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The Compositional Effects on Electrospinning of Gelatin and Polyvinyl-alcohol Mixed Nanofibers

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Abstract : This study investigates a feasible range of composition for the mixture of gelatin and polyvinyl alcohol to form nanofibers by electrospinning. Gelatin, one of the most available naturally derived hydrogels of amino acids, is a popular choice for food additives, cosmetic ingredients, biomedical implants, or dressing of its non-toxic and biodegradable nature. Nevertheless, synthetic hydrogel polyvinyl alcohol has long been used as a thickening agent for adhesion purposes. Many biomedical devices are also containing polyvinyl-alcohol as a major content, such as eye drops and contact lenses. To discover appropriate compositions of gelatin and polyvinyl-alcohol for electrospun nanofibers, polymer solutions of different volumetric ratios between gelatin and polyvinyl alcohol were prepared for electrospinning. The viscosity, surface tension, pH value, and electrical conductance of polymer solutions were measured. On the nanofibers, the vibrational modes of molecular structures in nanofibers were investigated by Fourier-transform infrared spectroscopy. The morphologies and surface chemical elements of fibers were examined by the scanning electron microscope and the energy-dispersive X-ray spectroscopy. The hydrophilicity of nanofiberswas evaluated by the water contact angles on the surface of the fibers. To further test the biotoxicity of nanofibers, an in-vitro 3T3 fibroblasts culture further tested the biotoxicity of the electrospun nanofibers. Throughstatistical analyses of the experimental data, it is found that the polyvinyl-alcohol rich composition (the volumetric ratio of gelatin/polyvinyl-alcohol < 1) would be a preferable choice for the formation of nanofibers by the current setup of electrospinning. These electrospun nanofibers tend to be hydrophilic with no biotoxicity threat to the 3T3 fibroblasts.

Keywords : gelatin, polyvinyl-alcohol, nanofibers, electrospinning, spin coating
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