Preparation of Bead-On-String Alginate/Soy Protein Isolated Nanofibers via Water-Based Electrospinning and Its Application for Drug Loading

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Abstract : Electrospun natural polymers-based nanofibers are one of the most interesting materials used in tissue engineering and drug delivery applications. Bead-on-string nanofibers have gained considerable interest for sustained drug release. Vancomycin was used as the model drug and sodium alginate (SA)/soy protein isolated (SPI) as the polymer blend to fabricate the bead-on-string nanofibers by aqueous-based electrospinning. The bead-on-string SA/SPI nanofibers were successfully fabricated by the addition of poly(ethylene oxide) (PEO) as a co-blending polymer. SA-PEO with mass ratio of 70/30 showed the best spinnability with continuous nanofibers without the occurrence of beads. Bead structure formed with the addition of SPI and bead number increased with increasing SPI content. The electrospinning of 80/20 SA-PEO/SPI was obtained as a great promising bead-on-string nanofibers for drug loading, while the solution of 50/50 was not able to obtain continuous fibers. In vitro release tests showed that a more sustainable release profile up to 14 days with less initial burst release on day 1 could be obtained from the bead-on-string fibers than from smooth fibers with uniform diameter. In addition, vancomycin-loaded beaded fibers inhibited the growth of Staphylococcus aureus (S. aureus) bacteria. Therefore, the SA-PEO/SPI nanofibers showed the potential to be used as biomaterials for tissue engineering and drug delivery.

Keywords : bead-on-string fibers, electrospinning, drug delivery, tissue engineering