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Novelties in bactericidal nanocomposites based on biopolymers and metal nanoparticles

The need for low-cost, scalable, and dispersion-processable nanomaterials is a leading motivation for extensive research in the field of nanocomposite synthesis. Nowadays, nanomaterials based on biopolymers and metal nanoparticles have attracted considerable attention not only in medicine but as well in many other fields such as catalysis, optoelectronics, information storage, environmental technology, engineering, etc. Furthermore, the use of Ag, Au and Cu nanoparticles (NPs) is a cause of intensive recent research due to excellent properties of these metals (e.g. good thermal and electrical conductivity, which might be used in electronics, or optical properties, which might be exploited in catalysis, diagnostics, sensing, and therapeutic applications). What is noteworthy, since multidrug-resistant microorganisms are a major problem for current medicine, nanoscale materials bring also new possibilities in the development of effective antimicrobial systems. Herein, the synthesis of materials based on Ag, Au, Cu NPs and chitosan with the careful analysis in terms of physicochemical properties and biological activity in vitro will be presented. In detail, the chemical structure, size, and morphology of metal NPs in the chitosan matrix have been studied by scanning electron microscopy (SEM), scanning transmission electron microscopy with energy-dispersive X-ray analysis (STEM-EDX) and powder X-ray diffraction (XRD). The surface oxidation state of the metallic nanoparticles and elemental analysis by depth profiling have also been evaluated by X-ray photoelectron spectroscopy (XPS). FTIR measurements were carried out to identify possible interactions between metal nanoparticles and chitosan molecules. Antibacterial activity was evaluated according to the European Norm ASTM E2180-07 for polymeric materials, against selected, resistant Gram-(+) and (-) bacterial strains (S. aureus and P aeruginosa, respectively). The cytotoxicity of the selected nanocomposites was also evaluated using two human cell lines: A549 (human lung adenocarcinoma epithelial cell line) and HaCaT (an immortal human keratinocyte). In view of the potential biomedical application, the most promising materials in form of colloids, films, and coatings will be pointed out.

Speaker Biography

Agnieszka Kyziol has completed her PhD at the age of 29 years from Jagiellonian University, Kraków, Poland. She is the assistant professor in Coordination and Bioinorganic Physiochemistry Group at faculty of chemistry of Jagiellonian University. She has over 60 publications that have been cited over 800 times, and her publication H-index is 15 and has been serving as an editorial board member of reputed Journals.

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