

REVIEW
of the domestic scientific advisor
on the dissertation of Ms. Ainur Nuralykyzy Imangaliyeva
"Sorption and catalytic characteristics of composite materials based on
natural raw materials" presented for the defense of PhD degree
on specialty "6D072000 - Chemical technology of inorganic substances"

Currently, the protection of natural resources from pollution and depletion is one of the important strategic government objectives. Water is the source of life and the most important natural resource, which is used in almost all spheres of human activity. Not a single technological process is possible without the use of water. Therefore, a huge amount of wastewater from industrial enterprises is released into the environment every year.

One of the most common pollutants of wastewater is heavy metal ions. It is known that, most of heavy metal ions have rather low MPC (maximum permissible concentration) values, are toxic and are capable of causing irreparable damage to living organisms. According to the analysis of literature data, it has been established that sorption methods for cleaning water bodies are effective and also contribute to their rational use as a result of the return of purified water to the production process cycle.

Dissertation of A.N. Imangaliyeva "Sorption and catalytic characteristics of composite materials based on natural raw materials" is devoted to:

- the creation of effective and economically available composite materials based on mineral and plant materials;
- the establishment of their sorption properties towards heavy metal ions;
- the establishment of catalytic activity in 4-nitrophenol reduction and yellow phosphorus oxidation reactions.

The following tasks are solved in the thesis:

- The composite materials based on mineral raw materials: BT-PEG, vegetable raw materials: OP-PVP, MP-PVP (BT - bentonite, OP - orange peel, MC - mandarin peel) are synthesized and the optimal conditions for obtaining them are determined;
- the physicochemical and textural characteristics of the obtained composite materials were established;
- the optimal conditions for the sorption of heavy metal ions (Cu^{2+} , Cd^{2+} , Pb^{2+} , Ni^{2+}) by obtained CM (composite materials) were established;
- the physicochemical characteristics of the sorption process of Cu^{2+} , Cd^{2+} , Pb^{2+} , Ni^{2+} ions by obtained CM were studied;
- the catalytic activity of coated copper – polymer complexes in 4-nitrophenol reduction reactions was established;
- the catalytic activity of homogeneous and coated copper-polymer complexes in the oxidation reactions of yellow phosphorus in aqueous and organic (butanol) media was established.

In the work of Imangaliyeva A.N. were obtained new composite materials based on bentonite clay, orange and tangerine peel, modified with polymers: PEG

and PVP. For the first time, the kinetic regularities of the sorption process of Cu^{2+} , Cd^{2+} , Pb^{2+} , Ni^{2+} ions by obtained CM were established. Being a pioneering effort, homogeneous and supported copper-polymer complexes were used as catalysts for the reduction of 4-nitrophenol and the oxidation of yellow phosphorus, and their catalytic activity was shown. The goal set in the work was achieved as a result of solving all the mentioned above tasks.

The results of the thesis have theoretical and practical significance. From a scientific point of view, the obtained regularities in the modification of natural raw materials, the sorption of metal ions, the study of the catalytic properties of composite materials contribute to the development of physical chemistry (sorption, catalysis) and the coordination chemistry of polymers. It should be noted that the composite materials obtained in the work are characterized by high sorption properties towards heavy metal ions, which opens up prospects for their use in the treatment of water bodies. It was established that composite materials after sorption extraction of copper ions exhibit catalytic activity in the reactions of 4-nitrophenol reduction and yellow phosphorus oxidation. These reactions are of industrial importance for the production of essential nitrogen and phosphorus-containing compounds.

In carrying out this dissertation, a large contribution was made by a foreign consultant, professor Yitzhak Mastai, who provided an opportunity to Imangaliyeva A.N. to work in the laboratories of Bar-Ilan University (Israel), equipped with modern facilities. During the internship period, the physicochemical characteristics of composite materials were obtained by the author, and the kinetics of 4-nitrophenol reduction was studied by a spectrophotometric method. It should also be noted that the opportunity to use the library fund of the university was provided. The results were discussed at the scientific seminars of the laboratory headed by Professor Yitzhak Mastai.

The results of the thesis were reported and discussed at the following International and Republican conferences and seminars: V All-Russian Scientific Youth School-Conference "Chemistry under the sign of sigma: research, innovation, technology" (Omsk, May 15-20, 2016); International Scientific Conference "Innovative development and relevance of science in modern Kazakhstan" (Almaty, October 20-21, 2016); International scientific conference of students and young scientists "Farabian readings" (Almaty, April 11-14, 2016); International scientific conference of students and young scientists "Farabian readings" (Almaty, April 11-12, 2017); 4th International Russian-Kazakh Scientific and Practical Conference "Chemical Technology of Functional Materials" (Almaty, 12-13 April 2018); International scientific conference of students and young scientists "Farabian readings" (Almaty, April 9-10, 2018).

On the basis of the main results of the thesis XX publications were issued, 2 articles of which are in journals included to the database of Thomson Reuters, 6 articles in publications recommended by the Committee on the Control of Education and Science of the Republic of Kazakhstan, 14 - in collections of International and Republican conferences, 2 innovation patents of RK were received.

During the work on the thesis, A.N. Imangaliyeva showed high independence, good theoretical knowledge and practical skills in the field of chemistry and chemical technology. She carried out a large amount of experiment with various physicochemical methods; the results obtained were interpreted using modern concepts in catalysis and sorption technology.

The thesis "Sorption and catalytic characteristics of composite materials based on natural raw materials" on the relevance, novelty and practical significance of the results obtained satisfies all the requirements for PhD dissertations, and its author Imangaliyeva A.N. deserves the award of a PhD degree on specialty "6D072000-Chemical technology of inorganic substances".

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