

Low cost paper-based materials functionalized with nanoparticles for antibacterial applications

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The increase of infectious diseases caused by pathogenic microorganisms and the development of new strains of antibiotic-resistant bacteria, represent a serious threat to public health. The search for new antibacterial agents with low toxicity and ability to inhibit the microbial contamination is a key issue in the development of new materials for healthcare, packaging and other applications. [1, 2]

Nanomaterials such as nanoparticles are being increasingly used for antimicrobial applications. Nanoparticles of different materials (Au; Ag; Cu; ZnO; CuO; TiO₂; MgO) have demonstrated antibacterial activity. [1-3] The main advantages of using inorganic nanomaterials when compared with organic antimicrobial agents are their stability, robustness, and long shelf life.[1]

Cellulose paper is a biodegradable, versatile and low-cost material with excellent functionalization possibilities for various research fields. The combination of paper materials with antibacterial nanoparticles yields new functional low-cost materials for diverse applications: wallpaper for hospitals; paper wipes; impregnated textiles; water filters and food packaging materials.[4]

In this work a study on the antibacterial properties of paper-based materials (coffee filter paper and Whatman paper) impregnated with silver nanoparticles (AgNPs); zinc oxide nanoparticles (ZnONPs) and copper oxide nanoparticles (CuONPs), is presented. The antibacterial properties of NPs impregnated papers were tested against Gram-negative and Gram-positive bacteria, namely *Escherichia coli* and both methicillin-susceptible and resistant *Staphylococcus aureus* (MSSA and MRSA) strains.

The best results were obtained for AgNPs impregnated low-cost coffee filter paper (Figure 1) which demonstrated antibacterial activity against all tested bacteria; *E. coli*, MSSA and MRSA, with a minimum AgNPs suspension concentration of 0.5 mM.

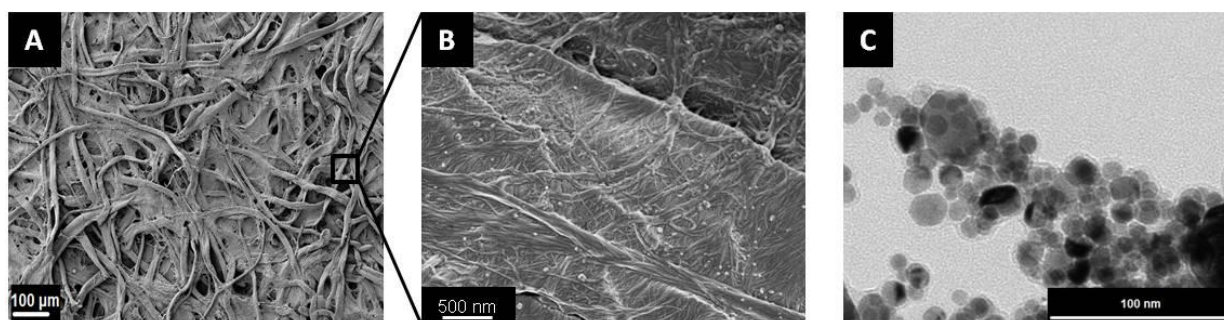


Figure 1. SEM micrographs of coffee filter paper (A) impregnated with silver nanoparticles (B) and TEM image of synthesized silver nanoparticles (C).

References

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