Cheap renewable energy: Cracking the photosynthetic process that enables plants to split wat

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If humans could split water using cheap materials like nature did, society would have an endless supply of cheap hydrogen fuel for transportation, without carbon emissions. Credit: Joseph Brent, Flickr

Scientists have cracked a key step in nature's water-splitting recipe, which powers all plant life on Earth and may be harnessed to make a limitless supply of cheap renewable fuel.

The Australian National University (ANU) and the Max Planck Institute for Chemical Energy Conversion (MPI-CEC) in Germany led the study, which for the first time identifies an important photosynthetic process that enables plants to split water.

Lead researcher Dr. Nick Cox said if humans could split water using cheap materials like nature did, society would have an endless supply of cheap hydrogen fuel for transportation, without carbon emissions that contribute to human-caused climate change.

"Enough sunlight hits the Earth in a single hour to power all human activity for over a year," said Dr. Cox from the ANU Research School of Chemistry.

"Plants use this harvested energy to split water and make complex carbohydrates which provide food for the plant to grow and thrive. This process also enriches our atmosphere with oxygen for animals, including humans, to breathe.

"Copying this process from nature would lead to new and improved renewable energy storage technologies."

MPI-CEC researcher Dr. Maria Chrysina said the study revealed how a key enzyme involved needed to 'breathe' to allow access to water.

"Half-way through its reaction cycle the enzyme develops the ability to stretch like a concertina, which enables the orderly uptake of water to begin the splitting process," Dr. Chyrsina said.

ANU co-researcher Dr. Eiri Heyno said water splitting in nature could be hindered without the critical step identified by the team.

"Without the careful, sequential binding of water, more reactive oxygen molecules can potentially be released that could unravel the whole water-splitting process," Dr. Heyno said.

The study, which also involved researchers from Sweden, is published in *Proceeding of the National Academy of Sciences* of the United States of America.

The research team used a technique called electron paramagnetic resonance (EPR) spectroscopy, which created 3-D images of the reactive site involved in photosynthesis process.

Dr. Cox is leading the establishment of a new state-of-the-art EPR facility at ANU, with support from the Australian Research Council (ARC), University of New South Wales, University of Queensland, University of Sydney and University of Wollongong.

"This new facility will operate at much higher magnetic fields than what's possible today, allowing more detailed measurements to be taken for medical, biological, chemical and materials research, as well as industrial applications," he said.

Provided by Australian National University

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