Better way to desalinate water discovered

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Chemical engineer Kamalesh Sirkar, PhD, a distinguished professor at New Jersey Institute of Technology and an expert in membrane separation technology, is leading a team of researchers to develop a breakthrough method to desalinate water. Sirkar, who holds more than 20 patents in the field of membrane separation, said that using his technology, engineers will be able to recover water from brines with the highest salt concentrations. The Bureau of Reclamation in the Department of Interior is funding the project.

"Our process will work especially well with brines holding salt concentrations above 5.5 percent," Sirkar said. Currently, 5.5 percent is the highest percentage of salt in brine that can be treated using reverse osmosis.

"We especially like our new process because we can fuel it with low grade, inexpensive waste heat," Sirkar said. "Cheap heat costs less, but can heat brine efficiently."

The science behind Sirkar's membrane distillation process is simple. The inexpensive fuel heats the water forcing it to evaporate from the salt solution. The cleansed vapor then travels through nano-sized pore in the membrane to wind up condensed in the cold water on the membrane's other side.

"The basic principles of membrane separation have been known for a long time," said Sirkar. "Intestines in animals and humans are semi-permeable membranes. Early experiments to study the process of

separation were performed by chemists using samples of animal membranes."

Today, membrane separation processes depend on the design of the membrane and the membrane module. The size of the pores is often key to determining which molecular components in either a liquid or gas form will pass through the membrane. Typically molecules flow from a region of high to low concentration. Pressure or concentration differences on both sides of the membrane cause the actual separation to occur. As pore size decreases, the membrane's efficiency and selectivity increases. Membrane separation processes are used in biomedical, biotechnology, chemical, food, petrochemical, pharmaceutical and water treatment industries to separate/purify/concentrate liquid solutions or cellular suspensions or gaseous mixtures.

Typically Sirkar works with miniscule membranes, smaller in size than nanometers.

Sirkar has been leading the effort in membrane separations and biotechnology at NJIT since1992. He is the director for the Center for Membrane Technologies at NJIT and is the Foundation Professor of Membrane Separations. Sirkar has authored more than 140 peer-reviewed articles that have appeared in AIChE Journal, Biotechnology and Bioengineering,, Chemical Engineering Science, Industrial and Engineering Chemistry Research; Journal of Membrane Science; Polymer; Biotechnology Progress; Journal of American Chemical Society; Journal of Controlled Release and more. Sirkar graduated with a bachelor's degree with honors in 1963 from the Indian Institute of Technology, Kharagpur, India. He received his master's degree and his doctorate from the University of Illinois, Urbana.

Although Sirkar has no crystal ball, he envisions many future applications for his process. "Desalinating seawater to stimulate

economic development and create potable water always has an attentive audience," he said.

Source: New Jersey Institute of Technology

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