Cotton Textile with Antimicrobial Activity and Enhanced Durability Produced by L-Cysteine-Capped Silver Nanoparticles P81

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In this study, L-cysteine-capped silver nanoparticles (Cys-AgNPs) were successfully linked in a cotton textile, being attached in a covalent way to the cotton fibers via esterification with the hydroxyl groups from the cellulose. The AgNPs were strongly adhered to the fiber surface through coordination bonds with the thiol groups from the L-cys. In addition, they were compared with biogenic silver nanoparticles produced from fungi (bio-AgNPs). Materials and methods: The characterization of the Cys-AgNP and the bio-AgNP solutions were accomplished by UV–visible (UV–Vis), Z-potential, and X-ray diffraction (XRD). After the attachment of the Cys- AgNPs and the bio-AgNPs to the raw cotton, the textile surface was characterized by variable pressure scanning electron microscopy (VP-SEM), energy dispersive X-ray (EDX), and Fourier transform infrared spectroscopy (FT-IR). The antibacterial activity was performed by disk diffusion analysis. Results: The results of the UV–Vis analysis showed the presence of AgNPs in the Cys-AgNPs and the bio-AgNPs solutions, showing the Surface Plasmon resonance (SPR) for the AgNPs among 380–420 nm. In addition, they exhibited a Z-potential of −27 and −24 mV, respectively, with the presence of elemental silver shown by the XRD analysis. The VP-SEM images from the cotton fabrics covered in Cys-AgNPs and bio-AgNPs showed the presence of spherical AgNPs on their surface, and EDX analysis revealed the presence of peaks associated with the presence of Ag, C, and O. Furthermore, FT-IR analysis exhibited peaks associated with the presence of L-cysteine (SH-) and carboxylic acid arising from the esterification reaction among the cellulose from cotton and the carboxylic acid in the L-Cys molecules. Finally, the cotton textile exhibited antibacterial activity against Escherichia coli and Staphylococcus aureus. Conclusions: This study demonstrates the ability of Cys-AgNPs to bind to the cellulose from cotton fabric so as to produce antibacterial fabrics with enhanced durability, opening a wide range of options to be further used in healthcare and other industries.