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# Controlled Antibacterial Activity of Polyester Fabric by Immobilization of Silver Nanoparticles in Thin Films

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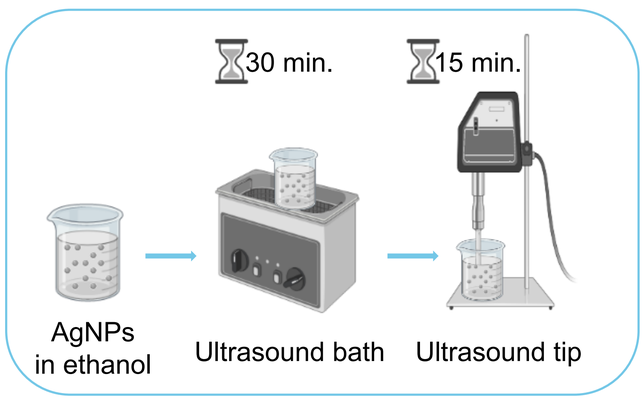
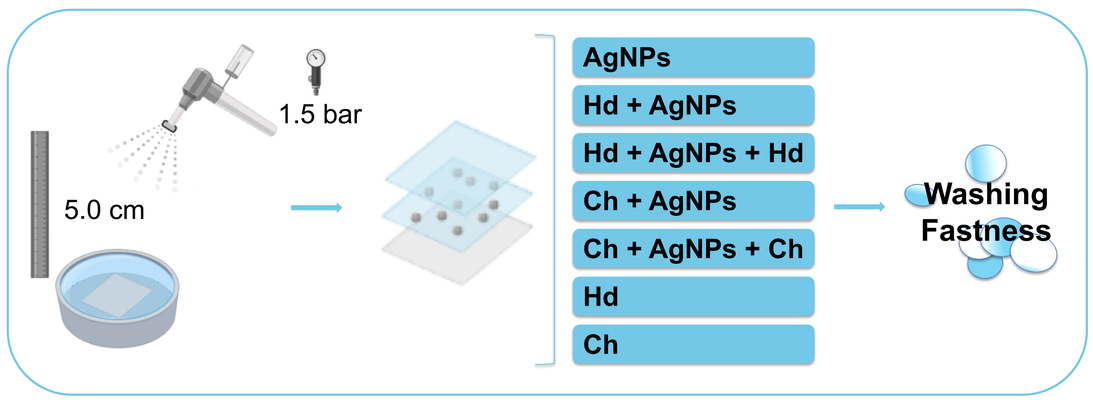
## Introduction

Antimicrobial materials are useful tools to fight against multidrug-resistant organisms and healthcare associated infections [1]. Textile coatings incorporating silver nanoparticles (AgNPs) can offer new physical, chemical and biological properties to address this need [2,3]. Special attention has been given to AgNPs stability and their controllable release to prevent toxicological effects [4]. In this work, Polyvinylpyrrolidone-coated AgNPs were immobilized onto polyester fabric (PES) through an easy spray method using Chitosan (Ch) or Hexamethyldisiloxane (Hd) thin layers to create a novel class of controllable antimicrobial coatings.

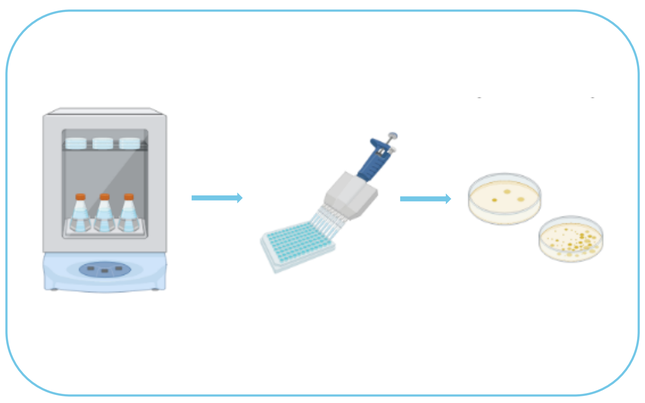
## Methodology and Results




1. Preparation of AgNPs dispersions in ethanol (1 mg.mL$^{-1}$)




2. Preparation of PES composites comprising sandwich-like structures



3. Antibacterial activity assessed by the shake flask method

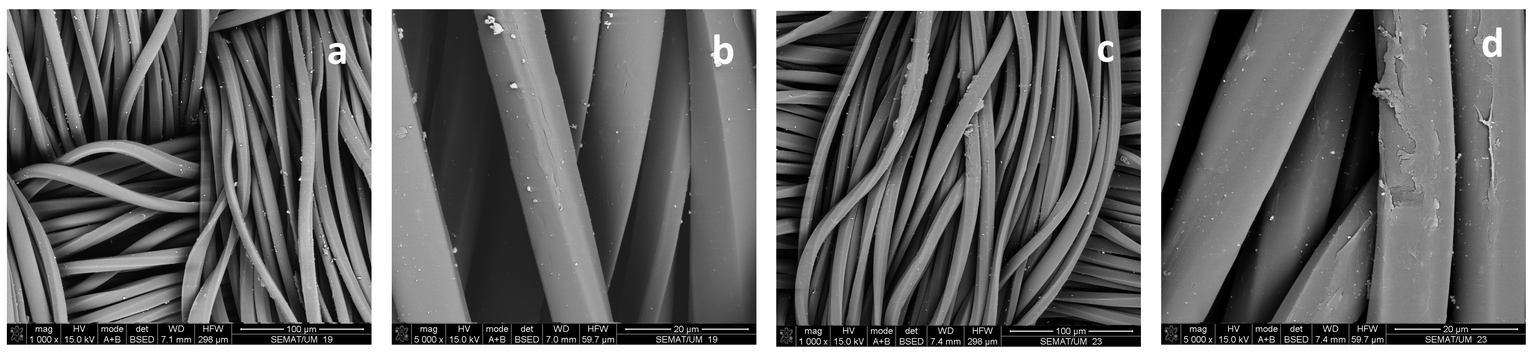



**Figure 1** - SEM images of PES fabric with AgNPs (a and b) and sample with a final chitosan layer (c and d).

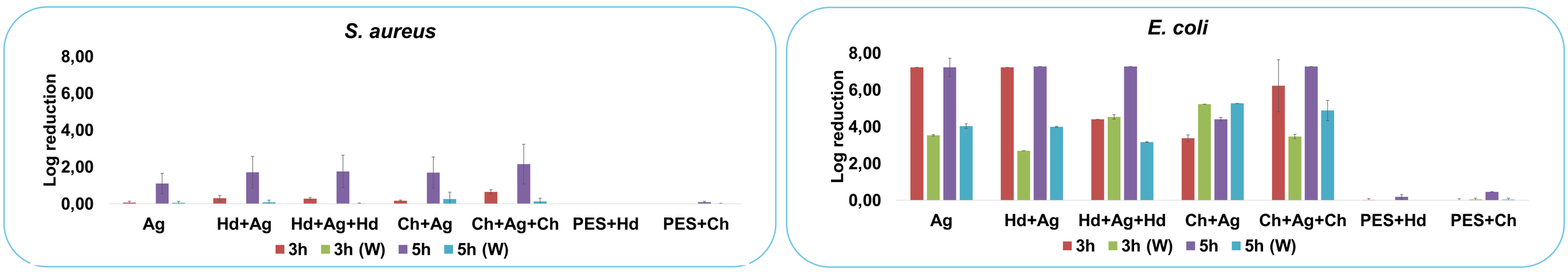



**Figure 2.** Antimicrobial action of samples against *Staphylococcus aureus* (*S. aureus)* and *Escherichia coli* (*E. coli)*.

## Conclusion

- Antimicrobial PES composites were obtained by spray, showing that the antimicrobial effect can be tuned by varying the layers formulation using Ch or Hd, without compromising the viability of cells according to the cytotoxicity tests.
- The antimicrobial activity of composites revealed to be effective against *E. coli* in all tested conditions. Despite the activity against *S. aureus* with Hd or Ch layers showed superior results than the control, the best result just presented log reduction of 2.2 after 5h.
- The addition of chitosan layers showed a higher control of the antimicrobial activity and a synergistic action when combined with AgNPs;
- After 5 washing and 5 rinse cycles, only the chitosan samples showed a superior antimicrobial activity after 5h against *E. coli*, which can be attributed to the protective effect of chitosan as observed in the SEM images.

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**References:**

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