

REVIEW

Scientific supervisor doctor of chemical sciences, professor Mansurov Z.A. for the dissertation work of Mohammad Shams, "Synthesis of Hydroxyapatite nanofibers for targeted drug delivery", submitted for the degree of Doctor of Philosophy (Ph.D.) in the specialty 8D07113 - "Nanomaterials and Nanotechnologies in Chemistry."

Dissertation work shams M. is devoted to the study of obtaining and using a biologically compatible material in medicine - calcium hydroxyapatite, with the subsequent study of their physicochemical properties. The doctoral student obtained calcium hydroxyapatite (HAP) from a biological waste material - eggshell, which was subjected to heat treatment at a temperature of 950 ° C, followed by adding an aqueous solution of phosphoric acid in an ultrasonic bath. As a result of the research, the method developed by the doctoral candidate made it possible to synthesize a powdered material, which is a finely dispersed powder of micron sizes (1-2 microns) with a purity of 95% HAP content. In addition, the physicochemical and mechanical properties of the HAP powder, surface morphology, phase analysis, specific surface area, and porosity were studied.

In this research, the doctoral student also obtained composite films from nanosized polymer fibers and synthesized HAP powder, obtained by electrospinning, which is the pulling of nanosized fibers from a solution under high electrical voltage.

Shams M. passed foreign practice at the University of Kashan (Kashan, Iran) under the guidance of a prominent scientist in the field of obtaining and using nanosized substances, Doctor of Inorganic Chemistry, Professor Masood Salavati Niasar, as well as at the Institute of Nano Science and Nano Technology (Kashan, Iran) under the direction of Professor Salavati Niasar.

Shams M. mastered modern methods of nanomaterials research at Al-Farabi Kazakh National University and showed a true scientist's perseverance and independence. The main task of the Kazakh National University is the development of the Republic of Kazakhstan. Therefore, his research can help the country's domestic production in the field of 3D printing of bone scaffolds.

The process of obtaining nanoparticles using the sonochemical method was studied with a group of scientists led by Dr. Salavati Niasar M. The obtained materials from the sonochemical method show the promise of using this method for obtaining biodegradable scaffolds for tissue engineering as osteogenesis enhancement agents. It has been established that the final products are soft magnetic materials that can be promising candidates for bone regeneration and enhancing osteogenesis based on VSM analysis.

In parallel, the doctoral student used an actively developing technology - 3D printing for designing and printing the TPMS and FGLS structures in the Institute of Combustion Problems (Almaty, Kazakhstan). For more certainty of the successful application of this technology and the use of synthesized nanomaterials, the doctoral

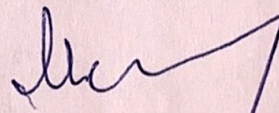
student simulated the movement of nutrients based on glucose in the biological framework and developed several algorithms for the parametric design of TPMS and FGLS structures from a unit cell. In the dissertation work of Shams M., various mechanical tests are done on models to ensure their strength under real conditions. The calculations carried out by the doctoral student showed that the porosity of scaffolds accelerates the delivery of nutrients and growth cells and can release the drugs over time.

The main provisions of the dissertation are reflected in seven published works, including three articles in journals with a non-zero impact factor included in the Scopus database, as well as three abstracts in the materials of international and foreign scientific conferences and symposiums.

I believe the results presented in this dissertation are reliable and undoubtedly arouse deep scientific interest. Nevertheless, the work meets the requirements of the modern scientific world.

In connection with the above, the dissertation work of Shams Mohammad, "3D printing of hydroxyapatite as a drug delivery agent in bone refining", submitted for the Ph.D. degree, according to the main features - the relevance of the problem, the novelty of the results obtained, their validity and reliability, the amount of research and practical significance - is a scientific work that has a promising direction for the development of the processes of obtaining and researching nanomaterials in bone regeneration in general, and the doctoral student deserves to be awarded a Ph.D. degree in the specialty 8D07113 - "Nanomaterials and Nanotechnologies in Chemistry."

Scientific supervisor,
Doctor of chemical sciences, Professor



Mansurov Z.A.

1st September 2022.

РАСТАЙМЫН
өл-Фараби атындағы Қазақ Ғылым және
Техника Академиясының
дәріяула және аттестаттау басқармасы
ЗАВЕРЯЮ
Начальник управления подготовки
научных кадров КазНУ им. а.
Р.Е. Кудайбергенова



« _____ » _____ 20