Kyle Maxey (http://www.engineering.com/Author/ID/149764/KyleMaxey) posted on February 23, 2017 | Comment (https://www.engineering.com/DesignerEdge/DesignerEdgeArticles/ArticleID/14379/Uranium-From-Seawater--A-Source-for-Future-Energy-Production.aspx#disqus_thread)

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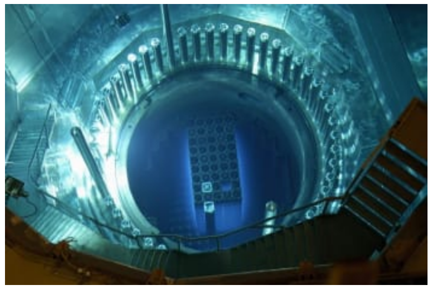


Whether you're vehemently opposed to nuclear power, have your reservations about the technology, or see it as the only viable energy solution in a post-petroleum world, nuclear power will be an important part of humanity's near term future.

One of the problems that will continue to plague nuclear power producers as the energy economy becomes greener is the fact that the world-wide uranium ore supply is dwindling. Like all mineral resources, there will come a day when the mines that dot the Earth won't give up any more ore. From then on we'll have to find another source of fissile material. Fortunately, there is a vast reservoir of uranium that isn't packed under millennia of sediment: it exists in the world's oceans.

The supply of uranium that exists in the ocean can probably be measured in the billions of tons. However, skimming the vast ocean for this material is near impossible because of how diluted it is. That's why researchers are trying to lure it to them using electrified fibers.

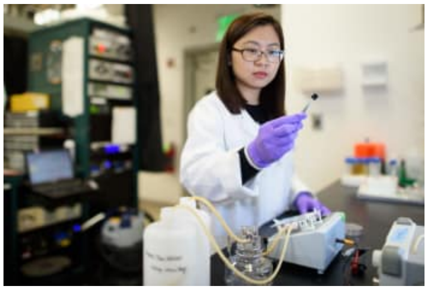
"Concentrations [of uranium] are tiny, on the order of a single grain of salt dissolved in a liter of water," said Yi Cui, a Stanford materials scientist. "But the oceans are so vast that if we can extract these trace amounts cost effectively, the supply would be endless."

Research at Oak Ridge National Laboratory has shown that plastic fibers coated in a chemical called amidoxime can attract a positively charged uranium ion, uranyl. By dunking a collection of these amidoxime-doped fibers into seawater, a modest amount of uranium can be collected and then harvested using a separate chemical process.

Although Oak Ridge researchers have proven that uranium extraction is possible, to make the technology viable, three limitations must be overcome: we must increase the amount of uranyl that will stick to the fibers, lower the time it takes for those fibers to be saturated with uranium ions and make the fibers reusable.

Fortunately, that's what a team of Stanford engineers (https://www.engineering.com/LinkClick.aspx?link=https%3a%2f%2fengineering.stanford.edu%2f&tabid=6551&portalid=0&mid=429) has just done.

Building on Oak Ridge research, Stanford's team introduced a conductive hybrid fiber to the uranium extraction equation, bypassing all three limitations on the technology. The new fiber, which



Postdoctoral scholar Chong Liu examines a carbon-amidoxime electrode as part of research to improve extraction of uranium from seawater. (Image courtesy of L.A. Cicero.)

incorporates carbon and amidoxime, receives electric pulses down its length that change its properties. As these properties change, more uranyl ions can be collected in a shorter amount of time. Additionally, these new fibers are longer lasting, making them more economical.

"We have a lot of work to do still but these are big steps toward practicality," said Yi Cui. "For much of this century, some fraction of our electricity will need to come from sources that we can turn on and off. I believe nuclear power should be part of that mix, and assuring access to uranium is part of the solution to carbon-free energy".

While Stanford's researchers have produced a promising prototype for leeching uranium from the sea, more work needs to be done to make this model commercial viable. Still, as the effects of manmade climate change continue to appear, creative solutions that can rapidly move the world from a carbon-based energy system to a greener reality should be welcomed and funded.

For more nuclear news, find out How Lean Automation Reduces Risk in Manufacturing of Nuclear Fuel Bundles (https://www.engineering.com/LinkClick.aspx?link=%2fAdvancedManufacturing%2fArticleID%2f14336%2fVIDEO-How-Lean-Automation-Reduces-Risk-in-Manufacturing-of-Nuclear-Fuel-Bundles.aspx&tabid=6551&portalid=0&mid=429).

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