



**Title of Project : Chemical conversion of solar energy by artificial photosynthesis: a breakthrough by fusion of related fields toward realization of practical processes**

**Haruo Inoue**

(Tokyo Metropolitan University, Department of Applied Chemistry, Professor)

**【Purpose of the Research Project】**

“Energy crisis” in global scale in near future is now becoming to be accepted to be inevitable. It is anticipated that fossil oil shall be consumed up within ca. 60 years. It should be most required to realize a renewable energy system, artificial photosynthetic one. It enables to convert solar energy into chemical energy (fuel) which can be utilized in a desired amount at a desired time. The artificial photosynthesis has been a “dream of human being,” but now is becoming the most crucial issue to be realized for the sustainable society. For getting to its realization, however, much breakthrough in the corresponding science and technology should be further required, though many Japanese scientists in the artificial photosynthesis-related fields have been leading their edges. On the basis of those pioneering achievements, this project challenges to realize artificial photosynthesis through a multiple-cross-fertilization among all the corresponding fields with all members of the project.

**【Content of the Research Project】**

To realize artificial photosynthesis, establishing redox reaction systems with water as electron donor should be indispensable. Research strategy of 1) learning and understanding natural photosynthesis, 2) mimicking nature, and exceeding nature will be adopted to organize the project team with the following four sub-groups.

1) Development of artificial photosynthetic system with efficient light harvesting devices (A01 group): (Learning and understanding natural light harvesting system to lead to artificial one which can be effectively coupled with catalytic center)

2) Development of artificial photosynthetic system with efficient photocatalytic oxidation of water (A02 group): (Learning, understanding, and being inspired by the structure and mechanism of PSII in natural photosynthesis to establish artificial system of photocatalytic oxidation of water)

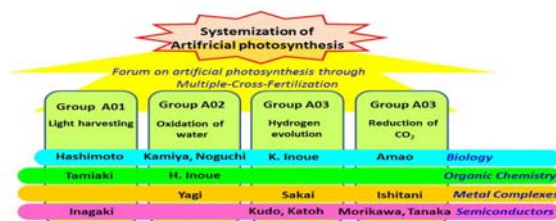
3) Development of artificial photosynthetic system with efficient hydrogen evolution (A03 group): (Efficient hydrogen formation by

electrons from water)

4) Development of artificial photosynthetic system with efficient photochemical reduction of carbon dioxide (A04 group): (Efficient photochemical reduction of carbon dioxide into CO, formic acid, and alcohol)

**【Expected Research Achievements and Scientific Significance】**

In this project, a forum on artificial photosynthesis among the leading scientists will be organized to realize chemical conversions of solar energy with water as electron donor and to develop them into practical processes through multiple-cross-fertilization among all the related area with all-Japan members of the project team. International open-innovation on artificial photosynthesis will be created. Each leading scientist is situated on the crossing point of the vertical axis of each sub-group with distinct object and the horizontal one of fundamental discipline with characteristic methodology. It induces the multiple-cross-fertilization among the discipline and the methodology to focus on the targeting object, which will promisingly lead to establish artificial photosynthesis with water as electron donor.



**【Key Words】**

Artificial photosynthesis: Solar energy and water store the energy in chemical substances such as hydrogen and alcohol.

Renewable energy: Energy which can be continuously supplied by nature.

**【Term of Project】** FY2012-2016

**【Budget Allocation】** 750,700 Thousand Yen

**【Homepage Address and Other Contact Information】**

<http://artificial-photosynthesis.net/>