

Techno-economical approach of GAC and microfiltration as a coagulant-free pre-treatment of seawater desalination

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ABSTRACT

Membrane filtration is lately becoming a popular process for the pre-treatment of seawater in reverse osmosis (SWRO) desalination. The common practiced method of controlling membrane fouling and reducing the treatment costs usually involves a short coagulation step prior to the membrane filtration. In this work, a study of the feasibility of a coagulation free microfiltration (MF) as pre-treatment for SWRO desalination from a technical, economical and environmental point of view was performed. The experimental part included filtration of seawater from the Yellow Sea in Korea both with and without granular activated carbon (GAC) pre-treatment using a laboratory scale MF plant and different constant fluxes in outside-in dead-end mode. The results show that a coagulant and GAC free, stand-alone microfiltration using low fluxes and intense chemical cleanings is technically possible. When compared to a state of the art coagulation-MF, such a process could be economically and environmentally favourable when accounting for the lower energy demand and the relinquishment of the sludge treatment system.

Keywords: SWRO pre-treatment; Microfiltration; GAC; Coagulation; Yellow Sea; Sludge treatment

1. Introduction

RO membranes used for seawater desalination are highly susceptible to fouling due to organic/inorganic, biological and particulate matter often present in the sea. Fouling of the RO membranes has several negative effects which decrease the plant's economical and environmental efficiencies. Such effects include reduction in production rate, higher energy and chemical consumptions, frequent membrane cleanings and replacements, increase in the plant's downtime etc. An effective pre-treatment

of the seawater is therefore a key issue for the long-term operational success of an SWRO plant.

A current trend is the replacement of the traditional granular media filters by microfiltration or ultrafiltration (UF) membranes as the main pre-treatment process step. The membrane based pre-treatment can provide a more reliable, higher quality RO feed especially when dealing with difficult waters which is prone to temporal and seasonal fluctuations in quality and temperature. The membrane pre-treatment's long-term economical and environmental benefits have not yet been proven but show a promising potential in the near future [1].

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