Investigation of SWRO membrane failures of two different configurations

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ABSTRACT

Membrane autopsy is a useful tool for identification of operational problems. In the procedure, membranes are cut open and their surfaces are examined. Chemical, physical and microbiological analyses are used to determine the type of foulant present. In addition, intrinsic viscosity measurement and degree of acetylation studies are carried out depending on the chemical nature of membranes to find out the extent of degradation. Other techniques such as scanning electron microscope (SEM) and Energy Dispersive X-ray (EDX) are also used to augment the autopsy. Two cases studies are presented. Cellulose triacetate (CTA) hollow fine fiber (HFF) SWRO membranes and thin film composite (TFC) spiral wound (SW) SWRO membranes were examined to identify root causes of performance decline. Both types of membranes are used in commercial SWRO plants operating along the Red Sea coast. Autopsy revealed that HFF membrane element was fouled by a mixture of organic matter, fine silt and iron oxides, whereas biological fouling was absent. The presence of fine silt on the membrane surface indicates inadequacy of pretreatment. The SW membrane element fouled by organic matter as well as iron in addition to corrosion product. Moreover, autopsy of a chemically cleaned SW membrane proved that cleaning was efficient in removing most (87%) of the foulants, especially the inorganic portions, except for some of the organic matter, which remained on the membrane surface.

Keywords: RO; Seawater; Fouling; Autopsy; SWRO; TFC; HFF; CTA

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