

# MULTIFUNCTIONAL FLAX FIBRES BASED ON THE COMBINED EFFECT OF SILVER AND ZINC OXIDE (AG/ZNO) NANOSTRUCTURES

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## ABSTRACT

### 1. Background and Objectives

In recent years, multifunctional fibrous systems have attracted attention because of their wide range of applications areas. The development of these systems can be achieved by the functionalization of fibres' surface with nanomaterials 1. In fact, nanoparticles (NPs) are very attractive materials due to their high surface area. Silver (Ag) and zinc oxide (ZnO) NPs exhibit numerous interesting properties including antibacterial effect, electrical conductivity, self-cleaning and piezoresistive response, allowing the development of one fibrous system presenting all these distinct properties 1–3.

Nowadays, the searching for sustainable products and methodologies are increasing dramatically. Therefore, natural fibres have been emerged as valuable alternatives to replace the synthetic ones due to their renewable sources, biodegradability, low-cost, lightweight and good mechanical properties 4. In this study, multifunctional flax fabrics with piezoresistive response, antibacterial and hydrophobicity properties were developed through the functionalization with Ag and ZnO NPs.

### 2. Methods

Firstly, AgNPs were synthesized by a green methodology and applied onto the fabrics, followed by in-situ of ZnONPs. Several concentrations of zinc acetate (precursor) were tested. All the samples were characterized by GSDR, FESEM, EDS, ATR-FTIR, XRD and TGA analysis. Electrical conductivity, piezoresistive response, antibacterial activity, hydrophobicity and durability/washability tests were also performed.

### 3. Results

GSDR results showed the appearance of absorption bands of Ag and ZnO NPs. FESEM images demonstrate the successful incorporation of both NPs onto fabrics, which was corroborated by ATR-FTIR, XRD and TGA analysis. The samples were able to change their electrical resistance under compression confirming their piezoresistive behaviour. The sensitivity of functionalized fabrics was quantified by gauge factor values, which ranged from 0.7 to 1.2 with the increase of zinc acetate concentration. The functionalized fabrics also exhibited antibacterial activity against Gram-positive and Gram-negative bacteria, high hydrophobicity (>100°), UV-resistance and wash durability.

### 4. Conclusions

This work shows the development of multifunctional natural fibres through their functionalization with NPs which can have a great potential in several areas.

### 5. References

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