

# ***Innovative treatments based on silver nanoparticles against the biodegradation of heritage textiles***

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## **PhD Thesis Summary**

**The main objective** of the thesis consisted in the manufacturing of innovative treatments based on silver nanoparticles (AgNPs), fabricated using an ecological method, which can be applied for preventing the degradation of heritage textile objects.

The efficiency of the synthesis was initially tested using three flavonoid compounds, then three plant extracts were used. The resulting nanoparticles were characterized in terms of size (DLS), morphology (SEM, TEM), crystallinity (EDX, XRD), and antioxidant activity, respectively, evaluated by the short-life radical scavenging capacity of the radical oxygen species (ROS), using the chemiluminescence method, and of long-life radicals (ABTS<sup>•+</sup>), using the trolox equivalent method (TEAC).

The capacity and functionality of the AgNPs-based treatments on textile samples (wool and cotton) was evaluated by determining the antimicrobial activity against *Escherichia coli*, *Staphylococcus aureus*, *Aspergillus brasiliensis* and *Penicillium hirsutum* (for demonstrating the antibacterial and antifungal properties) and by evaluating the chromatic impact, by determining the chromatic parameters, expressed in the CIE L\*a\*b\* system. The results indicated that the textile samples underwent insignificant color changes, both in the case of cotton and wool.

By studying the performance of the AgNPs dispersions obtained with the three types of extracts, two of them were selected to be applied on a historical textile sample, as they exhibited high antimicrobial efficiency both on wool and cotton textile samples. The characterization of the textile artifact treated with the two AgNPs dispersions consisted of the spectral (FT-IR), morphological (SEM), chromatic (parameters L\*a\*b\*) and antimicrobial activity measurements. The chromatic changes of the artefact are minimal following the application of AgNPs dispersions, which meets the conservation-restoration criteria of heritage objects. The antimicrobial efficiency of AgNPs-based treatments applied on the heritage object also supports the potential application of these treatments for preventing biodegradation of textile artifacts.