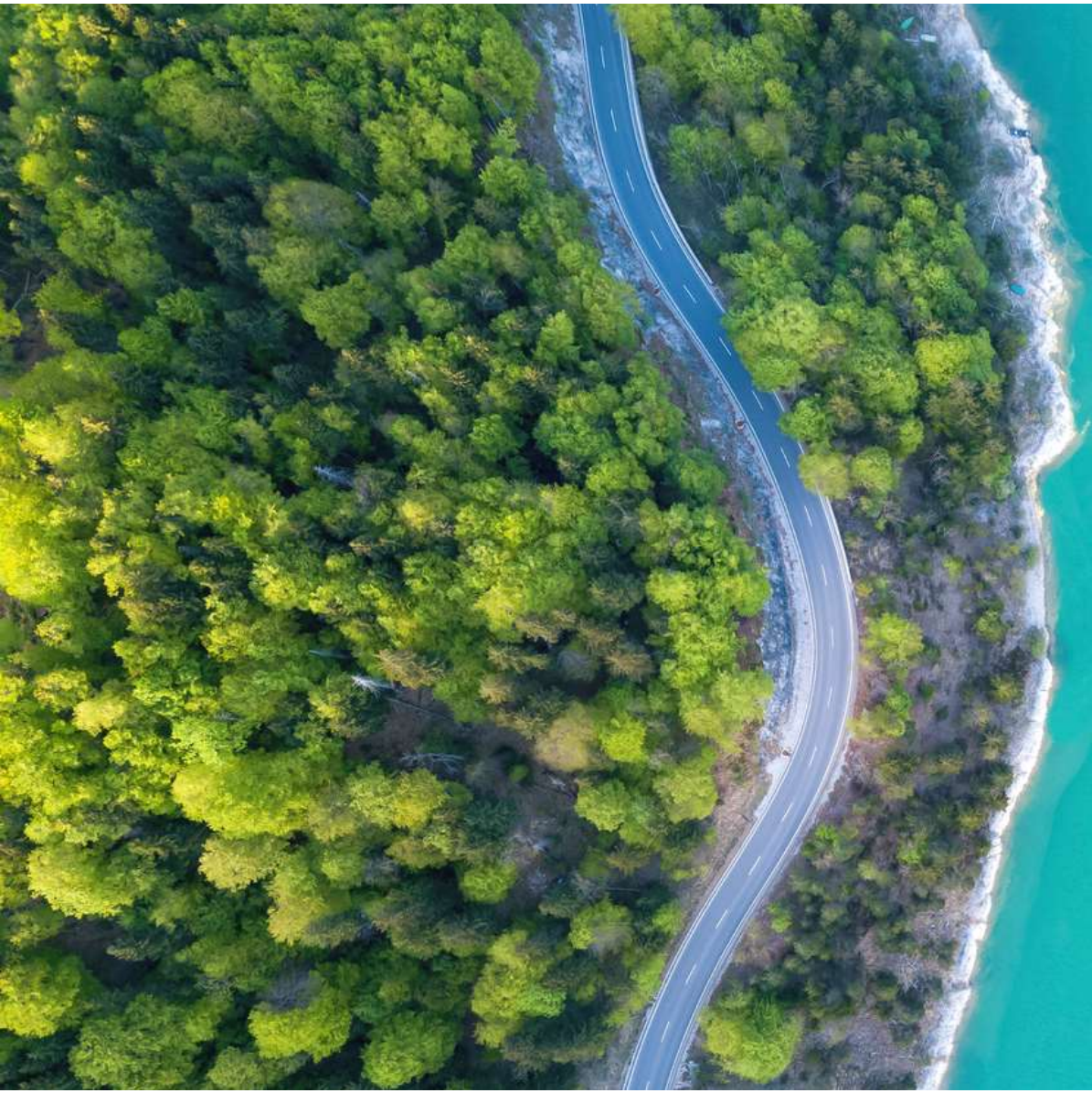

PVDF essentiality in Water and Wastewater Treatment

Javier Villa
Global Product Manager, DuPont Water Solutions
CEFIC collaboration workshop, Brussels
Dec 12, 2022

Some of the content of this presentation was provided by the courtesy of Veolia

DUPONT™

Having an expansive innovative mindset is essential to reaching our sustainability goals.

Because water is at the heart of the world's most critical needs, solving tomorrow's global water challenges unlocks the rest of the United Nations' 2030 Sustainable Development Goals.

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Water Solutions

Water Challenges Recently in the Headlines

A drought in Italy's risotto heartland is killing the rice

The Washington Post

Source: Washington Post

Spain Grapples With Water Shortages as Heat, Drought Continue

telesur

Source: teleSUR HD

Europe's water crisis is much worse than we thought

NATIONAL GEOGRAPHIC

National Geographic

REUTERS®

'Hitting rock bottom' - drought, heat drain Spanish reservoirs

Source: Reuters

BBC

Europe's drought the worst in 500 years - report

23 August

Source: BBC

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Water Solutions

EU Policy Strategy on Water

Zero-pollution ambition and Chemicals Strategy for Sustainability

Circular Economy Action Plan

Strengthening drinking water quality standards	Improving urban wastewater treatment	Ensuring safe water reuse for agricultural irrigation
• Drinking Water Directive • Industrial Emissions Directive	• Revision of the Urban Waste Water Treatment Directive	• Regulation on Minimum Requirements on Water Reuse

European Taxonomy DNSH Technical Guidance

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DuPont Water Solutions Portfolio

Leaders in RO, UF and IER Separation Technologies

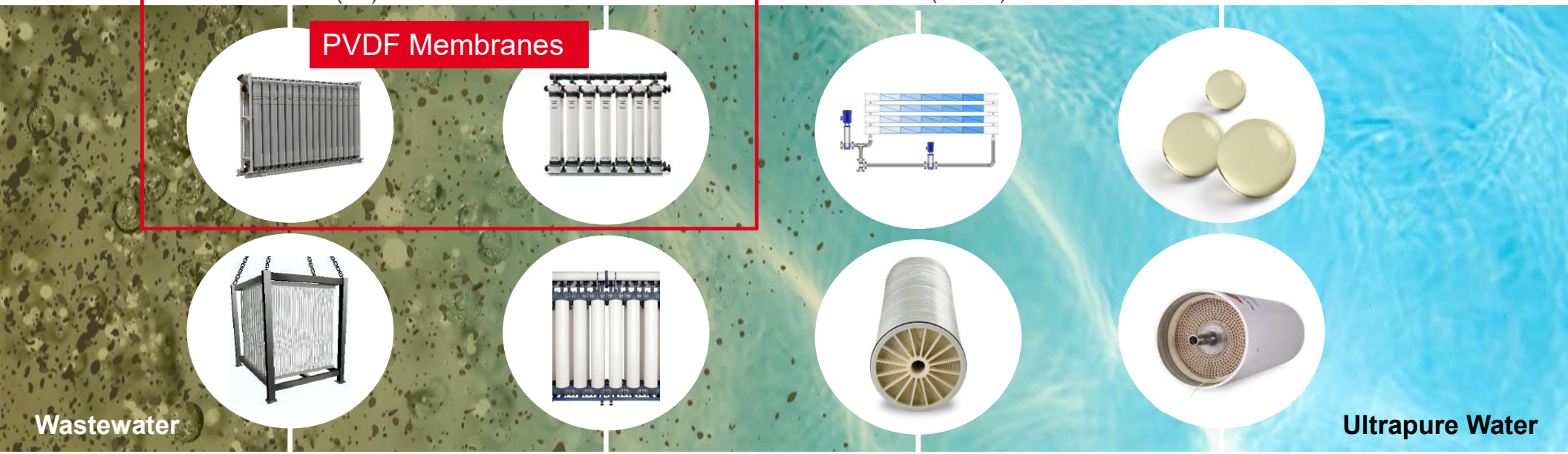
Memcor®
Membrane BioReactor & Ultrafiltration (UF)

IntegraFlux™
Ultrafiltration (UF)

PVDF Membranes

Desalitech
Closed Circuit Reverse Osmosis (CCRO)

Amber Series
Ion Exchange Resins (IER)



Wastewater

Ultrapure Water

OxyMem
Membrane Aerated BioReactor (MABR)

inge®
Ultrafiltration Multibore® membrane

FilmTec™
Reverse Osmosis (RO) Nanofiltration (NF)

Electrodeionization
(EDI)

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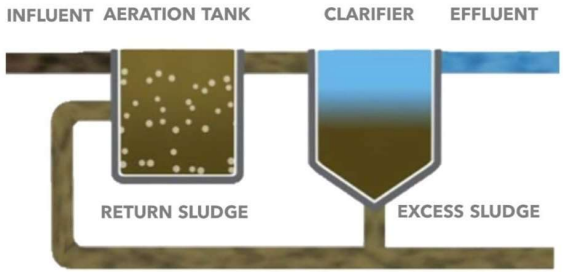
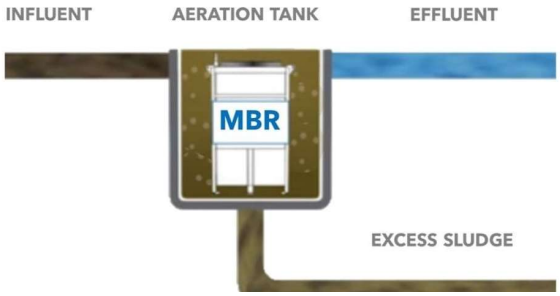
MBR Helps Turn Municipal Wastewater into Valuable Resource

FROM: Conventional secondary biological treatment



TO: Advanced Membrane Bioreactor (MBR)



PVDF hollow fiber membranes

MBR - Immediate benefits

- ✓ Highly efficient C, N and P removal in small footprint
  - 25-50% reduced footprint (new systems).
  - Retrofit conventional systems
- ✓ Pathogen and sediment removal - Water suitable for indirect or direct reuse:
  - Agricultural irrigation or industrial cooling tower (*)
  - Only one step away to aquifer replenishment or other industrial uses (*)

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(*) might require final disinfection before distribution or use

PVDF MBR Enables High-effluent Quality for Water Reuse

Parameter	Conventional effluents	*NEW* Water reuse standards	MBR Achieves
Nitrogen	10 - 30 mg/L	< 6 mg/L	✓
Phosphorus	1 - 30 mg/L	0.1 – 0.5 mg/L	✓
BOD	25 - 50 mg/L	< 2 mg/L	✓
TSS	25 - 50 mg/L	< 2 mg/L	✓
Turbidity	10 - 30 NTU	< 0.2 NTU	✓
Coliforms	10^5 - 10^7 cfu/100 mL	< 2.2 #/100 mL	✓
Virus / Protozoa	2-2.5 log	Regional	**5-6 log**

MBR biological value

MBR filtration value

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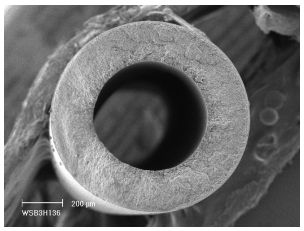
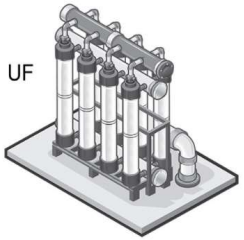
PVDF as material of choice in UF for “hard-to-treat” waters

PVDF (Polyvinylidene difluoride)		PES (Polyethersulfone)
2000 ppm	Resistance to cleaning chemicals (NaOCl)	200 ppm
No	Need chemical aids dosing	Yes
> 99,9999%	Pathogen removal	> 99,99%
0.25-1.0 bar	**Energy consumption (TMP)**	0.25-2.0 bar
82%	**Water efficiency (av. recovery)**	78%
NSF	Drinking Water certifications	NSF





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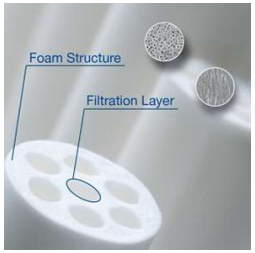

Impact of Restricting PVDF membranes for Water Treatment

Employing alternative wastewater sources will be challenging in the absence of PVDF membranes, as the material enables:

Lower land *footprint* and consume less *energy*

Highest treatment *quality* and *pathogen* absolute barrier

Lower *chemical use* (both coagulation and cleaning chemicals)

Operational water treatment facilities currently using PVDF membranes will need to discontinue use, with double impact:

Environment

Harder to meet Municipal WW Directive N & P limits, as well as net energy consumption requirements under *DNSH Tech. Guidance*.

People

More than 25 million people in Europe and 140 million people in the World have their wastewater treated by MBR PVDF membranes

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