

【Grant-in-Aid for Specially Promoted Research】

Science and Engineering (Chemistry)



Title of Project : Revolutionizing organic chemistry by utilizing water as solvent

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Research Project Number : 15H05698 Researcher Number : 50195781

Research Area : Chemistry

Keyword : Organic chemistry, water

【Purpose and Background of the Research】

One of the central principles in chemistry lies in the concept that “like dissolves like.” In contrast to the long-standing belief that organic solvents are required to conduct reactions with organic compounds, the ideal chemical processes using water as a solvent have made quite a splash in society. Our internationally acclaimed achievements in water-centered research have provided profound insights into the unique reactivities and selectivities found in organic chemistry conducted exclusively in water. Continuous progress in this field is of crucial importance since cutting-edge research bolsters Japan’s global competitiveness and status as a science-oriented nation. The applicant aims to make a paradigm shift from our reliance on organic solvents to water in order to achieve novel modes of chemical transformation.

【Research Methods】

In order to achieve the aforementioned objective, the research will be conducted under the following five sub-themes: (1) development of highly active catalysts for efficient synthesis in water, (2) elucidation of the function of water in catalysis and organic reactions, (3) development of new methodology for analyzing organic reactions in water, (4) construction of functional artificial enzyme-like systems in water, and (5) basic research for industrial processes using water as a solvent.

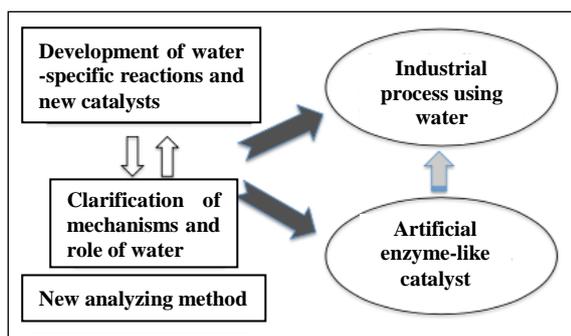


Figure 1 water-centered research project

【Expected Research Achievements and Scientific Significance】

Chemistry in water enables novel modes of chemical transformations that may normally be difficult or sluggish to perform in organic solvents. In order to make significant contributions to synthetic chemistry as well as minimize the ecological footprint of organic chemistry, fundamental and applied research is indispensable to cause a drastic paradigm shift of chemical synthesis in both academia and industry from “in organic solvent” to “in water” both in industrial and in chemical society. The outcomes of this research would advance our scientific understandings of the fundamental interactions between water, organic matter, and metal catalysts, which might serve as the foundation to elucidate the biochemical mechanism that still remains unclear in the cellular environment. In that sense, this research project should be highly valued as a multidisciplinary study that may solve a plethora of global and scientific problems.

【Publications Relevant to the Project】

- Chiral Copper(II)-Catalyzed Enantioselective Boron Conjugate Additions to α,β -Unsaturated Carbonyl Compounds in Water, S. Kobayashi, P. Xu, T. Endo, M. Ueno, T. Kitanosono, *Angew. Chem. Int. Ed.*, **51**, 12763 (2012).
- The New World of Organic Reactions in Water, S. Kobayashi, *Pure Appl. Chem.*, **85**, 1089 (2013).
- Chemistry-Based Design of the Simplest Metalloenzyme-Like Catalyst That Works Efficiently in Water, T. Kitanosono, S. Kobayashi, *Chem. Asian J.*, **10**, 133 (2015).

【Term of Project】 FY2015-2019

【Budget Allocation】 421,200 Thousand Yen

【Homepage Address and Other Contact Information】

<http://www.chem.s.u-tokyo.ac.jp/users/synorg/index.html>