

# Aquaporin Inside®



How to increase water sustainability while reducing costs in the textile industry

# Be at the forefront of sustainable water use while reducing capex and opex

The textile industry is one of the most water consuming and polluting industries in the world. As a result, textile factories are under increasing pressure from both society and governments, who are demanding more sustainable textile production.

Stringent regulation on the use and reuse of water in the textile industry is a growing trend, and some countries have even implemented regulations that require Zero Liquid Discharge (ZLD).

It is a tough balancing act for factory owners to use less water, reuse more water, use less chemicals and minimize liquid waste – all while running a profitable business – especially as tightening regulations typically entail costly investments in complicated cleaning processes and land.

At Aquaporin, we make it possible for factory owners to comply with, and even exceed, regulations while also lowering capital and operating expenses. By using Aquaporin Inside® Forward Osmosis membranes in your effluent treatment, you can minimize the steps needed to fulfil internal and external requirements to:



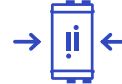
MINIMIZE  
YOUR WASTE



REUSE MORE  
WATER WITH  
BETTER QUALITY



SIMPLIFY YOUR  
EFFLUENT TREATMENT



OPTIMIZE YOUR  
LAND USE





# The textile industry - a leading water polluter

- Textile effluent has a complex composition, requiring several traditional treatment technologies (biological and chemical).
- Textile effluent is one of the world's most polluted wastewaters, with high COD concentration, pH and temperature, many toxic chemicals, strong color, and low biodegradability.
- Even after conventional treatment, effluent from the dye industry still releases 10-15% of its coloring contaminants into the ecosystem.
- 79 billion cubic meters of clean water was consumed by the textile industry in 2015, and this is expected to increase by at least 50% by 2030.

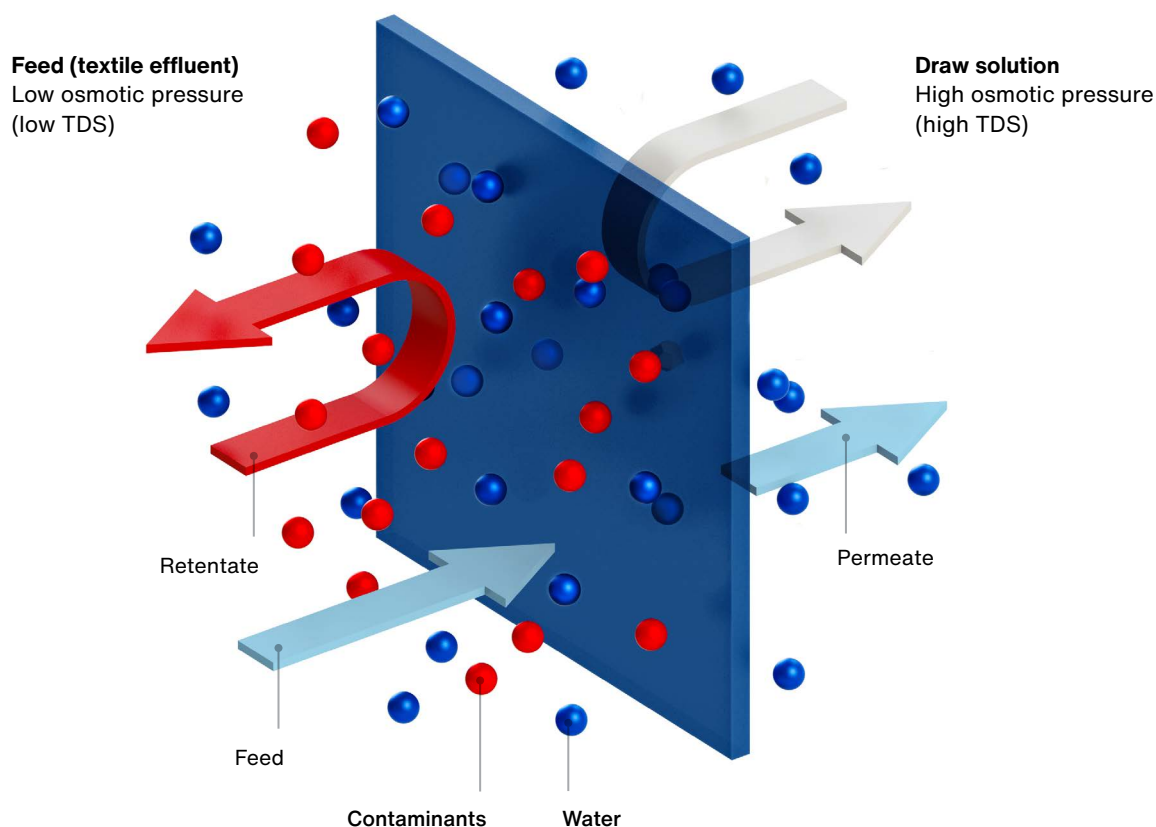
# Use forward osmosis to overcome effluent treatment challenges

Aquaporin Inside® Forward Osmosis (FO) enables the efficient extraction of water, leaving behind challenging contaminants and reducing effluent volume. In the textile industry, it can reduce wastewater volume up to 50 times while increasing water recovery by up to 98 %.

The process uses natural energy in the form of osmotic pressure to transport water through a filtration membrane, which improves efficiency without increasing energy use.

## The power of aquaporins

In FO processes, the quality of the membrane is key. Aquaporin Inside® FO membranes use aquaporin proteins to filter water. Aquaporins are 100% selective to water molecules, which ensures our FO membranes are highly efficient at rejecting chemicals, minerals, color and other contaminants.



***“The textile industry uses more than 90 billion cubic meters of water every year – much of it in water-stressed areas. The industry needs to become much better at conserving water, so we can dress the world without making it thirsty. We need to act now.”***

— Bahare Haghshenas

Partner, SDG strategy and innovation, Monitor Deloitte

### With forward osmosis you can

- ✓ Minimize waste by effluent volume and sludge reduction to save costs related to disposal or evaporation/crystallization in Zero or Minimal Liquid Discharge systems
- ✓ Reuse more water with better quality by treating streams with difficult contaminants and high BOD/COD/TOC – where other technologies fail
- ✓ Simplify treatment through fewer and faster process steps by partly/fully replacing primary, secondary and tertiary treatment – including chemical and biological treatments – to lower CAPEX/OPEX
- ✓ Optimize land use through simpler and more efficient treatment

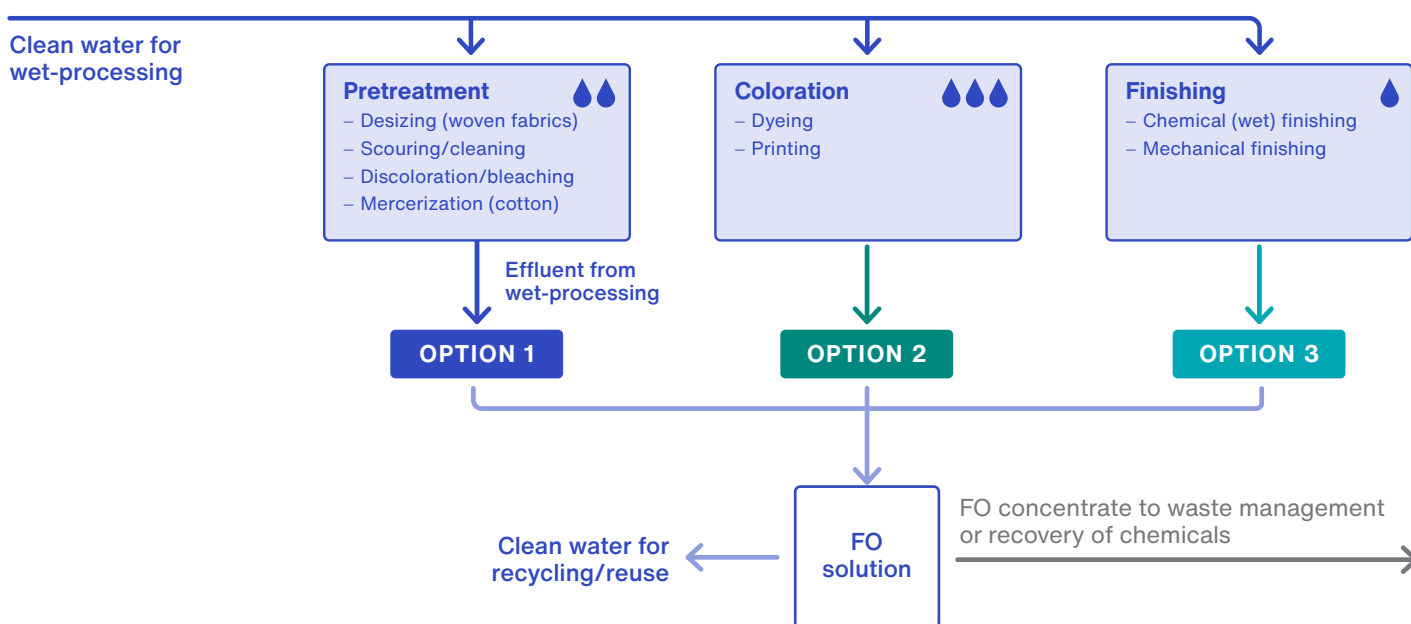
# How to apply Aquaporin Inside® FO membranes in your wet-processing and effluent treatment

## Wet-processing

An FO system can be added as a solution for treating separate effluent streams from washing and rinsing steps in pretreatment (Option 1), coloration (Option 2) and/or finishing (Option 3) processes. The choice of application of FO depends on the effluent feed composition, technologies already in place and desired water quality for reuse. The most water intense operations (marked with 💧) will benefit most from FO.\*

### Benefits of applying FO in textile wet-processing include:

- Reduce water consumption for washing and rinsing operations
- Recycle rinsing waters within the wet-processing or reuse the water for utilities
- Reduce the effluent volume sent to the effluent treatment plant and evaporator to save costs
- Recover chemicals (dyes/salts/metals) for reuse.



**Figure 1:** Schematic flow diagram of wet-processing displaying where forward osmosis can be utilized in the process (Option 1-3).

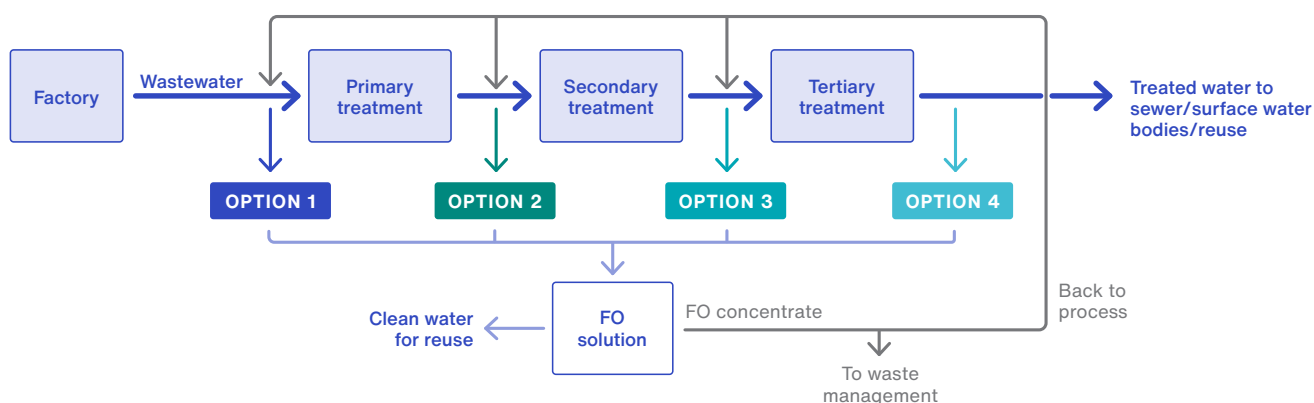
\*The FO applicability depends on the exact characteristics of the FO feed streams from the wet-processing operations. Let's discuss your specific application and feed characteristics to ensure compatibility.

## Effluent treatment

By integrating an FO process that uses Aquaporin Inside® FO membranes in your effluent treatment system, you can achieve Minimum or Zero Liquid Discharge and so meet or exceed wastewater treatment regulations – while also reducing costs and land use.

The optimal solution depends on your plant and treatment goals. In effluent treatment plants with

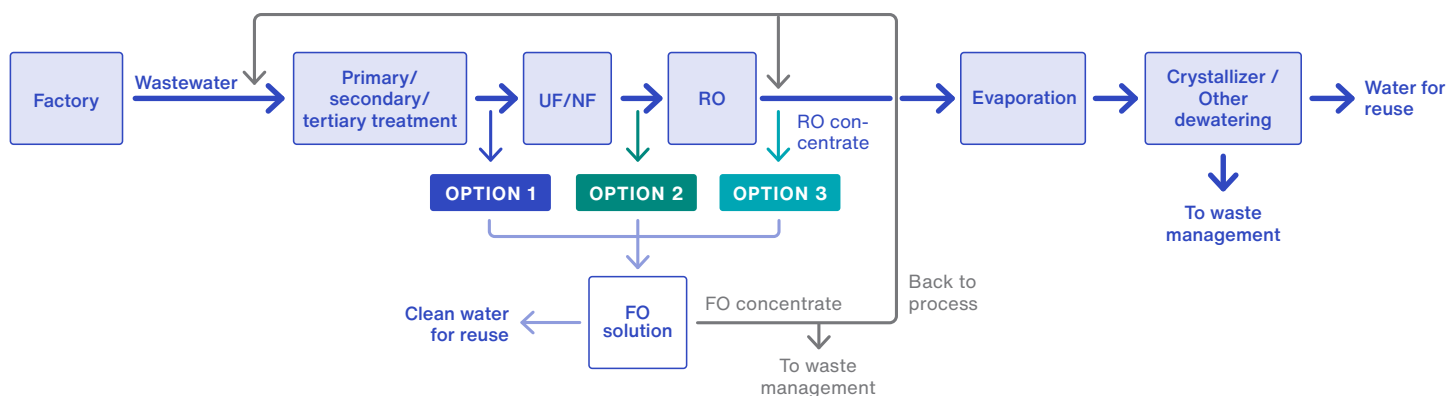
discharge to river or water bodies (figure 1) the primary, secondary or tertiary treatments can be partly or fully replaced by a FO system (option 1-3). An FO system can also be added as a final treatment step to further reduce the effluent volume to be discharged (option 4). The FO concentrate can be fed back into the effluent treatment process or sent to waste management, while the clean water extracted in the FO system can be reused in the factory.



**Figure 2:** Schematic flow diagram of effluent treatment plant with discharge to sewer or water bodies displaying where forward osmosis can be utilized in the process (Option 1-4).

For effluent treatment plants with ZLD (figure 2), the ultrafiltration (UF), nanofiltration (NF) or reverse osmosis (RO) stages can be fully or partly replaced by an FO system (option 1-2). FO can also be added after

RO (option 3) to further reduce the volume sent to the evaporator and so reduce the energy requirements for evaporation.



**Figure 3:** Schematic flow diagram of effluent treatment plant with minimal or zero liquid discharge displaying where forward osmosis can be utilized in the process (Option 1-3).



# Aquaporins, the world's most efficient water conductors



Our Aquaporin Inside® FO membranes are covered in a thin layer of aquaporins – the proteins responsible for transporting water in all living cells. The aquaporin proteins make the membrane extremely selective to water, while ensuring unwanted compounds are rejected. They minimize reverse salt flux and have very high rejection, which means the recovered water is of high quality.

These innovative membranes are packed into our Aquaporin Inside® Hollow Fiber FO modules. The modules are:

- 1 Simple to scale-up from lab to full-scale plant
- 2 Lightweight and easy to install – no pressure vessels required
- 3 Of high operational stability and flexibility
- 4 Allowing optimal land use via flexible and compact module design



# How to get started with your FO solution

Wastewater streams in the textile business can vary significantly from one application to another. Thus, there is no one standard fit for all applications. Each case must be evaluated carefully to ensure a tailored solution for your exact needs. But don't worry. We're here to assist and advise you, from initial ideation and feasibility testing through to full-scale operation.



PHASE 1 →	PHASE 2 →	PHASE 3 →
<b>Desk evaluation</b>  Evaluate feed stream and operating conditions to ensure technology match  Define treatment targets and initial cost range	<b>Feasibility screening</b>  <b>Application test:</b> <ul style="list-style-type: none"><li>- Concentration trial to determine flux expectations, maximum level of wastewater concentration and the rejection of the main contaminants</li></ul> <b>Material compatibility test:</b> <ul style="list-style-type: none"><li>- Trial to verify membrane chemical compatibility with the wastewater</li></ul> Note: Depending on the results from the feasibility screening additional tests may be recommended prior to piloting  AQUAPORIN LABS OR ONSITE	<b>FO solution pilot</b>  Pilot-scale, continuous operation of FO solution, including draw regeneration  Validate: <ul style="list-style-type: none"><li>– Water quality</li><li>– Energy consumption</li><li>– Cleaning needs</li></ul> ONSITE



# We must reuse wastewater

Water is a limited resource. To benefit our planet, let's go for the sustainable use and reuse of water. By incorporating Aquaporin Inside® FO membranes into your effluent treatment, you will get:

## Features

- High rejection
- High efficiency
- High recovery
- Compact design
- Flexible solution
- Water treated using natural aquaporins

## Benefits

- Minimize your waste
- Reuse more water with better quality
- Simplify your effluent treatment
- Optimize your land use
- Lower your CAPEX/OPEX

## Outcome

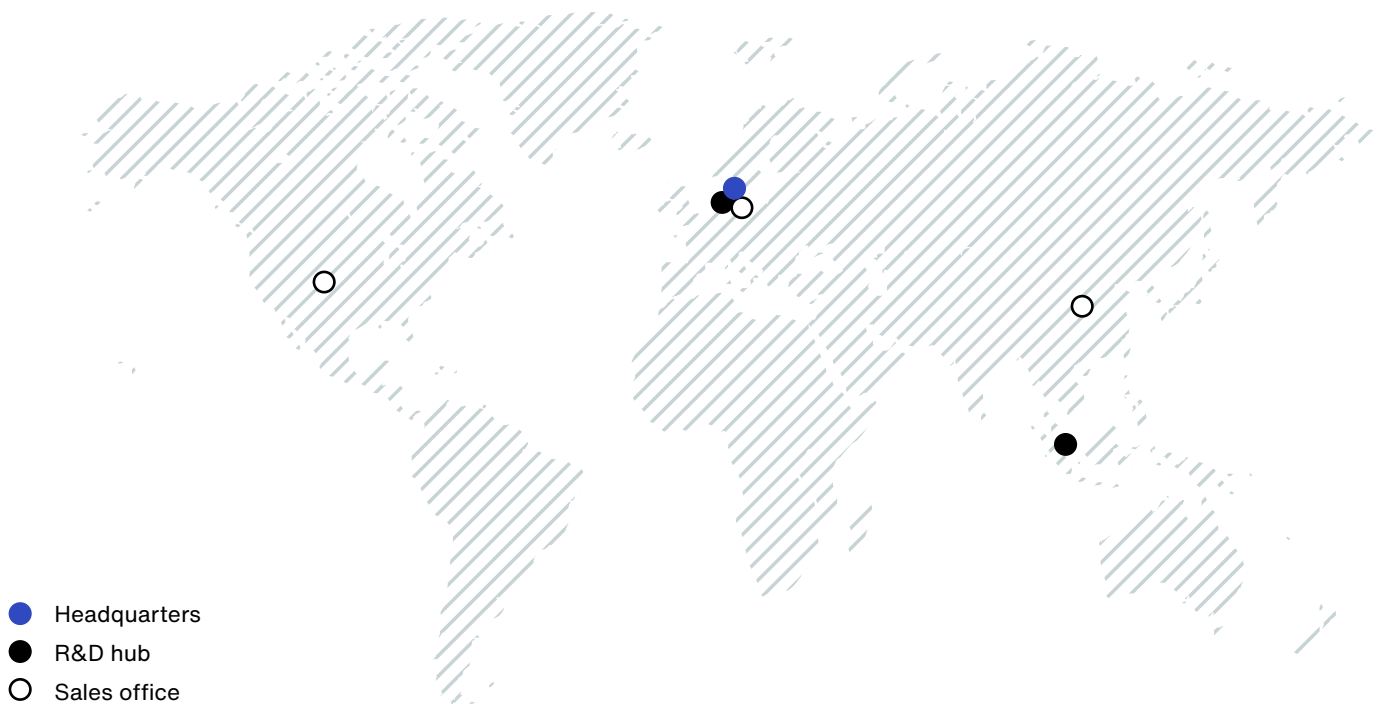
- Sustainable production & increased profitability
- Quick response to regulatory requirements
- Greater transparency towards end customers, brands and markets
- Better brand perception thanks to environmentally conscious use of water

# About Aquaporin

Aquaporin is a global water technology company headquartered in Denmark. We are dedicated to revolutionizing water purification, by merging biotechnological techniques and state-of-the-art engineering. We are the only company that incorporates aquaporins into water purification membranes

We are working with customers to develop more sustainable methods of dealing with wastewater streams – giving them a tangible way to improve their sustainability performance and connect with today's sustainability focused consumers, while also driving costs down.

For more information go to [aquaporin.com](https://aquaporin.com)



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**Aquaporin Inside®**