Description for the general public

Research carried out throughout the world in recent years on the use or disposal of waste of various types has led to the rapid development of technologies that produce low or zero quantities of waste. Included in this is the growing interest in complex, multifunctional materials. Subjects of research in this area include the synthesis and use of functional inorganic supports. Of particular note are mono-oxides or systems consisting of multiple components, which – in view of the wide range of available synthesis methods – may be designed to have highly specific physicochemical and structural properties. Parameters relating to porous structure (specific surface area, porosity) and activity, determined at the synthesis stage, very often allow these materials to be used in processes whereby harmful organic or inorganic compounds are removed from the environment.

The most important goal of this project will be to obtain functional inorganic materials with strictly defined properties, dedicated for use in the treatment of wastewaters containing harmful metal anions (vanadates). An additional aspect will be the comprehensive synthesis of selected inorganic matrices with the addition of vanadates, carried out *in situ*, with the aim of producing unique combinations. Because of the complexity of the chemistry of heteropolyanionic complexes and their physicochemical properties, the process of elimination of anionic forms of metals from the environment is not widely described in the existing subject literature. The taking up of a challenge in this area – to find a correlation between the physicochemical parameters of functional inorganic matrices, their activity, and the specific properties of vanadates – would appear to be a highly justified step and will undoubtedly constitute a novel area of scientific work. Identification of the mechanism by which oxyanions are incorporated into the structure of inorganic matrices, synthesized both by way of adsorption and *in situ*, will enable the selection of an optimum material, whose properties will be verified in catalytic and electrochemical systems. This is an important utilitarian aspect of the project, combining the elimination of harmful substances from the environment with the synthesis of multifunctional materials having a specific practical application.

The project fits perfectly with the principles of sustainable development and environmentally friendly technologies. The cooperation undertaken between the Chemical Technology Faculty of Poznań University of Technology (project leader) and the Chemistry Faculty of UMCS (project partner), and the complementary nature of those institutions' experimental resources, provide an undoubted guarantee that the research goals of the project will be completed to high practical and theoretical standards. A measurable result of the project will be the completion of interdisciplinary research leading to a significant expansion of knowledge and development of the scientific field in question, as well as highly ranked scientific publications indexed by Thomson Reuters JCR.