ANTIMICROBIAL PROPERTIES OF HYDROXYAPATITE MATERIAL OBTAINED BY GREEN TECHNOLOGY PATHWAY

Ivan Bracanović[1*], Dunja Miletić[2], Ana Kalijadis[1], Miloš Simić[1], Aleksandar Krstić[3], Aleksandra Sknepnek[2], Miljana Mirković[1]

*[1]University of Belgrade, „VINČA" Institute of Nuclear Sciences - National Institute of the Republic of Serbia, Department of Materials, Mike Petrovića Alasa 12-14, Belgrade, Serbia, ivan.bracanovic@vin.bg.ca.rs**

[2]University of Belgrade, Faculty of Agriculture, Nemanjina 6, Zemun, Serbia

[3]University of Belgrade, „VINČA" Institute of Nuclear Sciences - National Institute of the Republic of Serbia, Department of Physical Chemistry, Mike Petrovića Alasa 12-14, Belgrade, Serbia

Abstract

Due to increasingly intense problems in terms of resistance to various types of infections, including bacterial resistance to antibiotics, new materials with effective contact antimicrobial action are intensely being researched. Hydroxyapatite (HAp) represents the leading material from the calcium-phosphate group, which can be used as a biocompatible material, in environmental protection as an adsorbent for heavy metal removal from polluted waters, and also as an antimicrobial agent. The wide specturm of use of this material lies in its structural and functional properties. The main goal of this work was to obtain pure nanocrystalline hydroxyapatite material, using green technologies, i.e. precursors that are ecologically acceptable for the environment such as hydrogen phosphates as a source of PO4 and hydroxide as a source of Ca. Synthesized HAp nanocrystalline material was structurally investigated by X-ray diffraction method and morphological properties are investigated by scanning electron microscopy method. Based on obtained results pure nanocrystalline material was obtained with average crystallite sizes about 10 nm and hexagonal symmetry. The microstructural results confirms proper crystal grains small in sizes agglomerated in larger forms. The antibacterial activity of the obtained HAp was tested against Gram-positive bacteria Staphylococcus aureus, Listeria monocytogenes, and Gram-negative bacteria Pseudomonas aeruginosa and Acinetobacter baumanii by total plate count assay. Results shows that obtained material posses the best antimicrobial properties against Staphylococcus aureus with 50% and Acinetobacter baumanii with 45% of efficiency while for Pseudomonas aeruginosa and Lysteria monocytogenes shows 20% and 8% of efficiency compared to the control. Obtained HAp material at a concentration of 50 mg/mL showed a reducing property towards the bacteria.

Keywords: *hydroxyapatite, antimicrobial, structure, green technologies.*

Acknowledgments: *This research was funded by the Ministry of Science, Technological Development and Innovation of the Republic of Serbia (Contract numbers 451-03-136/2025-03/ 200017: number of research topic 1702407 and 451-03-137/2025-03/200116) and the project "Green technologies for obtaining antimicrobial composites for use in cosmetics", "EU for Green Agenda in Serbia", with the technical and financial support of the European Union and in partnership with the Ministry of Environmental Protection, implemented by UNDP in cooperation with the Embassy of Sweden and the European Investment Bank (EIB), with additional funding from the Governments of Sweden, Switzerland, and Serbia (Contract number 00136377/00127312/2023/24).*