Footwear Industry: Use of nanoparticles in the development of materials with antimicrobial properties

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Abstract

Footwear industry is recognized by its innovative capability in the development of added value fashion and comfortable leather shoes. Presently, consumers expectations and needs require the development of footwear that integrates fashion, emotional desires and real multifunctional performance. Consumers are becoming more enlightened and demanding, searching for differentiated products which promote their comfort, health and welfare is significantly increasing. To keep competitiveness, the footwear companies need to put their efforts in the development of differentiated and advanced products to meet the needs of the actual market. In this way footwear sector has been investing in the development of new and functional materials namely with antimicrobial properties. The control of bacteria and fungus growth is important to prevent and minimize the generation of malodors and some foot skin problems.

The footwear industry has been exploring the benefits of remarkable properties of nanoparticles on the development of new products with high performance.

This route was initiated at CTCP in collaboration with FCUP with a more fundamental study to prepare stable Ag NPs with antimicrobial properties. Ag NPs antimicrobial properties were confirmed against *E. coli*, *S. epidermis and B. subtilis* (figure 1). Ag NPS were also used on leather surface modifications to confer antimicrobial properties [1-3].

Cu, CuO and ZnO nanoparticles were also studied as alternatives to Ag NPs. Cu, CuO and ZnO NPs were prepared using different methods allowing to obtain NPs with different shapes, sizes and properties [4-15]. Furthermore the nanoparticles were characterized by TEM/SEM images and UV-Vis and their stability and antimicrobial properties were accessed. The antimicrobial properties were tested against *E. coli* and *S. epidermis* using methods developed by CTCP.

Although Cu NPs (figure 2) revealed good antimicrobial properties their low stability render them difficult to be used in industrial applications. By contrast ZnO showed good stability and also displayed antimicrobial properties.
Different procedures were used to prepare reproductively spherical ZnO nanoparticles (figure 3) and the following step is scale-up the use of nanoparticles to develop advanced and innovative nanotechnology based solutions for leathers and polymers components for footwear products, aiming a new sustainable and customer-driven production of consumer goods; where the health, environment, high quality of components, fair marketing communication and competitive sales price are combined to promote the competitiveness of the companies.

References

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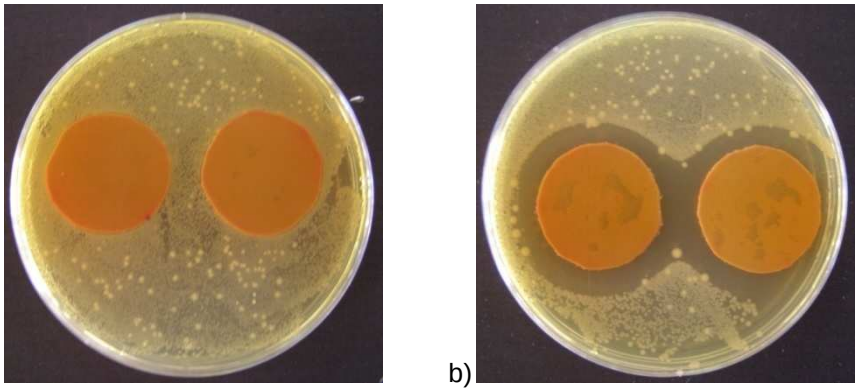
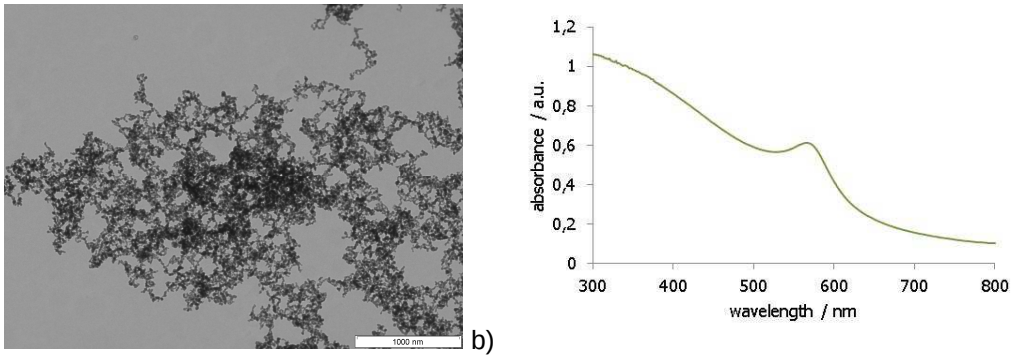
Figures



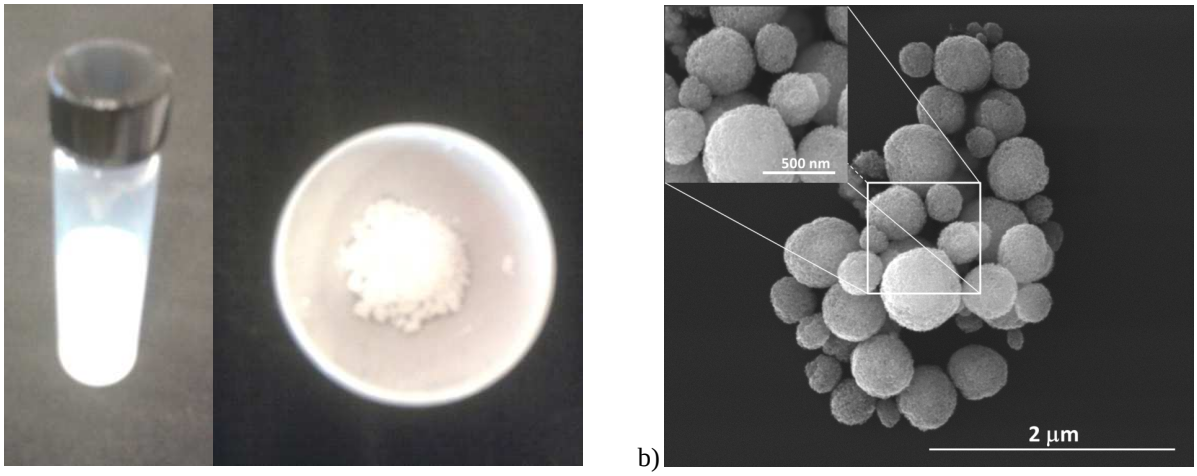
a) b)

Figure 1. Results of antimicrobial test of unmodified leather (a) and leather modified with Ag NPs (b).



a) b)

Figure 2. TEM image (a) and absorption spectra (b) of Cu NPs prepared with $NaBH_4$ and $CuCl_2$.



a) b)

Figure 3. Zinc oxide nanoparticles in suspension and in solid (a) and TEM image (b).