Study shows forward osmosis desalination not energy efficient

July 24 2014, by Alissa Mallinson

In a recent study published in the *Journal of Membrane Science*, MIT professor John Lienhard and postdoc Ronan McGovern, both of the Department of Mechanical Engineering, reported that, contrary to popular support, forward osmosis desalination of seawater is significantly less energy efficient, compared to reverse osmosis.

In forward osmosis, water is drawn from the seawater into a concentrated salt solution, known as a draw solution. Then, a second step is required to regenerate the concentrated draw solution and produce purified water. With reverse osmosis, the seawater is directly desalinated by being pressurized and driven through a membrane that only allows water to pass through.

McGovern performed an energetic comparison of reverse osmosis and forward osmosis to identify their respective energy consumptions. The problem, he says, is that even if the second step of draw regeneration—in which the concentrated salt solution is dewatered, producing fresh water—can achieve the same level of efficiency as the reverse osmosis process, the actual energy consumption of forward osmosis will consistently surpass that of reverse osmosis. This is because the salt solution that results from the first step of forward osmosis is necessarily more highly concentrated than standard seawater, meaning it always requires a higher level of energy for regeneration.

According to McGovern, forward osmosis is better suited to alternate applications, such as the production of hydration drinks. In such

applications, only the first step of the forward osmosis process is required—where a concentrated sugar syrup is diluted to a desirable level—placing forward osmosis at an advantage to reverse osmosis.

More information: Ronan K. McGovern, John H. Lienhard V, "On the potential of forward osmosis to energetically outperform reverse osmosis desalination," *Journal of Membrane Science*, Volume 469, 1 November 2014, Pages 245-250, ISSN 0376-7388. DOI: 10.1016/j.memsci.2014.05.061.

Provided by Massachusetts Institute of Technology