

Water, Energy and Minerals from the Sea

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ABSTRACT

Conventional sources of freshwater, energy and raw materials are facing the risk of depletion due to rapidly increasing population and improved living standards. To ensure the sustainable supply of these commodities in adequate quantities in future, their alternative sources must be exploited. Seawater is an interesting candidate in this context. Besides providing fresh water, seawater offers the possibility to extract more than sixty elements contained in it. Membrane operations offer technically viable routes to achieve these objectives. New developments in membrane technology also offer exciting perspectives to harness energy by exploiting the salinity of this water. Reverse osmosis (RO) has been widely practiced for freshwater production from seawater while membrane distillation/crystallization has been evolved as an interesting candidate to recover additional freshwater and minerals from brine coming from seawater desalination installations. Besides fulfilling the current demand of traditional minerals such as sodium, magnesium etc., the brine from the global desalination capacities has the potential to provide significant fraction of total consumption of strategic elements including copper, lithium, molybdenum, uranium and cesium. Similarly, the application of pressure retarded osmosis and reverse electrodialysis allows generating clean energy from seawater that can contribute significantly in lowering the dependence on carbon based fuel. However, to realize the commercial applications of less explored membrane operations, more initiatives at research and development level are required. Development of more specific membranes, better understanding and control of transport phenomenon, improvements in module designing, control of scaling and fouling (particularly biofouling) and minimization of internal concentration polarization

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