

Research project objectives/ Research hypothesis (in English)

Biomaterial engineering is currently a rapid growing science. The main research goal of many world's scientific teams is preparation a functional implant material intended to replace or regenerate damaged tissue and restore its original features. The obvious assignment of biomaterials is reduction of disability and elimination of inborn or acquired defects. However, there is recently also draw attention to the fact that with the development of civilization, the number of people aged over 65 years steadily increases and aging is becoming a global problem. This means that the rising demand for implant materials will be also result of necessity to improve the health conditions of older people who will need new artificial organs to comfortable living.

Proposed scientific project predicts conduct of research on multifunctional implant materials. The trial to preparation of composite coatings with bioactive calcium phosphates natural or synthetic origin doped with antimicrobial silver nanoparticles seems to be justified due to real possibility to create a new material used as bone substitutes. These pioneering studies in the field of synthesis and preliminary cytotoxicity tests have a chance to be an important step towards creating a new generation of bioactive materials.

Research project methodology (in English)

In the project plan, the following research issues are predicted: development of composition and base of preparation of ceramic-polymer composites coatings modified with antimicrobial silver nanoparticles and analysis of physicochemical, mechanical and biomedical properties of resulted materials. The realization of main goal requires a number of specific aims. Among them it can be distinguished: preparation of calcium phosphate synthetic and natural origin as a component of composite material, synthesis of biocompatible polymer matrix containing natural polymers, development of dispersion of calcium phosphate bioceramics and testing its stability and rheological properties, development and composition selection ceramic-polymer composites and fittings producing, incubation tests in fluids simulated of living body environment, cytotoxicity tests on cell lines. It is noteworthy to mention that preliminary studies on polymer dispersion preparation containing hydroxyapatite particles have been made by our research team. The addition of dispersant (PAA/PEG system) caused an increase the uniformity and stability of the colloidal system, which was clearly confirmed in the stability, sedimentation and rheology studies. In proposed research, the ceramic phase will be the biocompatible intermediates obtained from calcination of animal bones or synthetically produced. The polymer matrix will include natural polymers which are fully acceptable by living organism.

Expected impact of the research project on the development of science, civilization and society (in English)

Research issues presented above were selected because of cognitive significance and the possible development in chemical technology and in long term also in medicine and dentistry. Interesting and expected results of preliminary studies suggest that our team focused on the proper methodology of research, which suggests that the project may have a significant impact on the development of materials science and medicine. In case of expected experimental results, they can become the strong base for the development of new implant materials. Moreover, the innovative point of view of the proposed research gives the possibility to effective disseminating the results in world class publishing, and therefore the spreading knowledge about the improvement of materials improving the quality of life.