MODIFIED COTTON TEXTILE WITH HAP-AGNPS NANOCOMPOSITE AIMING ANTIMICROBIAL PROPERTIES FOR MEDICAL TEXTILE GOWN

Ester Fernanda Ferreira 1(*) , Carla Eiras 2, Jefferson Mendes de Sousa 3, Andrea Zille 4, António Pedro Garcia Valadares Souto 5

1,3 Center for Educational Sciences (CCE), Federal University of Piauí, Piauí, Brazil
2 Technology Center (CT), Federal University of Piauí, Piauí, Brazil
4,5 Department of Textile Engineering (DET), University of Minho, Guimarães, Portugal

ABSTRACT

The present study aimed the functionalisation of a textile with a nanocomposite based on hydroxyapatite (Hap) and silver nanoparticles (AgNPs) for the application in hospital gowns. The results confirm the inclusion of the AgNPs in the Hap structure and the successful immobilization in the cotton fabric structure. The antimicrobial tests confirm the enhanced action of the nanocomposite against Gram-positive and Gram-negative bacteria as well as in the prolonged and controlled release of the Ag ions.

INTRODUCTION

Cotton textiles have a large market share due to their excellent properties, such as flexibility, comfort, water absorption and air permeability. However, its natural origin and the ability to retain moisture induce the growth of pathogenic microorganisms that can cause deterioration of textiles and even potential human health risks (Xu, 2016). On one hand, AgNPs have a broad spectrum of antibacterial activity and low toxicity, but they should remain bound to the textile in order to avoid inadequate dispersion in the environment (Premasudha, 2015). On the other hand, synthetic hydroxyapatite has become a promising biomaterial due to its composition and chemical structure similar to the bone mineral phase (Andrade, 2016). In this work, the cotton fabric functionalization with a nanocomposite based on hydroxyapatite and silver nanoparticles with enhanced antimicrobial properties and good adhesion was proposed for the application in hospital gowns. The Hap-AgNPs nanocomposite was characterized by Infrared Region Spectroscopy (FTIR) and Scanning Electron Microscopy (SEM) techniques. In addition, antimicrobial activity tests were performed on the textile using the qualitative method (Agar-Well Diffusion Method), and the quantitative Shake Flask method (ASTM_E2149-01).

RESULTS AND CONCLUSIONS

FTIR and SEM tests confirm the impregnation of the silver nanoparticles in the hydroxyapatite. The FTIR spectrum shows the variation of the -OH vibration peak at 3300 cm\(^{-1}\) due to the action of the Ag ions (Figure 1). SEM images confirm the inclusion of the AgNPs on the hydroxyapatite structure due to the observation of glittering points in Figure 2b that are absent in pure hydroxyapatite (Figure 2a). Figure 2c corroborates that the size of AgNPs are in the range of 20 nm. Regarding the antimicrobial activity tests, the qualitative test displays antimicrobial action only for AgNPs, while the quantitative test shows satisfactory results for both AgNPs and hydroxyapatite (Table1). Other characterizations were also performed (data not shown) such as UV-Visible Spectroscopy, Zeta Potential and DLS, X-Ray Diffractometry, Vertical Capillarity, Dynamic Capillarity, Liquid Absorption. From the resulting data analysis, it is possible to state that the antimicrobial action of the Hap-
AgNPs nanocomposite is better and longer (data not shown), because the AgNPs are protected by the structure of the hydroxyapatite that control the release of the Ag ions when they come into contact with the microorganisms.

Fig. 1 FTIR of the nanocomposite HAp-AgNPs compared to that of HAp.

![Figure 1](image1.png)

Fig. 2 Pure HAp relative to the HAp-AgNPs nanocomposite.

![Figure 2](image2.png)

Table 1. Results of the antimicrobial activity using the Shake Flask method

<table>
<thead>
<tr>
<th>Samples</th>
<th>S. aureus</th>
<th>E. coli</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>AgNPs</td>
<td>99,809</td>
<td>100,000</td>
</tr>
<tr>
<td>HAp-AgNPs</td>
<td>97,636</td>
<td>100,000</td>
</tr>
</tbody>
</table>

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REFERENCES

