

Title How can we get through the bottle neck of the artificial photosynthesis upon visible light irradiation?

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Place I²CNER Hall, Ito campus, Kyushu University

Abstract

Artificial photosynthesis by visible light is one of the most desirable chemical systems to be realized. The probability of its realization, however, still remains not to be so straightforward, in spite of enormous efforts over the past several decades, since the most important problem of how to utilize the water molecule as an electron donor has not yet been fully solved. Oxidation of water, as an ideal electron donor, should be one of the central subjects of study. Among various approaches for the oxidation of water upon light irradiation, i.e., by 1) a one-electron process, 2) a two-electron one, 3) or a four-electron one, we have recently focused our attention on the two-electron oxidation of water sensitized by metalloporphyrins. The reaction is induced by only one-photon process, which can avoid the photon-flux-density problem [1]. The net chemistry indicates that the water molecule serves as both an efficient electron and oxygen atom donor in the reaction. A reaction mechanism involving the formation of an oxo-complex of the metalloporphyrin was revealed [2]. Ubiquitous metalloporphyrins have also been found to induce the two-electron activation of water by one-photon process. Recent progress of CO₂ photoreduction shall be also overviewed [3].

References:

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- [2] T. Shimada, A. Kumagai, S. Farayu, S. Takagi, D. Masui, Y. Nabetani, H. Tachibana, D. A. Tryk, H. Inoue, *Faraday Disc.*, **2012**, *155*, 145-163.
- [3] Youki Kou, Shogo Nakatani, Gen Sunagawa, Yasuyuki Tachikawa, Dai Masui, Tetsuya Shimada, Shinsuke Takagi, Donald A Tryk, Yu Nabetani, Hiroshi Tachibana, Haruo Inoue, *J. Catalysis*, **2014**, *310*, 57-66; Youki Kou, Yu Nabetani, Dai Masui, Tetsuya Shimada, Shinsuke Takagi, Hiroshi Tachibana, Haruo Inoue, *J. Am. Chem. Soc.*, **2014**, *136*, 6021-6030.

About the Speaker

Dr. Haruo Inoue graduated from the University of Tokyo in 1969. After finishing the graduate course of the University of Tokyo, he joined the faculty of Department of Applied Chemistry at Tokyo Metropolitan University in 1972. He has been a full professor since 1991. Currently he is the executive director of the Center for Artificial Photosynthesis at Tokyo Metropolitan University. He has also served as the Vice President of the Chemical Society of Japan (2004-2006), the President of the Japanese Photochemistry Association (2006-2007), the President of the Asian and Oceania Photochemistry Association (2008-2010), the editor-in-chief of *Journal of Photochemistry and Photobiology, C, Photochemistry Reviews* (2010-2013), and on the advisory board of *Langmuir* (~2013). His major research interests are photochemistry, energy coupling among chemical reactions, selective energy flow in solution, anisotropic control of chemical reactions in the excited state, nano-layered compounds, metal complexes, artificial photosynthesis, etc. He has been a project leader of Core Research on Evolutional Science and Technology (CREST and SORST) under auspices by Japan Science and Technology (JST) on the research subject of "Construction of Artificial Photosynthesis with Water as an Electron Source." He has also served as the research supervisor of PRESTO project (JST) on "Chemical conversion of light energy." (2009-2016) along with the project leader of "Artificial Photosynthesis" (Grant-in-Aid for Scientific Research on Innovative Areas, MEXT, 2012-2016).

Host: Professor Ken Sakai

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