating blades rotating dynamically at speeds customized for individual feed stream characteristics and operating conditions. Each module is pressurized to push concentrated or rejected feed streams upward through an opening hole on membrane tray, while permeate moves horizontally through drain cloth and then downward for collection.



“FMX’s efficient vortex-generating technology and unique modular design allow for easy and convenient replacement of individual membranes with minimal downtime.”

Application and References

Industrial Wastewater



Due to the presence of serious toxic contaminants and potentially hazardous materials, industrial wastewater is among the most difficult to treat for discharge or reuse. Nevertheless, as water becomes an increasingly scarce resource worldwide, both financial and environmental concerns have prompted escalating demand for water conservation. Fortunately, FMX's ability to effectively treat high-solids waste streams allow for reuse of challenging industrial wastewater streams, providing a sustainable solution that simultaneously reduces hauling costs and disposal expense.

- Shales gas produced water reuse
- Acid mine drainage treatment
- Process water reuse
- Volume reduction
- Hazardous material removal



Manufacturing Process



While more concentration delivers higher value in many chemical or biochemical processes, a tremendous amount of energy is normally required to improve recovery rates from the filtration of high-solids waste streams. By reliably handling higher concentrations while minimizing clogging or fouling issues, FMX can not only facilitate higher concentration in production but also simplify the process train, making it less energy-intensive and less water-intensive.

- Colloidal particle concentration
- Fermentation broth filtration
- Probiotics concentration & separation
- Amino acid concentration
- Diafiltration



Recovery/Recycle

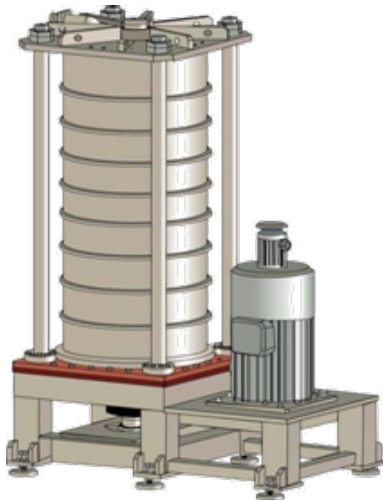


Many waste streams that result from conventional filtration processes still contain valuable components that are difficult to retrieve. Don't throw away what could become a lucrative source of additional revenue--FMX can help! Nutrients, precious metals, oils, chemicals, and even beer are among the resources that we have been able to recover from former waste streams. More recovery means more profit. Less waste means less cost. Either way, you win.

- Nutrient recovery from biogas effluent (Digestate)
- Phosphorus recovery from livestock manure
- Methylcellulose recovery from wastewater
- Precious metal recovery
- Oil recovery



FMX Models



S Class

Designed in close cooperation with Samsung Fine Chemicals, the FMX-S class is our full-featured standard model, boasting premium specifications in construction materials, temperature tolerances, and chemical compatibility. The combination of its stainless-steel construction and high temperature and pressure ratings make the FMX-S Class ideal for the most demanding high-value applications, including chemical, petro-chemical, etc.

E Class

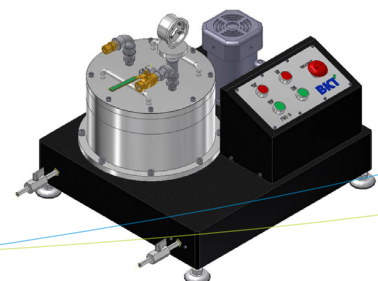
Specifically designed for lower temperature and pressure applications, the FMX-E class (Economic Model) provides a cost-effective option for alternative high-solid applications, including treatment of biogas plant digester effluent treatment, manufacturing processes in the food & beverage industry, etc. Use of fiberglass housing and basic mechanisms lowers equipment pricing up to 40% when compared to that of a comparable standard FMX-S model, at the expense of more comprehensive pressure and temperature ranges, making the FMX-E Class suitable primarily for MF and UF applications.

P Class

The FMX-P Class is a pilot-scale membrane filtration system whose size and capacity provide a more accurate design basis without sacrificing the efficiency of the smaller FMX-B class. Not only does the FMX-P class offer more than 80 times the membrane surface area of the B-class but it also contains a membrane module assembly with fluid mechanics and process designs very similar to those employed in full-scale industrial units. Designed to simulate full-scale operation, the FMX-P class is extremely useful for estimating performance factors of large-scale operations.

B Class

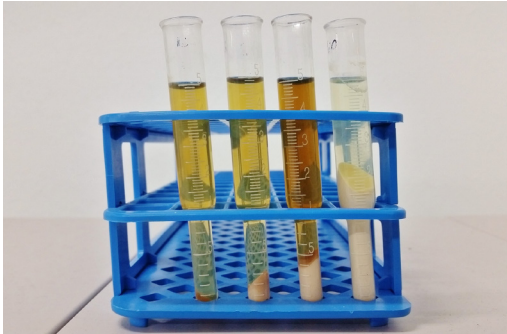
The FMX-B Class is a bench-top model comprised of a single membrane module constructed from one membrane sheet under a vortex-generating blade. The small scale of the FMX-B class facilitates efficient membrane selection and analysis of budgetary design factors, especially for in-house testing for scaling to full-scale operations. Ideal for R&D, this model is highly effective for testing the feasibility of membrane separation for unconventional applications.



Your Next Step

From our labs to your site

Lab Analysis



At BKT, we understand that every sample has unique characteristics and every client has unique targeted goals. Most likely, we have handled samples similar to yours, but we prefer hands-on confirmation of how we can separate your trouble from your process. Just send us 5 gallons of sample for analysis and membrane optimization for your specialized application.

- Full analysis of client's water sample
- Definition of project goals
- Selection of optimum membrane using FMX-B

On-site Test



To facilitate maximum accuracy of our design, we then simulate a full-scale operation of your process. Based on experience, we recommend an ON-SITE TEST (OST) to calibrate for all external factors; however, in the event of logistic difficulties, our labs are built to accommodate an IN-HOUSE TEST(IHT) instead. Both simulations allow us to help you determine the best real-time operation strategy, including choice of cleaning method, cleaning cycle timing, batch or continuous process, etc.

- Verify the flow rates that can be achieved using FMX technology
- Confirm long term operation and reliability
- Formulate optimum cleaning procedures and other operating variables
- Determine a replicable (%) recovery rate with sustainable permeate flow rate
- Measure effects of repeated cleaning and filtration cycles to estimate the lifespan of membrane modules

Customization



You can consolidate several processes into our single step. You may be able to reach higher concentration goals. You can retrieve formerly wasted materials for additional revenue. You may conserve resources by using less energy. You should explore a few readily available options more suitable for you than ours.

These are just a sample of conclusions from our post-test consultations. We never hesitate to reveal the complete truth, so if we assure you that our solution is best, you can be confident that it should be your only option.

- Objective consultation on ideal treatment process, per BKT's wide range of experience.
- Optimized selection of scale, model selection considering PRE & POST treatment with overall project objectives.
- Quantitative analysis of economic benefits & financing options.

Specifications

System

Model	S-Class	E-Class	P-Class	B-Class
Class Type	Standard	Economic	Pilot	Bench Scale
Membrane Surface Area	1,021 ft ²	431 ft ²	0.94 / 16 / 34 ft ²	0.16 ft ²
Maximum Pressure	213 psi	71 psi	435 psi	213 psi
Membrane Options	MF, UF, NF	MF, UF	MF, UF, NF	MF, UF, NF
Maximum Temperature	203 °F	158 °F	203 °F	158 °F
Dimensions(LxWxH)	7.2' x 4.6' x 12.1'	5.3' x 4.3' x 7.5'	4' x 1.3' x [2'/3'/3.5]	1' x 1.3' x 1'
Weight	17,600 lbs	5,510 lbs	1,235 / 1,680 / 1,800 lbs	189 lbs
Motor	75 kW	30 kW	7.5 kW	0.2 kW
Vortex RPM	270	270	290 ~ 350	800
Power Requirement	380/460 v	380/460 v	220/380 v	220 v (2P)

Material

Model	S-Class	E-Class	P-Class	B-Class
Chassis	SS 41 & SM45C	SS41 & SM45C	STS 304	STS 304
O-Rings	EPDM	EPDM	EPDM	EPDM
Membrane Trays	STS 304	Noryl	STS 304	-
Vortex Generators	Noryl	Noryl	Plastic	STS 304
Guide Rings	Noryl / STS304	Noryl	Plastic / STS 304	-
Bottom Cover Plate	STS 304	PE	-	-
Top Cover Plate	STS 304	PE	-	-
Drive shaft	STS 304	STS 304	-	-
Outer Shell	Coated SS41	FRP	-	-



