FILMTEC Membranes

System Design: System Design Suggestions for Troubleshooting Success

System Design Suggestions for Troubleshooting Success

When considering the design and purchase of large membrane systems, there are a number of possible equipment designs and additions that can be added to help with future troubleshooting. Depending on the size and complexity of the system, some or all of these suggestions could be discussed with your system supplier. None are required for successful operation, but all make day-to-day operation and troubleshooting easier, quicker and more effective.

Access to Load and Troubleshoot the System

Even though membrane systems are quite compact, there is often a temptation to save even more floor space by crowding equipment, pipelines and supports so close together as to limit access to the membrane system. Ideally, one should have unrestricted access to both the feed and brine end of each and every vessel for loading, unloading and troubleshooting of the membrane elements. When loading, at least the length of one element is necessary between the feed end of the vessels and the nearest equipment or supports. When unloading, often more room could be used so that a large wooden board or some other device can be used to push the element stack toward the brine end.

Connections Allowing Probing, Profiling and Sampling

When troubleshooting potential element problems, one of the first operations is always to attempt to localize any problem, either to a stage, a vessel, or even to an element. Having sample points on all the vessel permeates greatly facilitates these operations. Ideally, the permeate sample points can allow a probe tube to be passed through. Having additional sample points on the feed, the concentrate and any interstage headers, can help localize problems to a stage and even allow for mass balance measurements to corroborate flow measurements and ultimately setting of the system recovery.

To control the microbiological activity, adequate sampling points should be provided to make a microbiological balance and control in the plant possible. The minimum number of sampling points required are listed below:

1. Intake (surface) or well, before chlorination if any.
2. After a clarifier, settling pond, sludge contact unit, or similar sedimentation process.
3. After filtration units (sand, multimedia, activated carbon, or other).
4. After dechlorination (normally after cartridge filtration).
5. Concentrate stream.
6. Permeate stream.

Instrumentation to Allow Performance Monitoring by Stage

Beyond simple sample points, the next step in system sophistication is to instrument the stages so that performance data can be gathered and normalized, showing day to day variation in the system performance against a reference condition such as startup. Adequate instrumentation means having conductivity or TDS measurements, pressure measurements, temperature measurements, and flow measurements on the feed, concentrate and permeate of each stage. Given this data, performance of the stage can be monitored and early signs of trouble can be easily detected from the normalized data. Even though a mass balance around the system can be used to eliminate some of the instrumentation, having all the instrumentation means that the mass balance can be used to test the internal consistency of the data and thus monitor the performance of the instruments.

System Design Suggestions for Troubleshooting Success (cont.)

Real-Time Online Normalization

In terms of system monitoring, online instruments feeding an ongoing and continuous normalization program is the ultimate. For very large systems, or for systems with highly variable feed conditions, real-time control may be warranted.

Provisions to Clean Each Stage Individually

Many large systems are provided with so called clean in place systems (CIP). One design suggestion to consider is that by providing sufficient piping and valving to clean each stage of a system individually will invariably make the cleanings more effective. Cleaning multiple stages together means that dirt, debris, bio-mass and scale must be pushed from the first stage and through subsequent stages before being removed from the system. CIP systems should also provide adequate flow rates for effective cleanings as well as facilities to heat the cleaning solutions.

Permeate Flushing Capability

A potential system feature that can lower the frequency of cleanings is to provide for periodic permeate flushing of the system. Permeate flushing is accomplished by recycling permeate or product water through the system at a high rate to loosen and push out foulant layers before they adhere to the membrane surface. This capability is especially useful in systems handling treated waste water.

SDI Measurement Device and Connection Points in the System

A great diagnostic tool especially for the pretreatment end of a system is having and using an SDI instrument. Like profiling and probing the elements can localize a potential membrane problem, and SDI instrument with connections throughout the pretreatment system can help quickly localize pretreatment problems.

Wet Lab at the Plant Site

Having the capability to do laboratory work at the plant site means that water analyses can be more easily monitored, especially for setting up and maintaining pretreatment chemical additions.

Single Element Test Unit

Having a single element test unit at the plant can be a real advantage. Suspect membrane elements can be quickly tested and judged good or bad. In addition, cleaning strategies can be tested and proven on fouled elements before tried on whole stages of the plant.

FILMTEC™ Membranes
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