MODELING THE FUNCTIONALIZED POLYSULFONE FIBERS BY THE ELECTROSPINNING PROCESS AND CONTROL OF SOLUTIONS PARAMETERS

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Abstract

Industrial activities and increase of population worldwide have led to severe water and air contamination that result in major environmental concerns and cause adverse health effects. The development of nanostructured materials by electrospinning technique destine for use in environmental applications is considered to be of importance in the effective removal of water and air contaminants. Among those, long and continuous polymer fibers with tunable properties (e.g., high surface-to-volume ratio, high porosity and permeability), and tailored functionalities are highly promising in environmental applications (e.g., in water remediation and in air filtration processes). In this context, one of the most versatile polymeric materials is functionalized polysulfones (e.g., quaternized polysulfones, PSFQ) that have found industrial and medical applications as advanced membranes due to many useful characteristics, such as hydrophilicity, antimicrobial properties, higher permeability, and better separation. Therefore, the solutions of the functionalized polysulfone, with a tunable density of quaternary ammonium functional groups, were processed by electrospinning to create new fibrous materials that can modulate membrane properties. In the present study the relationship between processable solution properties and morphological aspects was assessed by scanning electron microscopy (SEM) technique (Figure 1). Images were conducted to visualize and compare the differences in morphology and characteristics of nanofibers attribute to the effects of the structural features of PSFQ and concentrations of the solution used in electrospinning process.

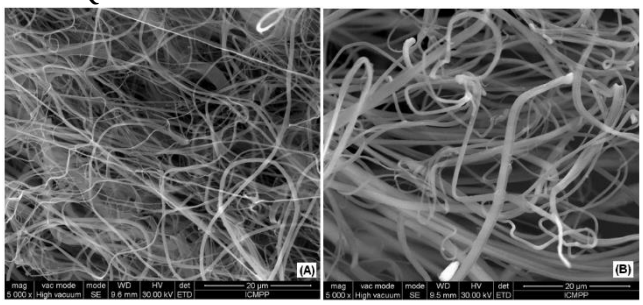

Figure 1. SEM images of PSFQ fibers obtained in N,N-dimethylformamide (DMF) at the polymer concentration of 40% (A) and 45 % (B), respectively.

The results have shown that the morphology of fibers formed with different forms and dimensions can be attributed to the combined effects of the solution parameters associated with polymer and solvent properties (concentrations, viscosity, boiling point of the solvents, and the surface tension) and also, processing parameters related with the operation of electrospinning apparatus and environmental parameters (temperature, humidity, and local atmospheric conditions). Therefore, the combining these factors assure the PSFQ fibers performance in terms of morphological and surface characteristics and implicitly, the possibility of fibrous material applicability in environmental field.

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