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OPTIMIZATION OF ELECTROSPINNING PARAMETERS TO PRODUCE POLY (ETHYLENE OXIDE) NANOFIBERS

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Electrospinning, one of the most cost-effective nanofiber production techniques, involves converting polymeric solution into solid nanofibers by applying an electric force. The technique needs optimization of several parameters, such as solution parameters (viscosity, concentration, surface tension, conductivity, temperature, and type of the solvent), instrumental parameters (shape of collector, geometry of spinneret, solution flow rate, drum speed, tip to collector distance and applied voltage), and ambient parameters (air velocity, temperature, and humidity of the environment) to refine nanofiber morphology, diameter, and porosity. However, certain promising materials, such as chitosan and protein-based biopolymers, cannot be electrospun in their pure form. It has been found that blending these materials with poly (ethylene oxide) (PEO) increases their spinnability. Therefore, this study aimed to optimize the solution and instrumental parameters for PEO to produce uniform fine nanofibers without beads, using the electrospinning technique and to identify the most determinant factor in this process. The effect of the polymer concentration, solvent, voltage, flow rate, drum speed, temperature, and tip-to-collector distance was tested and optimized in this study. The prepared nanofibers were characterized using Scanning Electron Microscopic (SEM) images. The polymer concentration and type of solvent were the most determinant solution factors that affected the electrospinning process of PEO. Six per cent (w/w) PEO concentration and 90% (w/w) acetic acid are the best solution conditions to obtain uniform fibres without beads. The voltage and the tip-to-collector distance are the most determinant instrumental parameters. Flow rate and drum speed could easily be optimized after the optimization of polymer concentration, solvent, voltage, and tip-to-collector distance. Based on SEM data, it could be concluded that the best instrumental parameters for the formation of uniform fine fibres without beads, with an average diameter of 268.6 nm are 20 kV voltage, 20 cm tip-to-collector distance, 700 rpm drum speed, and 0.5 ml/h flow rate at room temperature.

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