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Investigation on the Bactericidal Effects of Silver-Chitosan Nanobiocomposites

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Abstract – Silver nanoparticles (AgNPs) were synthesized in a simple route using $NaBH_4$ as reductor and chitosan as stabilizing agent. The interactions between AgNPs and the chitosan, as well as the degradation of the nanobiocomposites were investigated by electronic scanning microscopy - FEG (Field Emission Gun), Dynamic Light Scattering (DLS), UV – vis, and Fourier Transform Infra Red (FTIR) upon varying the chitosan / AgNP ratio. Bactericidal essays comprising Minimum Inhibitory Concentration (M.I.C.) and Optical Density (OD_{595}) evidenced a synergistic action between chitosan and AgNp against Gram-Negative microorganisms (*E. Coli*).

This study was aimed at developing bactericidal nanobiocomposites containing chitosan and AgNPs (1). Silver nanoparticles (AgNPs) had been synthesized in a simple route using $NaBH_4$ as reductor agent and chitosan as stabilizer. The nanobiocomposites were characterized by electronic scanning microscopy – FEG, Dynamic Light Scattering (DLS), as well as UV-Vis and FTIR spectroscopies. Minimum Inhibitory Concentration (MIC) and Optical Density (OD_{595}) essays were carried out to investigate the bactericidal properties of the composites against *E. coli*. The nanoparticles/chitosan complexes exhibited a size distribution between 10 – 30 nm, as shown in figure 1 (a) measured using both DLS and FEG-MEV. The majority of particles presented a spherical shape (figure 1 (b)), and the degradation time exceeded 100 h at room temperature, confirming the stabilizing action of chitosan. The shift of amide II characteristic band at 1560 cm^{-1} confirmed the interaction between AgNps and chitosan via the amide nitrogen from chitosan (2). The amide II band was verified to shift toward higher wavenumbers as a function of time after synthesis. After 24 h, for example, this band shifted to 1567 cm^{-1}, as shown in the spectra of figure 1 (c). Complexation of chitosan with AgNPs was advantageous, improving the bactericidal ability of the isolated components, as revealed by the MIC essays. The best bactericidal effect was achieved for nanobiocomposites at a ratio of 4:1 (chitosan/AgNPs), which exhibited a MIC of 20 mg/ml.

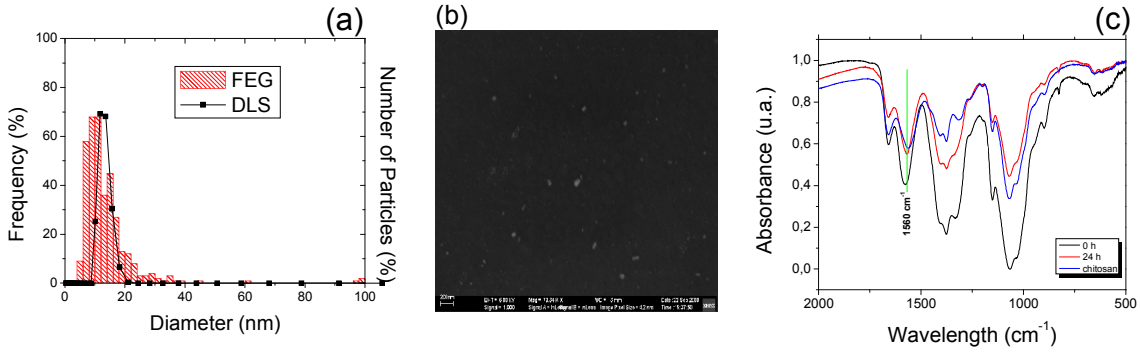

Figure 1) (a) Size distribution of chitosan/AgNps visualized via FEG and DLS, (b) FEG images of the nanobiocomposites (c) FTIR spectra from pure chitosan and chitosan/AgNPs collected at different times after synthesis.

REFERENCES

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