Crossflow Technology in Challenging Applications

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Cross flow filtration (CFF), also known as tangential-flow (TFF), is a separation method in which a particle-containing fluid passes tangentially along the surface of a membrane filter. By creating a pressure differential across the membrane, components smaller than the pores of the membrane pass through the filter while larger components are retained and move along the surface of the membrane. The material passing through the membrane is referred to as the permeate while the fluid returning to the reservoir is called the retentate. By having the flow of fluid move tangentially along the membrane surface, solids are swept away, thus preventing the build-up of material on the filter surface, reducing fouling of the filter.

This in turn allows for the filtration of high solids fluids, which would otherwise plug typical dead-end filtration technologies.

There are several basic filter designs that are generally used for CFF and are classified according to membrane configuration. Cassette filters and spiral wound filters use several flat sheets of polymeric membrane, which are separated from each by support screens and are assembled together in a cassette housing or in a spiral wound configuration. The feed stream passes into the space between two sheets and permeate is collected from the opposite side of the sheets. Hollow fiber filters consist of thin, straw-like polymeric membranes, which have a lumen and are configured into modules by packing bundles of parallel hollow fibers into a cartridge. The feed stream passes through the lumen of the fibers and the permeate is collected from outside the fibers. Tubular filters are similar in concept, but have much larger inner diameters to be able to process very high solids applications.

ROBUST TECHNOLOGY

Most crossflow filter technologies utilize polymeric membranes. These membranes may be composed of polypropylene, polysulfone, PVDF or other typical membrane materials. As such, the operating environment of the CFF technology may be limited by the temperature tolerance or material compatibility. Aggressive chemicals or elevated temperatures will damage or destroy the membrane and the structural components in the cassette or module, rendering it inoperative. In these extremely challenging clarification applications, a more robust technology is required such as the SCEPTER® crossflow microfiltration and ultrafiltration products offered by Graver Technologies. These rugged tubular stainless-steel membranes have a titanium dioxide (TiO2) membrane coating that is permanently sintered to the inside of the 316L stainless support tube. This creates a smooth, foulant-resistant membrane that permits the processing of dirty or hostile fluids over a broad range of chemical conditions, pressures and temperatures, often where no other membrane device can be used. In addition, the all-stainless materials tolerate virtually unlimited steam sanitization and even the harshest chemical cleaning procedures, and are back-pulse capable, with no deterioration of membrane performance or service life.

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COST EFFECTIVE AND VERSATILE

SCEPTER membrane tubes are welded together into all-stainless-steel module assemblies, which are

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The all-welded, no-gasket module construction enhances cleanability, durability and compatibility.

SCEPTER technology is broadly adaptable to a wide variety of system configurations. Because SCEPTER systems are based on modular units, it is easy to increase capacity as need arises, just by adding additional modules or stages.

generally incorporated into a custom engineered ultrafiltration system. The tubular membranes are produced in different diameters and pore sizes to better tailor the membrane module for the requirements of the application. Smaller diameter tubes provide greater membrane area in a smaller volume. Larger diameter tubes are the preferred choice where high solids or higher viscosities are the norm, or for the larger area systems. Complete SCEPTER modules can be fabricated into diameters from 1" (25 mm) to 48 inches (1.2 meters) and are available in one-, two-, or four-pass designs, having standard lengths of 5, 10, and 20-feet (6-meters); vertically or horizontally mounted, having membrane areas to 9000 sq. ft. (836 m2). To enhance chemical and thermal compatibility and to eliminate potential failure points, the modules are of all-welded construction with no gaskets, O-rings or polymeric components and provide a design pressure of 150 psig at 250° F (10.3 bar @ 121° C). The standard material of construction is 316L stainless steel, however, other alloys such as Hastalloy-C22 are available to meet the needs of specific applications.

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SCEPTER technology has been used successfully for over thirty years across a wide spectrum of industrial and commercial applications. These systems are often specified as replacements where other technologies have failed or where no other membrane technology can be used, making it a clear cost effective option in many applications:

- Sweeteners – clarification and polishing of glucose, fructose, dextrose, sucrose
- Fermentation broths – broth concentration and clarification, protein separation and recovery

- Fruit and vegetable juices, wine, beer
- Corn stillage concentration/ product recovery/clarification
- Starch washing/cook water/ wastewater recovery for reuse
- Wastewater product recovery – hazardous waste concentration, sludge dewatering, hot wash/wastewater recycle
- Waste oil recovery
- Alkaline cleaning/parts-washer solution recovery; CIP solution recovery for reuse
- Prefiltration for spiral-wound UF and RO membranes
- Catalyst recovery
- Membrane bio-reactors

The design of SCEPTER sintered tubes and membranes creates a durable and robust structure, making it superior under operating conditions that would normally damage or destroy polymeric or ceramic membranes. SCEPTER technology is broadly adaptable to a wide variety of system configurations, from basic batch processing to more complex multi-stage continuous designs. Because SCEPTER systems are based on modular units, it is easy to increase capacity as need arises, just by adding additional modules or stages. This allows for very high-area systems with the least number of individual modules providing the smallest footprint, void volume, complexity, capital and operating costs.

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