OPINION

from the local scientific supervisor

Doctor of Chemical Sciences, Professor Ospanova Alyiya Kapanovna

on the dissertation of Bekissanova Zhanar Bolatovna

"Synthesis, characterization and antibacterial activity study of composites based on natural adsorbents and silver nanoparticles"

submitted for the degree of Doctor of Philosophy (PhD) in the specialty "6D072000 – Chemical Technology of Inorganic Substances"

In modern medical practice, an important problem today is the fight against infectious diseases. This is primarily due to the problem of the addiction of many bacteria and viruses to the drugs used, and therefore the search for new anti-infectious drugs is of great interest. The main requirements for such drugs are good antibacterial and antiviral activity against existing carriers of infectious diseases. In addition, an important factor is their prolonged properties, which can be achieved by selecting carriers for drug substances. In this regard, clay minerals, due to their structural properties, can be promising carriers of active particles and bioactive substances. Kazakhstan has promising deposits of such minerals that have practically not been studied for biomedical purposes. One of these most promising deposits is the reserves of diatomite and kaolin, the latter is practically unexplored, although it is well-used in other countries. These minerals can be used as universal carriers for medicinal substances for widespread use in practical medicine.

In this regard, the dissertation work of Bekissanova Zhanar Bolatovna is devoted to the **synthesis, characteristics and study of the antibacterial properties of composites based on diatomite, kaolinite and bio-silica containing silver nanoparticles**. The dissertation developed and substantiated methods for the synthesis of new composite materials with antibacterial properties. For this, a literary search was worked out and conducted on the topic of the study and, based on a thorough analysis, a method was developed for producing silver nanoparticles on the surface of clay minerals, without additional modification of the structures of diatomite and kaolinite. Hydrogen peroxide was used as a reducing agent, which is most suitable for use in the synthesis of medical preparations since it does not introduce additional degradation products. In the process of obtaining and studying the antibacterial activity of the obtained diatom composites, she found that in addition to silver nanoparticles, silver chloride particles are also obtained, which exhibit even greater activity than the silver particles themselves. Biosilica, proposed by Professor Myroslav Sprynskyy at Nicolaus Copernicus University, showed the promise of using pure synthetic silica as a carrier and the possibility of its application in various innovative technologies.

Zhanar Bolatovna independently carried out a large amount of experimental work both in the laboratories of our university and during an internship in Poland, at the Nicolaus Copernicus University in the scientific group of Professor Myroslav Sprynskyy. In 2021, she received the team award from the Rector of the Nicolaus Copernicus University in Torun (Poland) for achievements in the scientific field in 2020.

Bekissanova Zh. B. is the owner of grant funding for research by young scientists under the "Zhas Galym" project for postdoctoral students, funded by the Ministry of Education and Science of the Republic of Kazakhstan.

Research within the dissertation work was carried out within the framework of projects:
- State Fund for 2018-2020 AP05131647 "Physical-chemical basis for obtaining multifunctional biomedical materials (nanofilms) with antibacterial and anti-inflammatory properties";
- State Fund 2021 AP09561734 " Development of conditions for the production of multipurpose antibacterial composite material based on Kazakhstan kaolin";
- State Fund for postdoctoral students under the Zhas Galym-2 project for 2022–2024 AP14972864 "Synthesis, characterization, photoluminescent and antibacterial properties of nanomaterials based on europium/biosilica and silver/biosilica"
- Programs "PROM - International Scholarship Exchange for Doctoral Students and Teachers" (December-2022).

The main results of the dissertation research were published in 14 publications that fully correspond to the topic of the dissertation research, including articles in peer-reviewed scientific journals with a non-zero impact factor included in the Scopus and Web of Science (Materials, Percentile 63% (Q2), (IF=3.748)), Colloids and Surfaces B: Biointerfaces, (Q1, Percentile 91, IF=5.999).

Three articles in scientific journals were recommended by the Committee for Quality Assurance in Education and Science of the Ministry of Education and Science of the Republic of Kazakhstan and two patents of the Republic of Kazakhstan.

During the period of execution and writing of the dissertation, Bekissanova Zh.B. showed herself as an enterprising and responsible, hardworking and mobile young scientist. She has all the necessary qualities to work in science, she can independently set tasks and motivate the plan for their implementation, and actively discuss and prove the correctness of her ideas and assumptions.

Based on the foregoing, I believe that Zhanar Bolatovna is a well-trained specialist in the development of innovative technologies for biomedical agents, and the results obtained by her are of scientific theoretical significance and practical application.

The results of the dissertation received by Bekissanova Zh.B. fully comply with all the requirements of the Committee for Control in the Sphere of Education and Science of the Ministry

of Higher Education and Science of the Republic of Kazakhstan. The author is worthy of being awarded the **degree of Doctor of Philosophy (PhD) in the specialty "6D072000 - Chemical Technology of Inorganic Substances".**

Scientific supervisor:
Doctor of chemical sciences
Professor of Al-Farabi Kazakh
National University **A. K. Ospanova**