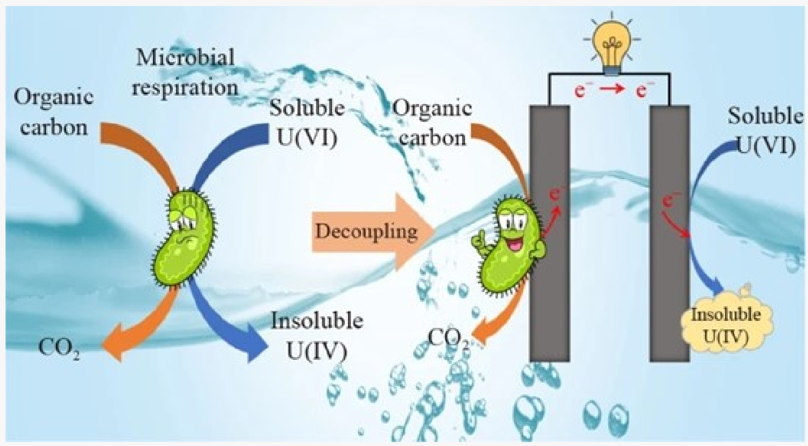
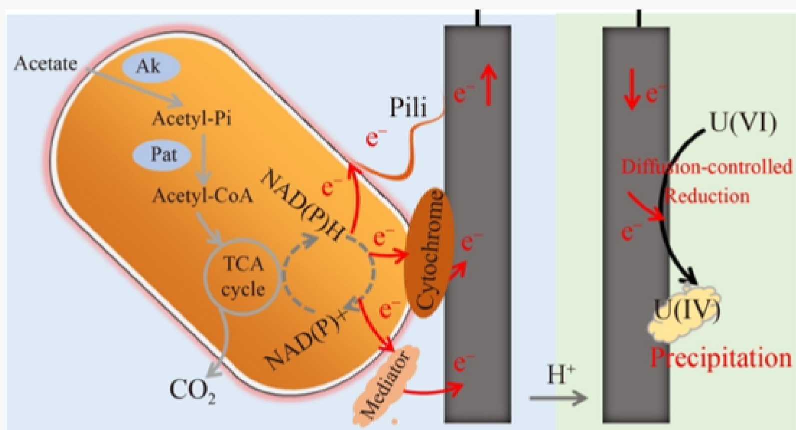
Innovative Study Achieves Uranium Extraction and Electricity Generation Using Microbial Electrochemical Method



Graphic abstract.



Conceptual model for microbial-driven ectopic uranium extraction with net electrical energy production.

CHINA, December 15, 2023 /EINPresswire.com/ -- The increasing reliance on nuclear power as a low-carbon energy source has led to a significant production of uranium-bearing wastewater, posing environmental risks due to the radioactivity and chemical hazards of uranium. This situation is exacerbated by the depletion of conventional uranium sources, highlighting the urgent need for alternative, more sustainable methods of uranium extraction.

In a new study published on 11 August 2023, in the journal Frontiers of Environmental Science & Engineering, researchers from Northwestern Polytechnical University introduced a revolutionary SMEC method for uranium recovery from wastewater. This innovative technique not only efficiently extracts uranium but also generates electrical energy, offering a more sustainable and less complex alternative to traditional extraction methods that are often hindered by biotoxicity.

Researchers developed a spontaneous microbial electrochemical (SMEC) method that spatially decouples microbial oxidation and uranium reduction reactions. This innovative system consists of two chambers separated by a proton exchange membrane, with an anode made of carbon felt and a cathode of titanium foil. The process involves microbial-driven electrochemical reactions, which facilitate uranium extraction from wastewater while simultaneously generating electrical energy. The study have demonstrated stable and efficient uranium extraction with net electrical energy production. The SMEC method proved effective with both synthetic and real wastewater, achieving high uranium extraction efficiency. Moreover, metagenomic sequencing revealed the formation of efficient electroactive communities on the anodic biofilm, enriching key functional genes and metabolic pathways involved in electron transfer and energy metabolism.

Highlights
 Stable and efficient U extraction with electrical energy production was achieved.
 The U(VI) removal proceeded via a diffusioncontrolled U(VI)-to-U(IV) reduction.
 Electro-microbiome was constructed for microbial-driven ectopic U extraction.
 Metabolic pathways of anode biofilm were deciphered by metagenomics.

This research marks a significant step forward in the field of sustainable and cost-effective uranium extraction technologies. It opens the door to innovative strategies in resource recovery and wastewater management, offering potential solutions for industries dealing with heavy metal contamination and energy production challenges.

DOI
10.1007/s11783-024-1764-y

Original Source URL
https://doi.org/10.1007/s11783-024-1764-y

Funding information
The National Natural Science Foundation of China (52200202 and 42077352).

Lucy Wang
BioDesign Research
email us here
