

【Grant-in-Aid for Scientific Research(S)】

Biological Sciences (Medicine, dentistry, and pharmacy I)



Title of Project : Development and Efficient Production of Organosulfur and Organophosphorus Compounds by Transition Metal Catalyzed Method

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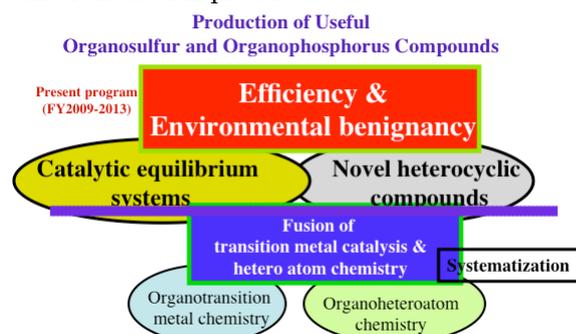
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Research Area : Organic Chemistry

Keyword : catalysis, environmental benign, heteroatoms, organic synthesis

【Purpose and Background of the Research】

There is a strong requirement for the development of an environmentally conscious society to conserve energy and resources and reduce carbon dioxide emissions. The amount of industrial waste discharged by the chemical industry, including the pharmaceutical sector, is the third largest among the manufacturing industries, after the steel industry and the paper/pulp industry. Also, the amounts of carbon dioxide emissions and energy use are the second highest after the steel industry. Because improvements in the manufacturing processes of basic chemical products are reaching their limits, improvements of the manufacturing processes of pharmacological products and electronic materials are required. However, the massive consumption of energy and discharge of waste products cannot be essentially prevented if we continue using the currently used methods for transforming materials. Accordingly, a more efficient chemical reaction is required from the viewpoint of producing environmentally conscious useful products.



【Research Methods】

By developing the catalytic reactions of transition metals, we will realize the highly efficient and environmentally conscious use of organosulfur and organophosphorus compounds, which are important materials for pharmaceutical products and functional materials. The following are included in this research: 1) development of the catalytic reactions of highly active transition metals, 2) control of the equilibrium reaction system, 3) development of systematic synthesis methods for new heterocyclic compounds containing sulfur or phosphorus, 4) improvement of the functions of

pharmaceutical products and functional materials, and 5) research on the material cycle via the catalytic decomposition of transition metals.

【Expected Research Achievements and Scientific Significance】

Sulfur and phosphorus belong to the third period in the periodic table. Organosulfur and organophosphorus compounds, in which sulfur or phosphorus are bonded to carbon, are widely used in functional materials such as pharmaceutical products, pesticides, optical materials, conductive materials, and photosensitive materials. For example, proteins and nucleic acid in an organism are mainly composed of oxygen and nitrogen. Therefore, the use of compounds containing sulfur and phosphorus, which are in the same groups as oxygen and nitrogen, respectively, but in a different period, is promising for the development of synthetic pharmaceutical products used for controlling the expression of bioactivity. However, organosulfur and organophosphorus compounds have not yet been satisfactorily applied for such purposes. The reason behind this is that only heterocyclic structures that are easy to synthesize are used. Therefore, if we can develop a new simple, general, and environmentally conscious method of synthesizing organosulfur and organophosphorus compounds, the use of new materials with heterocyclic structures will be significantly progressed and contribute to the development of new pharmaceutical products.

【Publications Relevant to the Project】

- M. Arisawa, M. Yamaguchi, *J. Synth. Org. Chem., Jpn.*, **65**, 1213 (2007).
M. Arisawa, M. Yamaguchi, *Pure Appl. Chem.*, **80**, 993 (2008).

【Term of Project】 FY2009-2013

【Budget Allocation】 159,000 Thousand Yen

【Homepage Address and Other Contact Information】

<http://www.pharm.tohoku.ac.jp/~sekkei/sekkei-j.html>