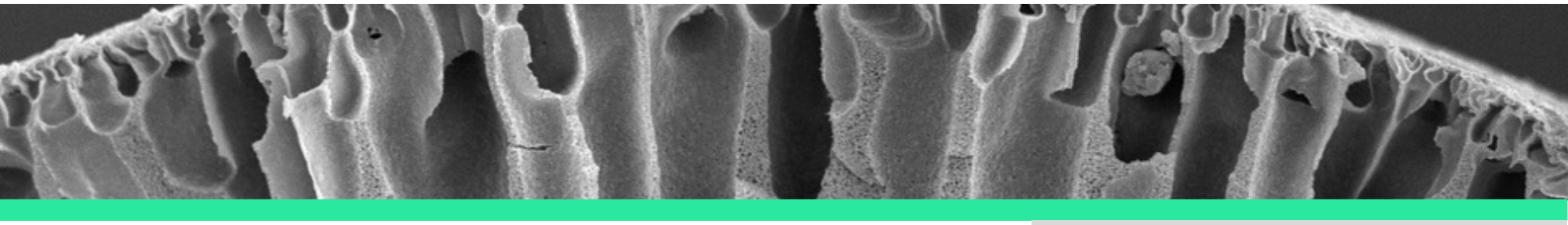
LOW PRESSURE MEMBRANE AUTOPSY

ULTRAFILTRATION, MICROFILTRATION AND MBR



Our low-pressure membrane autopsies focus not only on the identification of membrane foulants, but also on their removal, allowing you to restore flux and meet production goals.

Like other membrane processes, UF membranes are susceptible to fouling when particulate matter adheres to the membrane surface. Unchecked, this build-up will eventually decrease water production as well as increasing operating pressures, energy consumption and result in more frequent cleaning.

There are a few different types of fouling that can occur, some are reversible and others are irreversible.

Solids fouling: Suspended solids and colloidal particles can collect on the membrane surface and within its pores, preventing the flow of water through the membrane. They are normally removed during cleaning, but some types may be hard to remove, making the existing cleaning program ineffective.

Biological fouling: Biological contaminants like algae and bacteria are often found in surface water and in MBR systems. These microorganisms can attach themselves to the membrane and begin multiplying and form a film that will prevent water from passing through the membrane.

Scaling: Scaling occurs when minerals precipitate on the membrane surface when they exceed their solubility or are oxidized. Once these minerals crystalize, they can be nearly impossible to remove without specific chemical cleaning.

Filtered water contamination: If either solids or bacteria are detected in the filtrate, this usually indicates a damaged membrane. This can be caused by high temperature, pH, oxidants or physical damage. Unfortunately, once this occurs and water is no longer meeting your specifications, replacement is the only option.

UF AND MBR AUTOPSY FEATURES

- **Complete membrane fouling and failure assessment**
- **Cleaning process improvement**
- **Electron microscopy for microscopic membrane view**

UF AND MBR AUTOPSY BENEFITS

- **Increase water production by reducing cleaning and increasing flow rates**
- **Reduce cost and waste water during backflushing and cleaning**
- **Increase up-time and reduce cleaning frequency**

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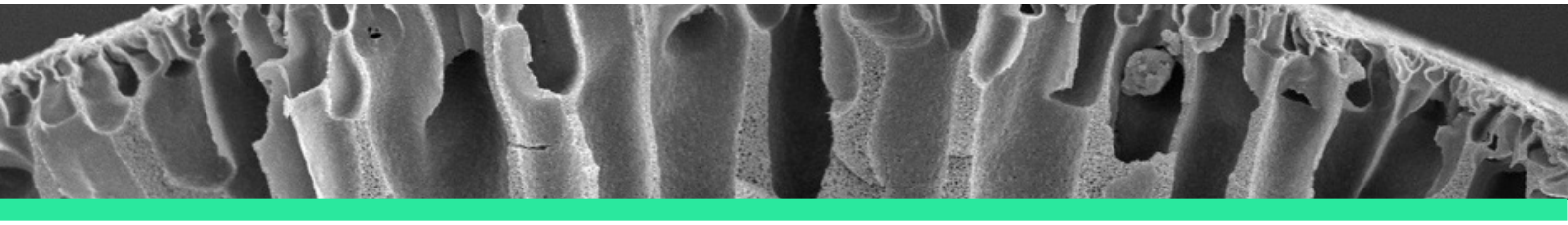

Autopsy options

We have a range of autopsy options to suit your needs. Our Standard Autopsy identifies the cause of failure and is valuable where there is a suspected issue or as part of a maintenance optimisation. Our Advanced Autopsy identifies cleaning strategies when the existing cleaning program is not working and our Premium Autopsy works to evaluate your whole process including pre-treatment and operational procedures to wholistically improve the operation.

Low Pressure Membrane Autopsy Options			
	Standard	Advanced	Premium
Physical inspection and identification of damage, leaks and fouling	✓	✓	✓
Inorganic fouling identification	✓	✓	✓
Organic and biological fouling identification	✓	✓	✓
Membrane cleaning study	✗	✓	✓
Cleaning procedure review	✗	✓	✓
Review of operational procedures	✗	✗	✓
Plant performance review and benchmarking	✗	✗	✓
Comprehensive report	✓	✓	✓

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Test	Importance
Physical Inspection	Physical inspection of the membrane tells us a lot. We look for physical damage to the membrane as well as the different components of the system such as air spargers, membrane potting and seals. Inside the membrane we will also look to fouling materials and density.
Membrane integrity	Two types of membrane integrity test are available depending on the membrane format. A pressure decay test measures membrane leaks through the loss of pressure over a period of time. A bubble point test measures the apparent porosity by measuring the pressure required to force air through the pores.
Fouling and deposit analysis	Fouling on an ultra-filtration membranes can be inorganic (such as clays, iron, aluminium or scale), organic (oils/greases, tannins or Natural Organic Matter) or biological bacterial slime (extracellular polysaccharide or proteins). We use a mix of analytical techniques to identify and quantify these deposits to help you eliminate them at the source.
Electron microscopy	Electron microscopes allow us to look deeply at the membrane and see what kind of fouling layers exist on the membrane and more importantly if they have penetrated into the pore structure. An additional X-ray analysis allows us to quantify the elements across the fouling layer to find the fouling causes.
Membrane cleaner extraction study	Indentifying the fouling material is the first part in solving a UF problem but knowing how to remove it is even more important. In this study we will screen up to 10 different cleaners and use different analytical techniques to quantify their effectiveness.
Flux recovery cleaning study	The ultimate test of the cleaning is to mimic the cleaning process on site an demonstrate improved flux recovery. We will look at 2-3 conditions using our inhouse flat-sheet or potted hollow fibre membrane rig.
Cleaning procedure review	Current site cleaning procedures will be reviewed against both the manufacturers recommendations and our inhouse experience from across the industry. Improvements and recommendations will be prepared for implementation on site
Plant data review	Reviewing site operational data helps identify if fouling is continual or event based and whether cleaning procedures are effective at recovering flux. This is key to understanding if a pre-treatment or cleaning approach is the best way to bring the plant to optimal performance