Anticoagulant and antimicrobial finishing of nonwoven Polypropylene textiles

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The aim of this work was to modify a nonwoven polypropylene (PP) membrane with acrylic acid (AA) in order to immobilize on the grafted carboxylic functions bio-active molecules, and thereby to obtain a therapeutic activity of the material.
We have optimized the grafting process of AA on pre-activated polypropylene using in situ cold plasma polymerization [1], which is a more rapid and more efficient method than the usual bath polymerizations [2]. The optimal activation and grafting conditions determined using experimental designs consist in an argon cold plasma pre-treatment, followed by AA rapid impregnation and again Argon cold plasma to allow in situ polymerization. The amount of carboxylic groups grafted on polypropylene, the grafting rate and the quality of the coating surrounding the fibres have been investigated.

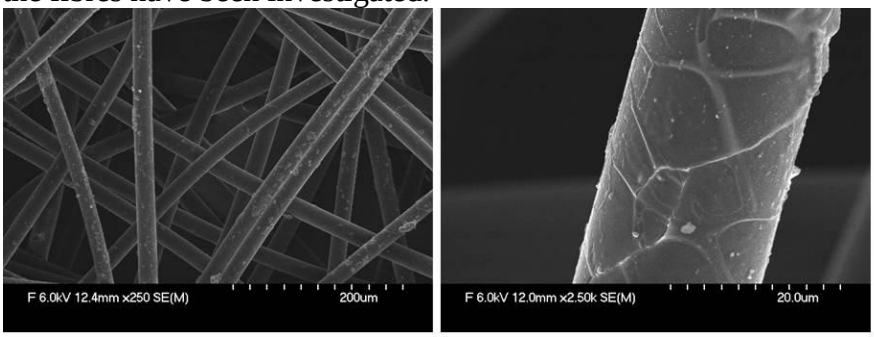

Figure 1: SEM pictures of optimized AA-grafted-PP sample.

Then, the immobilization of gentamicin (aminoglycoside antibiotic) and heparin (anticoagulation agent) has been carried out on the optimized grafted samples by either ionic interactions or covalent linkages. Their bioactivity has been investigated and related to the nature of their interactions with the substrate. For gentamicin-immobilized AA-grafted samples, an inhibition radius and a reduction of 99% of the adhesion of *Escherichia coli* have been observed when gentamicin was linked by ionic interactions, allowing the release of the antibiotic. By contrast, for heparin-immobilized AA-grafted PP samples, a strong increase of the anticoagulant effect up to 35 min has been highlighted when heparin was covalently bonded on the substrate, by contact with the blood drop. Next step consists in immobilizing in a two-step process both heparin and gentamicin on the AA-grafted PP samples to combine the antibacterial and anticoagulant properties.

References

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