Effect of Solution Properties and Operating Parameters on Needleless Electrospinning of Poly(Ethylene Oxide) Nanofibers Loaded with Bovine Serum Albumin

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ABSTRACT

Background: This paper presents the effect of solution properties and operating parameters of polyethylene oxide (PEO) based nanofiber using a wire electrode-based needleless electrospinning.

Methods: The feed solution was prepared using a PEO dissolved in water or a water-ethanol mixture. The PEO solution is blended with Bovine Serum Albumin protein (BSA) as a model drug to study the effect of the electrospinning process on the stability of the loaded protein. The polymer solution properties such as viscosity, surface tension, and conductivity were controlled by adjusting the solvent and salt content. The morphology and fiber size distribution of the nanofiber was analyzed using scanning electron microscopy.

Results: The results show that the issue of a beaded nanofiber can be eliminated either by increasing the solution viscosity or by the addition of salt and ethanol to the PEO-water system. The addition of salt and solvent produced a high frequency of smaller fiber diameter ranging from 100 to 150 nm. The encapsulation of BSA in PEO nanofiber was characterized by three different spectroscopy techniques (i.e. circular dichroism, Fourier transform infrared, and fluorescence) and the results showed the BSA is well encapsulated in the PEO matrix with no changes in the protein structure.

Conclusion: This work may serve as a useful guide for a drug delivery industry to process a nanofiber at a large and continuous scale with a blend of drugs in nanofiber using a wire electrode electrospinning.

KEYWORDS

Needleless electrospinning, polyethylene oxide (PEO), electrospinning parameters, drug embedding nanofibers, bovine serum albumin (BSA), poly(vinyl alcohol) (PVA)

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