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Translated from Russian

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Artificial leaves have been shown to extract hydrogen from dirty seawater using only sunlight.

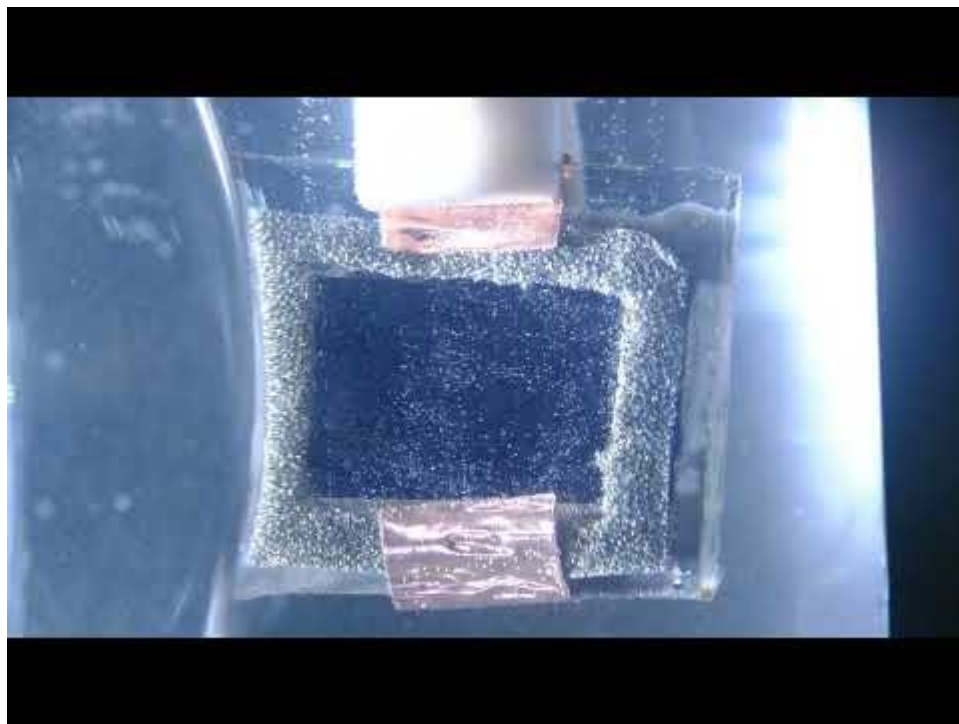
Scientists from Nanyang Technological University in Singapore have developed an "artificial leaf"—a photoelectrochemical device that simultaneously produces hydrogen from seawater and removes the toxic industrial pollutant hydrazine from it. The system is powered directly by sunlight and requires no external power source.



Image source: Nanyang Technological University

Unlike conventional electrolysis, where oxygen is formed at the anode, the anode reaction in the device presented by the scientists involves the decomposition of hydrazine into hydrogen and nitrogen. This requires less energy and simultaneously produces additional hydrogen.

The key element of the device was a photocathode based on lead-halide perovskite, which converts sunlight into electric current. To protect it from degradation in seawater, it was coated with titanium foil and a conductive epoxy composite containing silver and copper particles. The anode contained a corrosion-resistant catalyst based on iron, cobalt, and chromium. This approach also suppressed the formation of toxic chlorine compounds, which are one of the main problems with direct seawater electrolysis.



In experiments with artificial and real seawater, the photocathode demonstrated a photocurrent density of 25 mA/cm^2 . Under illumination corresponding to the intensity of sunlight at the Earth's surface on a clear day, the device maintained stable operation for over 72 hours and achieved a hydrogen production rate of $466 \text{ } \mu\text{mol}/(\text{cm}^2 \text{ h})$. Simultaneously, the hydrazine concentration decreased from 0.5 mol (approximately 1.6% by weight) to just 0.5 parts per billion within 30 hours—more than 20 times lower than the 10 parts per billion limit set by the U.S. Environmental Protection Agency.

Scientists believe the concept can be developed beyond water purification to remove hydrazine. In the next step, they plan to create catalysts for removing other contaminants while simultaneously converting waste into useful products—fuel and industrial raw materials.

<https://3dnews.ru/1148745/iskusstvennie-listya-nauchili-dobivat-vodorod-iz-gryaznoy-morskoy-vodi-dlya-etogo-nugen-tolko-solnechniy-svet>