Influence of processing parameters on the morphology of polyaniline/poly(lactic acid) electrospun fibers described by statistical modeling

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Electrospinning is a very interesting and unique method for producing ultra thin fibers and has been successfully employed in a wide range of polymeric materials. During the process, the electrically charged jet undergoes a series of electrically induced bending instabilities, resulting in the hyper stretching of the jet, which is accompanied by a reduction of the jet diameter and a rapid solvent evaporation. The resulting fibers have a diameter that ranges from an order of a few nanometers to several micrometers. For many applications, precise diameter control during the proceeds is essential. Fiber diameter, morphology and bead formation are mainly controlled by processing parameters including flow rate, electrical field and solution properties such as viscosity and interfacial tension. In this work the investigation of the main parameters that contribute to decrease the diameter of the PAni (TSA)/PLA electrospun fibers using hexafluor-2-propanol (HFP) as the solvent were performed. The analysis emphasized especially the influence of some operational parameters, including polymer concentration, applied voltage and flow rate. In order to establish the best combination of processing parameters and polymer concentration for nanofiber formation, an experimental design was performed based on the factorial analysis approach. The electrospinning of PLA/PAni blends in HFP was successfully described with fiber diameters ranging from 50 nm to 1300 nm, which were obtained in different process conditions. A statistical model of the electrospinning process was successfully fitted under the studied conditions using a level of significance of $p < 0.10$. Empirical modeling was able to predict the experimental data with a good accuracy and also indicates that PAni concentration plays the major role in the process but, the synergies with others parameters should be considered.

Keywords: electrospinning, polyaniline, poly(lactic acid), nanofibers

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