

Electrospun Chitosan Nanofibre Membranes for Antimicrobial Application: Role of Electrospinning Processing Parameters

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INTRODUCTION: Electrospinning is a straightforward and versatile technique for fabrication of nanofibres from a variety of polymer solutions.¹ Nanofibers with high surface area to volume ratio, high porosity and small fiber diameter make them ideal materials for biomedical applications such as wound dressing.² In this paper, we report investigation on the effects of governing parameters on the formation of chitosan nanofibre membranes. These membranes were subjected to various cell cultures for antibacterial properties.

METHODS: Various concentrations of chitosan-based solutions in the range of 2-5% were prepared in acidic solutions. The polymeric solutions were electrospun under various processing electrospinning parameters to form nanofibre membranes. The electrospinning setup utilized in this study consists of a Pasteur pipette, an electrically grounded metal screen. A high voltage power supply was used to produce voltages ranging from 0 - 30kV and a distance of 10 to 20 cm was maintained between the nozzle and the collector screen.

Antibacterial properties of the electrospun nanofibres was determined by subjecting the membranes into a well that has been made in the agar plate containing *E.Coli* or *S.Aureus*, and then incubated at 37°C.

The fiber diameter and structural morphology of electrospun chitosan fibers were determined using FEI Quanta 200 Scanning Electron Microscope (SEM).

RESULTS: Electrospinning of pure chitosan solutions from weak acids has been a challenge as previously mentioned by previous authors.³ Thus, the combination of weak acids and volatile solvents increased the capacity of nanofiber formation. The form of electrospun membranes was also encouraged by blending chitosan with PEO. As the chitosan concentration (PEO-chitosan) increases, the bead formation decreases.

Neither *E.Coli* nor *S.Aureus* growth was inhibited by PEO-chitosan nanofiber membranes.

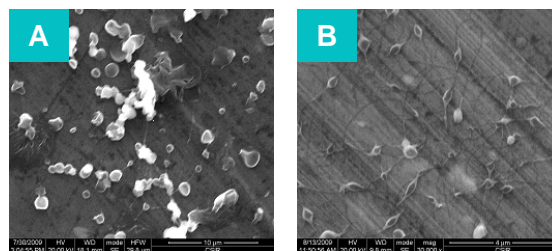


Fig. 1: SEM images showing the effect of chitosan concentration on the bead formation of electrospun nanofiber membranes: A) PEO nanofibers. B) PEO-chitosan nanofibers.

Table 1. Cell growth inhibition of electrospun nanofibers.

Nanofibres	Organism Tested	
	<i>E.Coli</i> (37°C)	<i>S.Aureus</i> (37°C)
PEO	0	0
PEO-Chitosan	0	0

DISCUSSION & CONCLUSIONS: A blended chitosan nanofibers with electrospinnable PEO polymer encourages the formation of electrospun membranes. Mixture of weak acidic solution with volatile solvent improves the capacity of electrospun nanofibers. Various concentration ratios of PEO-Chitosan nanofiber membranes exhibited no biotoxicity.

REFERENCES: ¹ D.H. Reneker and I. Chun (1996) *Nanotechnol* 7:216-23. ² S. Hirano (1999) *Polym Int* 48:732-34. ³ C.K.S. Pillai and C.P. Sharma (2009) *Trends Biomater Artif Organs* 22:175-97.