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Composite material with nanoscale architecture based on bioapatite, sodium alginate and ZnO microparticles(Article)

Pogrebnjak, A.a, Sukhodub, L.a, Sukhodub, L.a, Bondar, O.a, Kumeda, M.a, Shaimardanova, B.b, Shaimardanov, Z.b, Turlybekuly, A.b View Correspondence (jump link)

aSumy State University, 2, Rymskogo-Korsakova st., Sumy, 40007, Ukraine

bD. Serikbayev East-Kazakhstan State Technical University, 69, Protozanov st., Oskemen, 070001, Kazakhstan

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A nanostructured composite material in the form of a hydrogel and beads based on hydroxyapatite (HA), sodium alginate (Alg) and ZnO microparticles was fabricated under the influence of microwave irradiation. An average crystallite size of the HA was 40 nm, while ZnO crystallites of the size 25 nm–11 μm were formed. The inorganic HA-ZnO phase of studied composite is distributed in the polysaccharide matrix of the alginate, which corresponds to the structures of natural bone nanocomposites. The introduction of ZnO into the composite increases its porosity up to 5 times and the degree of swelling in phosphate buffered saline up to 2 times, as well as provides weak antimicrobial activity. The effect of microwave and ultrasonic treatment on the structure of HA-ZnO and HA-Alg-ZnO composites' microcrystals was studied. The mechanism of antimicrobial activity of ZnO crystals in the HA-Alg-ZnO composite was proposed. The in vitro biocompatibility and cytotoxicity of the synthesized materials was studied and it was found that addition of ZnO make insignificant effect on biocompatibility. Thus, the main goal of our work was fabrication of the bioactive material using microwave and ultrasonic treatment for additional enhancement of antibacterial properties. 