

Chapter 3

Reverse Osmosis and Nanofiltration

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The learning objectives of this chapter are the following:

- give an understanding of the importance of reverse osmosis and nanofiltration membranes and how they are used for water treatment
- give an introduction to the different equations that govern reverse osmosis fundamentals and how to control, analyze and normalize a membrane installation
- give knowledge of how reverse osmosis and nanofiltration membranes are designed
- give knowledge on how membranes system is best operated to reduce membrane fouling and ensure system availability.

3.1 THE RISE OF REVERSE OSMOSIS

Water scarcity is being recognized as one of the main threats that mankind is facing globally (Fritzmann, *et al.*, 2007). Reverse Osmosis (RO) membrane technology has developed as a promising technology to address this problem, holding roughly 44% market share and growing among all the desalinating technologies (Valavala, *et al.*, 2011). This increased market adoption has been driven as materials have been improved and costs have dropped (Greenlee, *et al.*, 2009). This is especially relevant in arid regions such in the Middle East countries (ME), where population is located in arid and semi-arid regions, with a very limited rainfall, and where due to high ambient temperatures, evaporation contributes to a higher stress degree to the naturally available water sources. Moreover, water scarcity is aggravated by the population increase this region is exposed, as well as the economic development (Guo, *et al.*, 2000). All these factors, together with the favorable energy to product quality ratio that seawater reverse osmosis (SWRO) offers, has situated this technology as one key driver to sustain population living standards in ME countries (Carroll, *et al.*, 2000).

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Chapter 7 Reverse Osmosis Ksu Faculty Member

Marcel A. Müller



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