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COMPOSITES BASED ON BIODEGRADABLE POLYMERS FOR TISSUE ENGINEERING

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Abstract. Tissue engineering (TE) is becoming one of the most promising methods for the reconstruction of tissue defects. TE proposes new treatment approaches that are alternative to existing treatments. However, for the development and improvement of methods TE is necessary to master new materials, high specificity and functionality. In this regard, the preparation and study of composites, in particular those possessing the properties of biocompatibility and biodegradation, is especially promising. Bacterial cellulose (BC), chitosan, and polyhydroxyalkanoates (PHA) are often used for biomedical technologies, including tissue engineering. BC has high biocompatibility and doesn't cause allergic reactions *in vivo*; BC has a unique structure, including porosity and high moisture absorption [1]. Chitosan is a linear polysaccharide obtained by partial deacetylation of chitin and has high hydrophilicity and antimicrobial activity [2]. Bacterial polyhydroxyalkanoates (PHA) – polyesters of hydroxycarboxylic acids synthesized by microorganisms, due to a variety of their composition, have different physicochemical and physicomechanical properties and have been actively studied recently [3]. However, despite the advantages of each of the biopolymers, their mixing, in particular, hydrophobic PHA and hydrophilic chitosan, leads to the production of composites with new properties characterizing their behavior as intermediate between hydrophilic and lipophilic polymers. On the example of composite films and nonwoven fibers, it has been proven that the inclusion of chitosan in a polymer matrix reduces the crystallinity of poly-3-hydroxybutyrate (P3HB) in films and nonwoven fibers to 47 and 62%, respectively. The inclusion of chitosan promotes a change in the surface morphology and a decrease in the diameter of ultra-thin fibers from 800 nm to 460 nm. At the same time, P3HB has reinforcing properties and improves the physical and mechanical characteristics of chitosan. The introduction of bacterial cellulose into a polymer matrix made of PHA, in particular a copolymer of 3-hydroxybutyric and 4-hydroxybutyric acid (P3HB/4HB) makes it possible to obtain hybrid wound dressings. The wound dressings support the growth and adhesion of fibroblasts and help restore model third-degree skin burns in laboratory animals.

References

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