Advances in decades-old dream of mining seawater for uranium

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Scientists today reported progress toward a 40-year-old dream of extracting uranium for nuclear power from seawater, which holds at least 4 billion tons of the precious material. They described some of the most promising technology and an economic analysis showing uranium from the oceans could help solidify nuclear energy potential as a sustainable electricity source for the 21st century. Their reports were part of a symposium at the 244th National Meeting & Exposition of the American Chemical Society being held here through Thursday.

"Estimates indicate that the oceans are a mother lode of uranium, with far more uranium dissolved in seawater than in all the known terrestrial deposits that can be mined," said Robin D. Rogers, Ph.D., who organized the symposium and presented his own technology. "The difficulty has always been that the concentration is just very, very low, making the cost of extraction high. But we are gaining on that challenge."

Erich Schneider, Ph.D., another speaker at the symposium, discussed an economic analysis done for the U.S. Department of Energy (DOE) comparing seawater extraction of uranium to traditional ore mining. It shows that DOE-funded technology now can extract about twice as much uranium from seawater as the first approaches, developed in Japan in the late 1990s.

That improvement reduces production costs down to around $300 per pound of uranium, from a cost of $560 per pound using the Japanese technology. However, extraction from seawater remains about five times more expensive than uranium mined from the ground.

Schneider explained, however, that the current goal is not to make seawater extraction as economical as terrestrial mining. Instead, scientists are trying to establish uranium from the ocean can act as a sort of "economic backstop" that will ensure there will be enough uranium to sustain nuclear power through the 21^{st} century and beyond.

Nuclear power plants, he noted, are built to operate for 60 years or longer and involve a huge investment. In 2008, for instance, one energy company in Florida estimated it would cost more than $14 billion to build a new two-reactor plant. Before making that kind of outlay, energy companies want assurance that reasonably priced uranium fuel will be available on a century-long time frame.

"This uncertainty around whether there's enough terrestrial uranium is impacting the decision-making in the industry, because it's hard to make long-term research and development or deployment decisions in the face of big uncertainties about the resource," said Schneider. "So if we can tap into uranium from seawater, we can remove that uncertainty."

Another advantage of seawater extraction could be avoiding some of the environmental costs of extracting uranium ore. Like other kinds of mining, recovering uranium can produce contaminated wastewater, impact the environment and have health consequences for miners.

The Japanese technology uses mats of braided plastic fibers embedded with compounds designed to capture atoms of uranium. The mats are 50-100 yards long, and suspended 100-200 yards below the surface. When brought to the surface, the mats get a rinse with a mild acid solution that captures the uranium for recovery. The mats then go back down in a cycle that can be repeated several times.

Rogers said the next steps are to improve both parts of the adsorbent system, the plastic substrate and the compounds that lock onto uranium. His research group is testing waste shrimp shells from the seafood industry to make a biodegradable sorbent material.

Provided by American Chemical Society

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