Review of material selection and corrosion in seawater reverse osmosis desalination plants

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ABSTRACT

Seawater desalination infrastructures require a careful material selection with high corrosion resistance. The high seawater temperatures in warm regions, where many desalination plants are developed, must be clearly considered regarding the corrosion of materials. To comply with the operational characteristics of seawater reverse osmosis (SWRO) process (high pressure, high chloride content and dissolved oxygen content at saturation values), the conventional material selection was stainless steel with sufficient pitting resistant equivalent number. However, many cases of corrosion failures of stainless steel in SWRO desalination units have been reported. In most cases the cause of the failures was attributed to the use of not enough alloyed grades. However, high alloy stainless steels are also susceptible to crevice and pitting corrosion in seawater. The operational corrosion risk will highly depend on the stainless steel composition, on the metallurgy (i.e. cast or wrought), on the service conditions, and on the geometrical configuration of the confined zones in contact with seawater. The present paper reviews the corrosion performance of metallic materials used for SWRO desalination plants. It focuses on the corrosion behaviour of several stainless steel grades. Recent corrosion failures of stainless steel pumps used in SWRO desalination plant in the Mediterranean Sea are also discussed.

Keywords: Metallic materials; Stainless steels; Corrosion; Seawater; Reverse osmosis desalination

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