

Enhancing Seawater Desalination Efficiency with Combined Reverse Osmosis and Vibratory Shear-Enhanced Processing for Higher Conversion Rates and Reduced Energy Consumption

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Abstract : Reverse osmosis (RO) is one of the most widely used techniques for seawater desalination. However, the conversion rate of this method is generally limited to 35-45% due to the high-pressure capacity of the membranes. Additionally, the specific energy consumption (SEC) for seawater desalination is high, necessitating energy recovery systems to minimise energy consumption. This study aims to enhance the performance of seawater desalination by combining RO with a vibratory shear-enhanced processing (VSEP) technique. The RO unit in this study comprises two stages, each powered by a hydraulic turbocharger that increases the pressure in both stages. The concentrate from the second stage is then directly processed by VSEP technology. The results demonstrate that the permeate water obtained exhibits high quality and that the conversion rate is significantly increased, reaching high percentages with low SEC. Furthermore, the high concentration of total solids in the concentrate allows for potential exploitation within the environmental protection framework. By valorising the concentrated waste, it's possible to reduce the environmental impact while increasing the overall efficiency of the desalination process.

Keywords : specific energy consumption, vibratory shear enhanced process, environmental challenge, water recovery

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