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Novel composites based on nanoceramics and silver nanoparticles with antimicrobial activity for biomedical applications

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Recently, the increasing resistance of microorganisms to antibiotics has triggered intense research for finding alternatives. Moreover, the apparition of microbial strains with multiple resistance has determined numerous studies on the efficiency of metal ions, especially Ag+and silver nanoparticles, AgNPs, on various microorganisms, mainly bacteria and fungi. In this work, we describe first the synthesis of spherical AgNPs in aqueous media via reduction of silver nitrate using glucose in alkaline media in the absence and the presence of TEOS. Also, an aqueous dispersion of AgNPs was prepared by using a solution of silver nitrate and a mixture of two chemical agents: sodium citrate and tannic acid in alkaline media. The size, shape and size distribution of AgNPs were determined by UV–Vis spectroscopy, dynamic light scattering (DLS), atomic force microscopy (AFM) and scanning transmission electron microscopy (STEM). The compounds present on the surface of the AgNPs were identified using FT-IR spectroscopy. Obtained data indicated that the use of TEOS and the combined use of sodium citrate and tannic acid produced spherical AgNPs dispersions, as they allow the control of nucleation, growth and stabilization of the synthesis process. Therefore, synthesis of new nanostructured composite materials made from the mixture of HAP ceramics and AgNPs at different ratios (from 0.1 to 5 wt% Ag) is realized. The HAP ceramics was previously obtained by a wet precipitation method, while AgNPs were prepared by reduction of silver nitrate as described above in alkaline media. HAP and HAP & AgNPs composites were characterized by X-ray diffraction, different imagistic methods (TEM, SEM and STEM, AFM), UV-Vis spectroscopy and zeta potential measurements. The antimicrobial effect of the AgNPs alone in aqueous dispersions and in their composites with HAP ceramics was tested on five pathogenic species: Escherichia coli, Staphylococcus aureus, Salmonella typhimurium, Bacillus cereus and Micrococcus luteus and important results were obtained for biomedicalapplications.

Speaker Biography

Balint Reka graduated from the Faculty of Chemistry and Chemical Engineering at Babes-Bolyai University in Cluj-Napoca, where she got chemistry diploma. Now, she is a PhD student and assistant researcher at the Chemistry Physics Center at the Babes-Bolyai University.

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