SPECIALIZING IN MEMBRANE FILTRATION/SEPARATION

With experience developed over three decades, Membrane Specialists is able to offer innovative, customized process solutions for a wide variety of filtration and separation applications using microfiltration, ultrafiltration, nanofiltration and reverse osmosis technologies from among the full range of membrane geometries, including spiral wound, hollow fiber and both ceramic and polymeric tubular membranes.

If you are already know what membranes can do, or if you are simply curious about how the technology might work in your application, call Membrane Specialists. Our wide-ranging experience, process expertise, engineering design and testing capabilities mean we can help you every step of the way, from feasibility studies to piloting to plant design, build and installation, and technical support.

SEPARATION CHALLENGES?
Membranes Offer Solutions

When process engineers need to separate, clarify, or fractionate process streams — and where they demand reliable and repeatable performance — membrane filtration is frequently their first choice. It is a versatile technology and cost-effective for many different separation applications. Membrane filtration involves no added chemicals, is relatively energy efficient, and involves well-defined, proven processes.

Typical applications include:

- Bio-Fuels & Bio-Products
- Fine Chemicals
- Food & Beverage
- Industrial Effluent
- Nutraceuticals
- Pulp & Paper
- Water Treatment

Membrane SPECIALISTS

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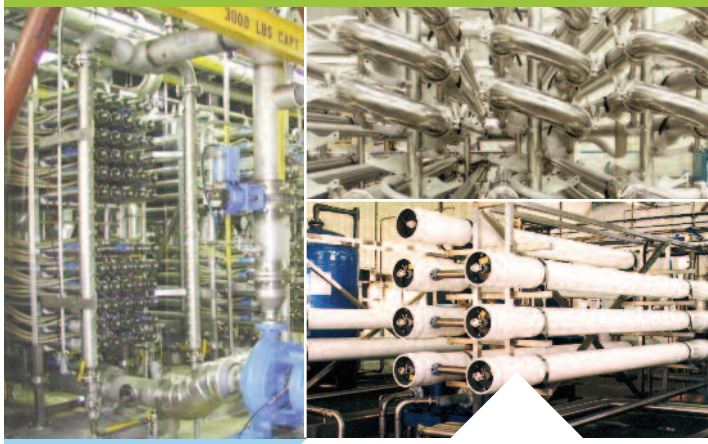
MEMBRANE FILTRATION SOLUTIONS FOR PRODUCTION OF BIO-FUELS & BIO-PRODUCTS



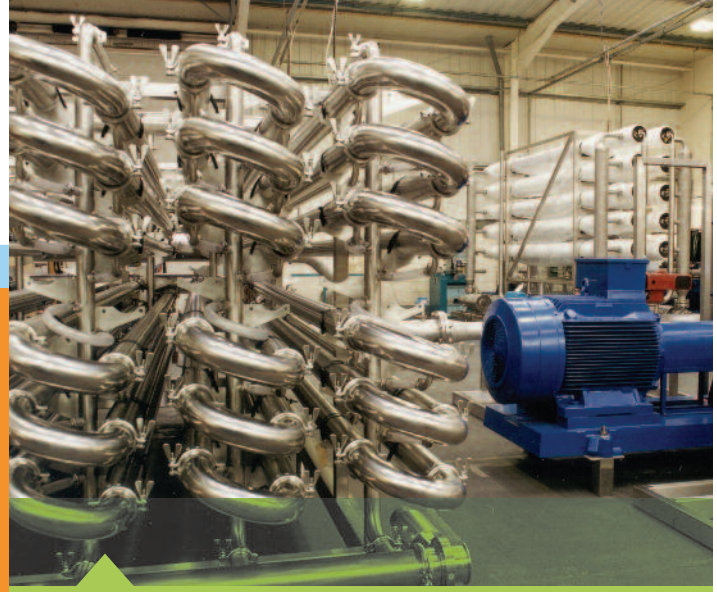
Membrane SPECIALISTS

MEMBRANE FILTRATION SOLUTIONS FOR PRODUCTION OF BIO-FUELS & BIO-PRODUCTS

Biological conversion of lignocellulosic biomass to ethanol or other bio-fuels or bio-products is a process involving multiple separation and concentration steps. These processes are complicated by recalcitrant material and fermentation-inhibiting by-products. As producers drive for greater efficiency, maximum utilization of raw materials and waste reduction, membrane filtration is playing an increasingly important role.

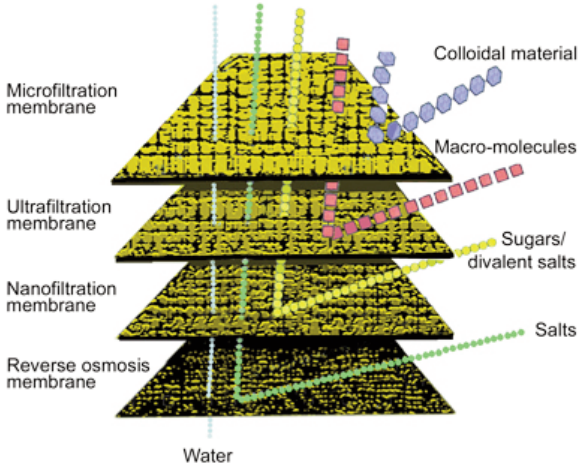
Membrane filtration has been used for many years in a wide range of industrial applications requiring liquids/solids separation and separation of dissolved species. These versatile and highly engineered systems can be developed to allow only materials with very specific characteristics to pass through, so users are able to separate particulates from dissolved species and to separate dissolved species themselves. Additionally, tangential flow across the membrane surface results in a continuous scouring action that reduces membrane fouling due to feed stream debris and macro molecules. Crossflow membranes, therefore, require minimal cleaning downtime so system utilization and efficiency are high and overall processing costs are reduced in many of the steps involved in converting ligno-cellulose to bio-fuels and bio-products. Potential applications include:

- concentration of extracts and hydrolysates
- separation of fermentation inhibitors
- acid and alkali recovery and reuse
- biomass and microbial cell retention
- concentration of organic acids
- amino acid concentration and purification
- condensate treatment for water re-use



Depending on the application requirements, a separation system can incorporate one or more different types of membranes. Here, an ultrafiltration system with tubular membranes (foreground) is matched with a reverse osmosis stack (back right), which houses spiral membranes.

CHOOSING THE RIGHT MEMBRANE FOR EACH APPLICATION IS VITAL, AND MEMBRANE SPECIALISTS CAN HELP.



WHY MEMBRANE SPECIALISTS?

- Independent process and membrane evaluation
- Applications and process development
- Rental of pilot equipment from our extensive inventory
- Capital plant and process operational cost projection
- Engineering and system design, build and installation
- Operator training and technical support for optimal plant performance
- On-site support or modem-based monitoring and control adjustment
- Supply of replacement membranes and parts
- Consultancy services

VERSATILE MEMBRANE TECHNOLOGY

- Microfiltration, ultrafiltration, nanofiltration and reverse osmosis
- Tubular (polymeric and ceramic), spiral-wound, hollow-fiber membranes
- Tubular membranes for difficult-to-handle, fouling feed streams, including high levels of suspended solids and fibers
- High-temperature/high-pressure operation
- pH capable from 0-14
- Solvent-resistant
- Energy efficient

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