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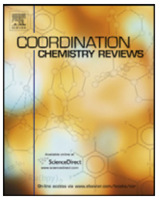

Preface

Vanadium, atomic number 23, is one of the most interesting transition metals not only for a wide range of chemists including basic inorganic, catalytic, and applied chemists but also for biochemists including the physiological, molecular, pharmaceutical, and clinical biologists.

The discovery of vanadium compounds in ascidian blood cells dates back to 1911 when the German physiologist M. Henze discovered high levels of vanadium in an ascidian collected from the Bay of Naples. In the 1970s, the biological significance of vanadium was the focus of several reports. In 1972, Bayer and Kneifel isolated a pale-blue compound containing vanadium from the toadstool *Amanita muscaria*, which they designated amavadin.

In 1977, Cantley et al. determined that a low level of vanadium ions in the +5 oxidation state (vanadate) in muscle acts as a potent inhibitor of the Na^+–K^+-ATPase. The inhibition of the Na^+–K^+-ATPase by quabain activates glucose transport and glucose oxidation in rat adipocytes. Shechter and Karlish (1980) found new inhibitors in the form of vanadium salts (vanadate and vanadyl) that stimulated glucose oxidation in rat adipocytes. In 1985, Heyliger et al. reported that vanadate appeared to have insulin like effects. Meyerovitch et al. (1987) showed that the oral administration of vanadate normalized blood glucose levels in streptozotocin-treated rats. The inorganic and organic vanadium-containing compounds have been of interest as insulin mimics and have been studied in clinical trials. Vanadium compounds are also effective as anticancer agents in several variants of leukemia.

In 1984, Vilter first revealed the presence of vanadium bromoperoxidase in the marine macroalga *Ascophyllum nodosum*. This finding triggered the discovery of various vanadate-dependent haloperoxidases, including iodo-, bromo-, and chloro-peroxidases not only in marine algae but also in terrestrial fungi and lichens, which harbor enzymes that catalyze the halogenation of organic substrates by H_2O_2 and halides. In 1986, Robson et al. reported that the alternative nitrogenase of *Azotobacter chroococcum* was a vanadium enzyme. Subsequent genetic and physiological studies showed that V-nitrogenases are widely distributed but are only synthesized when molybdenum is a limiting nutrient.

The reason why vanadium attracts scientists covering so many areas, is fundamentally attributed to its wide range of oxidation states (from −3 to 5) and their redox processes. Depending on these properties, a variety of vanadium compounds including Lewis acids, organometallics, and oxidants or reductants can be synthesized. Furthermore, vanadium compounds can induce or catalyze various organic reactions and polymerizations. Especially, selective molecular transformations provide versatile synthetic protocols. For example, the bio-inspired vanadium-catalyzed oxidative bromination based on bromoperoxidase has permitted environmentally harmonious catalysis.

The Seventh International Symposium of Chemistry and Biological Chemistry of Vanadium was held at Toyama Shimin Plaza in Toyama, Japan, from 6th to 9th of October, 2010. This Conference followed the Symposia in Cancun, Mexico (V1-1997), Berlin, Germany (V2-1999), Osaka, Japan (V3-2001), Szeged, Hungary (V4-2004), San Francisco, USA (V5-2006) and Lisbon, Portugal (V6-2008).

The main themes in the symposium, were as follows. (1) Vanadium Inorganic Chemistry – Coordination, Speciation and Structure. (2) Vanadium Bioinorganic and Biological Chemistry. (3) Vanadium Transport, Toxicology and Enzymology. (4) Therapeutic Applications of Vanadium Compounds. (5) Vanadium-Induced or – Catalyzed Reactions. (6) New Materials Containing Vanadium and their Processes.

The review articles of this issue described by the influential participants selected cover the latest aspects of vanadium science.

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