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# Surfactant and acidity effects on nanofibers based on chitosan with different molecular weight

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**Abstract** – Nanofibers are fabricated by electrospinning technique (Fig. 1). Blend solutions of chitosan and poly(ethylene oxide) (PEO) at different acidities were used to produce membranes of nanofibers with different diameters (Fig. 2). The use of surfactant to improve functionality of these nanofibers was studied. Preliminary SEM and AFM images showed the ability to electrospin chitosan solution with this additive and differences in morphology and distribution of nanofibers.

Chitosan ((1/4)-2-amino-2-deoxy-β-D-glucan) is a biopolymer resulting of partial deacetylation of chitin, the most abundant natural amino polysaccharide [1]. The development of new active nanofibers based on this biopolymer is in growth due to the promising use in biomedical and pharmaceutical applications [2]. These applications need a precise description of the aim characteristics of these nanofibers.

Electrospinning technique is a convenient and effective method to produce chitosan nanofibers. The electrospinning process can be manipulated by a number of variables. Pham et al. [3] reported that parameters that control the process are classified in terms of solution properties, controlled variables, and ambient parameters. Solution properties include the surface tension, viscosity, conductivity, polymer molecular weight, dipole moment, and dielectric constant. The effects of the solution properties can be difficult to isolate since varying one parameter can generally affect other solution properties (e.g., changing the conductivity can also change the viscosity). Controlled variables include the flow rate, electric field strength, distance between tip and collector, needle tip design, and collector composition and geometry. Ambient parameters include temperature, humidity, and air velocity [3].

In this work, the procedure was as follows. 5% w/v of two high deacetylation degree chitosans with different molecular weight (Mw= 148 kDa and 68 kDa) were dissolved in solutions with different acetic acid concentration (10, 50 and 90% v/v) and it were used in mixture with poly(ethylene oxide) (PEO). The electrospinning process conditions were adjusted to a flow rate of 0.03 ml/min, an applied voltage of 25 kV, a capillary tip-to-target distance of 20 cm. To study the influence of surfactant on the produced nanofibers, polyoxyethylene sorbitol ester (Tween 20) as surfactant with Hydrophilic Lipophylic Balance (HLB) of 17 was added. The influence of molecular weight and acidity on the morphology and physicochemical properties of nanofibers was also investigated.

Results revealed that pure chitosan dissolved in different acidities did not form fibers and was instead deposited as beads. Addition of PEO was necessary to electrospin all chitosan solutions. The solution with lowest acidity (10%) gave membranes with uniform surface. Average fiber diameters and size distribution differ with acidity and molecular weight. Composite solutions of chitosan, synthetic polymer (PEO), and micellar solutions of surfactant can be effectively electrospun. The presence of surfactant resulted in the formation of smooth or beaded fibers. This may be of considerable commercial importance since micelles could serve as carriers of components such as drugs or additives thereby further enhancing the functionality of nanofibers.

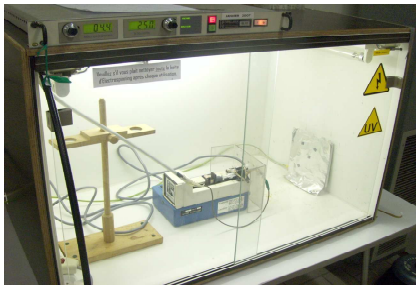

**Figure 1:** Photograph of the electrospinning technique used.

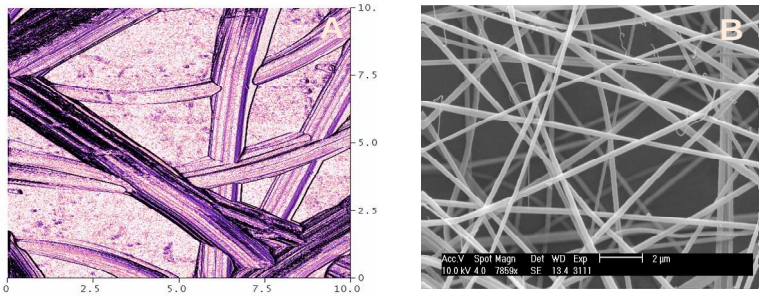


**Figure 2:** (A) AFM image of chitosan membrane (148 kDa, 10% Ac A, 10 µm) (B) SEM micrograph of chitosan membrane (68 kDa, 10% Ac A).

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