SUPRAMOLECULAR SUBSTANCES BASED ON POLYOXOMETALATES AND DOUBLE-LAYER HYDROXIDES

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The problem of obtaining competitive chemical products at Ukrainian enterprises currently remains extremely important. In today's realities in the world, an urgent problem remains express diagnostics for the elimination of chemical pollution of the environment as a result of armed conflicts, terrorist attacks, accidents at factories and utility facilities [1]. To solve these problems, research is being conducted on supramolecular compounds, which can be the basis for the development of sensor of various types: electrochemical, fluorescent, luminescent, etc., which will allow rapid determination of the presence and concentration of pollutants in soil or drinking water. The chemistry of supramolecular compounds is currently one of the new areas that, despite its novelty, is developing very quickly [2,3]. For the development of such sensor, various compounds are widely used, from which inorganic-organic hybrid complexes are obtained, which have a great potential for further application in various industries.

We plan to carry out research on the development of scientific foundations and methods of synthesis of a number of new electroactive supramolecular substances. The main task of such research is to find ways to obtain materials with maximum electrical activity, both redox and ion-mobility. Experimental and theoretical study of the laws of synthesis of a number of new electroactive substances using methods of intercalation of solid phases and synthesis of supramolecular complexes will make it possible to develop new supramolecular substances based on polyoxometalates and double-layer hydroxides for sensors of environmental pollutants [4].

Solving this problem requires a comprehensive study of the mechanisms of the processes of physical and chemical transformations that take place at various stages of the synthesis of multicomponent materials. The obtained results will be used, for example, in the improvement of electrochemical sensors of dangerous chemical pollution, which is directly related to issues of technological and environmental safety of Ukraine. The results of the project will be relevant for such branches of science as physical chemistry, colloidal chemistry, inorganic chemistry, analytical chemistry and materials science.

In recent years, we have been conducting systematic research into the patterns of synthesis of new materials with electrochemical activity. For the first time, a number of methods for obtaining electrochemically highly active nickel hydroxides were proposed, including electrochemical synthesis, high-temperature two-stage synthesis, and cold homogeneous precipitation [5]. A number of double-layered hydroxides of nickel and other metals intercalated with inorganic and organic anions were also obtained for the first time. The resulting compounds have anion-exchange electroactivity and may be promising for use in potentiometric sensors.

Research on the properties of polyoxometalates and double-layer hydroxides undoubtedly needs to be continued, as it will allow to expand the range of electroactive substances and sensors based on them for rapid determination of organic soil and water

pollution that appeared as a result of armed conflict. Research will be focused on a comprehensive study of physicochemical transformations that take place at various stages of the synthesis of electroactive materials. New synthesis methods will be proposed and optimized, which will allow obtaining competitive chemical products at domestic enterprises.

Prospective compounds for use in sensors are electroactive supramolecular substances based on double-layer hydroxides intercalated with various ions. Such substances have clearly expressed anion-active properties. This allows them to be used to determine pollutants of the anionic type, both inorganic (phosphates, chromates, fluorides, etc.) and organic. It should be noted that double-layer hydroxides are supramolecular compounds that can be purposefully designed and synthesized by the method of ion design to determine the selected organic substance.

The existing base of chemical sensors based on polymer membranes with immobilized electroactive materials is currently not sufficiently developed, since most of such sensors are aimed at determining the presence and content of various organic cations. In addition, the existing potentiometric sensors usually have an insufficient level of sensitivity (10^{-5}-10^{-6} mol/l), which, in our opinion, is connected both with certain properties of the supramolecular substances used in their basis, and with conditions for the synthesis of these supramolecules, which require additional research to choose rational conditions for the synthesis of active substances and polymer membranes. It is also necessary to further study the influence of the methods of obtaining supramolecular substances and their immobilization in polymer matrices on the electroactive characteristics of these composites, which will allow to increase the sensitivity and selectivity of sensors, which can be developed in the future to determine the studied organic and inorganic substances.

New knowledge about chemical processes and properties of synthesized substances will become a scientific basis for their creation and improvement, selection of optimal synthesis conditions, development of rational technologies for their production and use in electrochemical sensors. All these achievements are especially in demand for the post-war recovery of the country and the development of domestic technologies.

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