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Optimum nanofiltration membrane arrangements in seawater pretreatment - Part-I

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ABSTRACT

NF membrane seawater pretreatment is an attractive technique that can provide unique permeate quality having negligible fouling and scaling potential and hence suitable for both membrane and thermal desalination processes. The technique was applied commercially in SWCC Umm-Lujj SWRO plant at 65% recovery. Operation at such recovery as pretreatment process is considered unattractive from the economic point of view. Accordingly, the aim of this study was to maximize NF product recovery and reduce operational cost while maintaining long membrane life. To achieve the target different investigation areas and techniques are considered. This paper presents Part-1 of this study which includes the performances of seven different NF arrangements in seawater pretreatment starting from 4 up to 20 NF elements in terms of recovery ratio, product quality, energy consumption and membrane hydraulic performance. The study revealed that 8-elements array at 65% recovery is the best choice for single stage NF process. Whereas, 14-, 18- and 20-elements arrays are optimal for two-stage NF process at 75%, 80% and 85% recovery, respectively with lower feed pressures and minimum fouling potential. Moreover, results indicated that transition of NF process from single stage operation at 65% recovery to two-stage at 85% recovery results in an increase in NF permeate TDS by 2000 mg/l which was compensated by major benefits such as higher productivity, higher recovery and lower energy consumption. Also, this paper describes results of successful long term performance of about 6048 h for 18-elements array at different recoveries of 65%, 75% and 80% in terms of SDI reduction, TDS rejection, and chemical composition of NF permeate.

Keywords: Seawater; Nanofiltration; Pretreatment; NF arrangements; Optimization; SWRO

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