

Predicting Membrane Fouling Rates

Short of having a crystal ball, what's the best way of predicting how fast your reverse osmosis, nanofiltration, or UF membranes are going to foul? There are a lot of tests and terminology, but how does one correlate to another?

Scaling is mineral in nature - pretty simple and easy to control. It's the other stuff - colloidal material, organics, biological material – that can keep you awake nights, or worse, give you nightmares.

There are several indicators of membrane fouling, the most commonly used is Silt Density Index. This value has historically been the industry standard for pretreatment selection and for sizing the RO system itself. Membrane manufacturers have published guidelines for system flux rates based upon the SDI of the feedwater, with flux rates generally 12-18 GFD (gallons per square foot per day) for SDI's of less than 3, and 8-14 GFD for SDI's of 3-5. SDI's are performed by running a continuous flow at 30 psig through a 0.45 micron filter pad and recording the time it takes to collect a 500 ml sample at Initial, 5, 10, and 15-minute intervals. (There are also automated SDI instruments available, if you prefer.) The SDI is calculated as follows:

$$SDIT = (\%P30/T) = [1-(t_i/t_f)] \times 100 T$$

Where: %P30 = percent pluggage at 30 psi feed pressure

T = total elapsed time in minutes (usually 15)

t_i = initial time to collect 500 ml of sample

t_f = final time to collect 500 ml of sample (usually 15 min.)

While SDI has long been the industry standard for predicting membrane fouling, it is not a conclusive measurement. Since the size, shape, and nature of the potential foulants vary significantly, similar SDI values may be obtained for different types of foulants that may require very different forms of pretreatment to keep system fouling at a manageable rate.

Turbidity is another parameter which is extremely useful for managing the rate of fouling in a membrane system. Turbidity is measured by a light-scattering technique, and can be performed on-line or using a portable turbidimeter. Target turbidities feeding the membranes should be in the 0.1-0.2 NTU range or less. There is no direct correlation between SDI and turbidity, but both measurements are useful tools for diagnosing fouling problems and correcting them.

Recently, there has been a lot of interest in using particle counters as a means of monitoring the performance of pretreatment filtration systems, and subsequently in predicting membrane fouling. This is done using a continuous on-line analyzer which uses advanced laser optics and has the sensitivity to monitor particles even in the sub-micron range, and can detect changes in turbidity as low as 0.0005 NTU. The data generated by the particle counter can be utilized to optimize coagulant chemical addition, detect impending filter breakthrough, and maximize effective filter run time – all of which can have a positive impact on membrane fouling.

For copies of the SDI test procedure, information on testing equipment and instrumentation, or an assessment of your particular application, contact your Process Solutions, Inc. sales representative.