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Functionalized chitosan nanofibers with enhanced antimicrobial activity for burn wound healing applications

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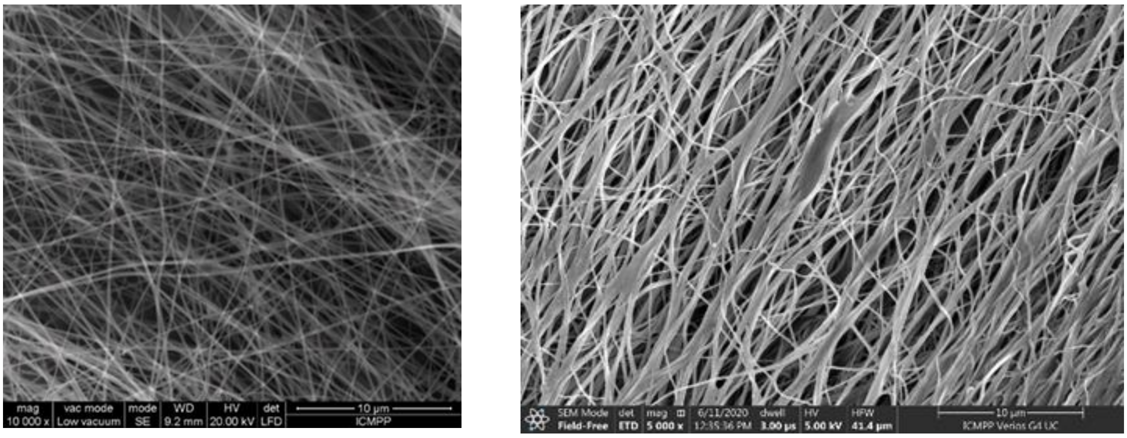
The electrospinning, a facile, ecological and efficient technique from production cost view, was applied to yield chitosan (CS) nanofibers with sub-micrometric diameter which preserved the intrinsic properties of chitosan such as biocompatibility, lack of toxicity and good therapeutics activity (anti-microbial, anti-fungus, anti-tumor, anti-viral and anti-cholesterolemic activity) with potential for a large variety of applications [1-6].

The aim of this study was to prepare chitosan-based nanofibers functionalized with 2-formylfenilboronic acid by the imination reaction in heterogenous medium, in order to obtain biodegradable, biocompatible and antimicrobial bandages for burn wound healing applications. The aldehyde has been chosen due to its antifungal and antibiofilm properties demonstrated when it was combined with chitosan [7].

The preparation of the proposed fibers was realized in 3 steps. First, CS/PEO fibers were electrospun form a blend solution of CS/PEO (weight ratio of 2/1) in 80% acetic acid using an Inovenso electrospinning apparatus with a rotary collector, when applied the following parameters: voltage equal with 7 kV, tip to collector distance 10 cm, flow rate 0.4 ml/h, collector rotation speed 800 RPM, the process being realized at room conditions. The obtained material was neutralized using an aqueous solution of 5% NaOH to remove the residual acetic acid and then it was washed with ultra-pure water to remove the PEO, in order to obtain pure chitosan nanofibers. Further, the chitosan nanofibers were reacted with 2-folmylphenylboronic acid in different conditions to obtain a series of materials with different substitution degrees. The as obtained imine functionalized fibers were morphologically characterized by scanning electron microscopy and polarized optical microscopy. The imination reaction and the substitution degree were monitored by FT-IR and ^{1}H-RMN spectroscopy. The presence of the imine units was also evidenced by thermo-gravimetrical analysis, by variation of the degradation temperature. The water adsorption capacity was investigated by dynamic vapor sorption (DVS) technique and the antimicrobial activity was screened against different bacterial and fungal strains. It was established that the substitutuion degree influence the water sorption capacity of the fibers and the antimicrobial activity, the best results being obtained against *staphylococcus aureus*, *candida albicans* and *aspergillus brasiliensis. It was* concluded that as prepared materials keep a high potential for wound healing applications.



(**a**) (**b**)

Figure 1. SEM images of: (**a**) Chitosan/PEO nanofibers (**b**) Iminoboronate chitosan nanofibers

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Acknowledgements

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