

Energy aspects in osmotic processes

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ABSTRACT

Water, energy and environmental issues are on the top list of the world problems. Energy is needed for augmenting our water resources. Renewable energies are hardly the answer since innovative techniques based on biofuels and biodiesel consume an incredible amount of water. The modern desalination techniques in use consume different energy levels from different sources. Thermodynamics sets the absolute minimum limit of the work energy required to separate water from a salt solution. Unavoidable irreversibilities augment the actual energy consumption. Modern desalination techniques have succeeded in narrowing considerably the gap between actual and minimum energy levels. The implication of this small gap is that only marginal energy reductions are possible. Energy consumption of different desalination processes are reviewed. Forward osmosis is shown to be a high energy consumption process. It offers, however, advanced cost effective backwash techniques. The limitations of power generation by osmotic processes is discussed. Sidney Loeb together with Sourirajan were the pioneers that opened the door and introduced the RO process that allows us to desalinate seawater and brackish water at affordable energy consumption. Loeb continued during his last years to develop the osmotic energy machine, and even tried to develop an air condition system based on water evaporating from tubular membranes.

Keywords: Desalination; Energy; Reverse osmosis; Osmotic processes; Forward osmosis; Osmotic backwash

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