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Preparation and characterization of poly(caprolactone) PCL nanofiber for filtration application

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Detection and removal of arsenic from drinking water is one of the biggest challenges before scientific community.Polymer nanofibers exhibit properties that make them a favorable material for the development of filtration devices, sensors, and high strength lightweight materials. Polymer nanofibers, an important class of nano-materials, have attracted increasing attention in recent years because of their high surface-to-mass (or volume) ratio and special characteristics attractive for advanced applications. In particular, electro-spun nanofiber membranes have high porosity, interconnected open pore structure and tailorable membrane thickness. Electrospinning is a versatile method commonly used to manufacture polymer nanofibers. Collection of electrospun nanofibers across two electrodes is a technique useful for creating nanofiber structures because it allows for the collection of individual nanofiber arrays and these arrays can be easily transferred to other substrates or structures. It is of importance to have some understanding of the capabilities of this collection method, such as the maximum length of fibers that can be collected across two parallel plates. In this work, effect of different electrospinning parameters on maximum fiber length, average fiber diameter, diameter uniformity, and fiber quality was explored for poly(caprolactone) PCL nanofibers. The nanofibrous membranes were subjected to detailed analysis for its physicochemical properties by scanning electron microscopy (SEM), thermogravimetric analysis, contact angle determination and Fourier-transform infrared spectroscopy. It was shown that relatively long polycaprolactone (PCL) nanofibers with average diameters from approximately 300 nm to 1 μm could be collected. Polymer solution concentration, electrode shapes, rotating collector drum speed and applied voltage were all shown to have varying effects on maximum fiber length, fiber diameter, and fiber uniformity. These fibers is being finetuned to develop point of use arsenic removal system for developing economies.
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