



## Overview of pressure-retarded osmosis (PRO) process and hybrid application to sea water reverse osmosis process

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### ABSTRACT

The development and exploitation of sustainable and environment-friendly energy resources are required in order to resolve global energy shortages. Recently, salinity gradient power (SGP) has been considered a feasible candidate, with high potential to become a substitute for the current use of fossil fuels due to benefits such as less periodicity, abundance and no emission of carbon dioxide. In this paper, one SGP, pressure-retarded osmosis (PRO) system, was reviewed in terms of its mechanism, limitations and available applications. In the PRO system, water permeates through a semipermeable membrane from the feed solution to the draw solution, and energy is generated by depressurizing the permeated flow through a hydro turbine. Models for understanding its mechanism and for improving of its performance were reviewed. In addition, applications of sea water reverse osmosis (SWRO), wastewater treatment (WWT) and PRO hybrid process were introduced in order to develop new water-energy nexus processes. In particular, it is thought that the SWRO–PRO hybrid process and SWRO–PRO–WWT hybrid process can contribute to reducing the total energy consumption in SWRO plants as well as to applying the SGP energy to other engineering fields.

*Keywords:* Pressure-retarded osmosis; Renewable energy; Salinity gradient power; Power density; SWRO–PRO hybrid system; SWRO–PRO–WWT system

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