# Effects of PVA Concentration on Morphological Characteristics of Electrospun Nanofibers

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# PVA 농도에 따른 전기방사한 나노섬유의 형태학적 특성에 미치는 영향

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Abstract

Electrospinning is one of the simplest and most efficient nanotechnologies for preparing continuous fibers. Based on the following advantages of electrospun fibers: small diameter, small pore size, high porosity and good fiber uniformity, and its simple equipment and easy operation, electrospinning has been widely used in the fields of environmental protection, biomedicine, new energy, catalysis and electronic information. Polymer is the most commonly used material class for electrospinning. The spinnable materials that are commonly used for electrospinning are polyurethane (PU), polyacrylonitrile (PAN), polyvinyl acetate (PVAc), polyvinyl alcohol (PVA), polyvinylidene fluoride (PVDF) and so on. Among them, only PVA is a water-soluble polyhydroxy polymer, which is selected as the fiber precursor for filtering oil and has great application potential. In recent years, using PVA as a hot spinning material has attracted substantial attention due to its cleanliness, safety, excellent chemical resistance, and thermal stability, biodegradability, and the capability to be easily modified through its hydroxylic groups.

To observe the membrane-forming characteristics of the PVA fiber and obtain the best mixing ratio, a variety of PVA/water electrospinning solutions (8 wt%, 9 wt%, 10 wt%, 11 wt%, 12 wt%, 13wt%, 14 wt%, and 15 wt%) were prepared. The PVA fibers are arranged crosswise to each other, randomly distributed on the collected final mat and forming a non-woven network. Further, the PVA fiber surface was not smooth due to the presence of microstructures, such as linear grooves. These random crossover permutations form a large number of interconnected voids/porous structures between the fibers. The interconnected voids/porous structures are helpful for the adsorption effect because they provide more adsorption sites. In addition, it can be clearly seen that different PVA concentrations have a significant effect on the mean fiber diameters and other morphological characteristics. However, when the concentration of PVA exceeds 14 wt%, the nanofibrous structures of the PVA membranes are difficult to maintain due to their contraction, agglomeration, and adhesion between the fibers during the electrospinning process. A few spider-web-like structures are found in the 15 wt% PVA fibrous membranes. A high magnification shows that this spider-web-like fiber is grown from the main PVA nanofibers. The reason for the formation of this PVA spider-web-like structure may be related to the presence of PVA particles, because some PVA particles are not completely dissolved when excess PVA particles are added to water. In a word, although the PVA membranes could be successfully prepared when the PVA concentrations were between 8 wt% and 15 wt%, respective undesirable beaded fiber and agglomerate structures were formed when the PVA concentration was lower than 9 wt% or more than 14 wt%.

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