

Preparation and characterization of CU-, FE-, AG-, ZN- and NI- doped gelatin nanofibers for possible applications in antibacterial nanomedicine

ABSTRACT

A facile and efficient approach to prepare metal nanoparticles doped electrospun gelatin from metal salts precursors was successfully developed. The incorporation of metal ions with antimicrobial activity into electrospun gelatin (Ge-espun) is an attractive approach to control the inflammatory reaction and prevent infection in wound. In this study, metal salts precursors AgNO_3 , $\text{Fe}(\text{NO}_3)_3 \cdot 9\text{H}_2\text{O}$, $\text{Cu}(\text{NO}_3)_2 \cdot 3\text{H}_2\text{O}$, $\text{Zn}(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ and $\text{Ni}(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ were reduced to metal nanoparticles with acetic acid as solvent and reducing agent. The agglomeration of nanoparticles was inhibited by the gelatin polymer matrix. Electrospinning of both neat Ge-espun and metal-nanoparticles/Ge-espun resulted in the formation of smooth fibres with average diameters of $\sim 280\text{nm}$ and $\sim 40\text{nm}-150\text{nm}$, respectively. The efficacy of metal nanoparticles/Ge-espun against bacteria commonly found on wounds was tested with different metal loading by measuring the inhibition of colony forming units. The results indicated a broad spectrum of antibacterial activity showed by Ag/Ge-espun, followed by Fe/Ge-espun and Zn/Ge-espun. An interesting finding on the efficacy of Cu/Ge-espun and Fe/Ge-espun against the Gram \times positive bacteria is worth exploring to further investigate the potential application of metal-based antibiotics against the antibiotic-resistant bacterial strains.

Keyword: Antibacterial; Electrospinning; Electrospun; Metal-nanoparticles