NEW TRENDS IN WATER DESALINATION FOR LOW POWER CONSUMPTION

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ABSTRACT

Freshwater and energy are two inseparable and essential commodities for sustaining human life on earth.Water shortage is a worldwide problem, where 40% of the world population is suffering from water scarcity. In Egypt, the per capita water share is continuously decreasing going below the international standards because of the limited fresh water resources and steadily populations increasing. So, there is a crisis concerning the availability of good quality water. Brackish and seawater desalination has been a solution to the water scarcity in many countries around the world. However, desalination processes require significant quantities of energy to achieve separation of salts from seawater.

The energy requirement for the production of freshwater shares up to 30% of desalination cost.This is highly significant as it is a recurrent cost. The dramatic increase of the water supply by desalination will drive to serious effort by scientists and experts for research and development, especially those related to energy consumption and environmental issues.
Hybridization and low-grade heat utilization can be incorporated to reduce the power consumption and also bring down the capital cost of desalinated water. Hybrid thermal/membrane combinations offer several advantages.The use of warm seawater from the thermal plant as feed to RO, having an optimized feed temperature, could be utilized for production of water of different qualities. It could be produced for different uses such as high quality boiler feed make up water, process water and potable water.

Another hybrid desalination method is Membrane Distillation (MD) that is a promising technology for desalting highly saline water.This hybrid process is a thermally-driven separation process, in which only vapour molecules are able to pass through a porous hydrophobic membrane. The driving force in the MD process is the vapour pressure difference induced by the temperature difference across the hydrophobic membrane. This process has various applications, such as desalination, wastewater treatment and in the food industry.Using MD has many attractive features, such as low operating temperatures, lower hydrostatic pressure encountered in MD is than that used in pressure-driven membrane processes and it is expected to be a cost effective process, which requires less demanding of membrane characteristics too.

Forward osmosis (FO) that has been recognized another promising low energy processes for desalination is an alternative to conventional desalination techniques. The driving force in the FO process is generated by the osmotic pressure difference between the feed water and the concentrated draw solution.Where a natural source of high concentration DS is available, FO can be highly attractive due to its significantly lower energy demand for pumping.

This study intended to explore the literature and practical applications to present the new trends such as forward osmosis and hybridization of different desalination processescompared with well-established desalination technologies.The cost requirements of such processes for domestic, small and large-scale applications will be analyzed. Also, the study will discuss alternatives for reducing energy requirements of desalination processes by utilization of low cost, low-grade energy sources and their applications in the desalination industry.