

Title New Strategy and Perspective of Artificial Photosynthesis

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Place I²CNER Hall, Ito campus, Kyushu University

Abstract

Sustainable and clean energy resources using solar energy are highly required in order to solve global energy and environmental issues. This lecture presents our new strategy and perspective of artificial photosynthesis focusing on combination of photocatalytic production of hydrogen peroxide from water and dioxygen as a solar fuel and hydrogen peroxide fuel cells.

A variety of photosynthetic reaction center models composed of electron donors and acceptors linked by covalent or non-covalent bonding have been developed, undergoing efficient charge separation and slow charge recombination. The efficient charge-separation step has been successfully combined with the catalytic water reduction step with earth-abundant metal catalysts to attain efficient photocatalytic hydrogen evolution systems.

The hydrogen storage system is also presented by the catalytic fixation of CO₂ with H₂ as a form of formic acid that can be converted back to H₂ whenever needed by appropriate metal complex catalysts depending on pH, together with direct synthesis of hydrogen peroxide from H₂ and O₂. Efficient water oxidation catalysis has also been achieved by a composite of earth-abundant elements. The photocatalytic water oxidation with O₂ to produce hydrogen peroxide (H₂O₂) as an environmentally benign solar fuel is reported together with the development of hydrogen peroxide fuel cells. Thus, the combination of the photocatalytic H₂O₂ production from H₂O and O₂ using solar energy with one-compartment H₂O₂ fuel cells provides on-site production of a solar fuel and the usage.

About the Speaker

Prof. Shunichi Fukuzumi received Ph.D. degree from Tokyo Institute of Technology in 1978. After a post-doctoral position at Indiana University, he joined the faculty at Osaka University in 1981. He was promoted to a full professor in 1994. In 2013, he was selected as a distinguished professor at Osaka University, where he is currently the Director of an ALCA (Advanced Carbon Technology Research and Development) project of Japan Science Technology Agency (JST). He has published more than 930 articles with over 26,600 citations (h-index = 78). He is the recipient of Chemical Society of Japan (CSJ) award (2005), Commendation for Science and Technology by the Minister of Education, Culture, Sports, Science and Technology (2010), and Medal with Purple Ribbon from the Emperor of Japan (2011), and Robert Burns Woodward Career Award in Porphyrin Chemistry (2014). His research interests are artificial photosynthesis, electron transfer chemistry and catalysis.

Host: Professor Ken Sakai

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