Stability of lysozyme incorporated into electrospun fibrous mats for wound healing

In this study, we investigated the feasibility of incorporating protein drugs into electrospun fibrous mats (EFMs) for wound healing using lysozyme as a model drug. Lysozyme nanoparticles (Lyso-NPs) were first obtained by electrospray. Lysozyme solutions were prepared with a binary solvent mixture of ethanol (EtOH)-water (H2O) at varied volume ratios. Subsequently, Lyso-NPs were suspended in poly(lactic-co-glycolic acid) (PLGA) solutions using trifluoroethanol (TFE) as a solvent. Lyso-NPs loaded EFMs were obtained by electrospinning of the aforementioned suspensions, and the bioactivity of lysozyme in the EFMs was investigated using fluorescence-based assay kit. The electrosprayed Lyso-NPs were spherical with barely altered bioactivity as compared to the untreated raw material when using EtOH-H2O (30:70, v/v) as solvent. After the subsequent electrospinning process, more than 90% of the bioactivity of lysozyme was retained compared to the raw material. The cytotoxicity of the produced EFMs was evaluated by thiazolyl blue tetrazolium bromide (MTT) study and the proliferation and distribution of mouse fibroblast cells (L929) growing on EFMs were investigated using 4,6-diamidino-2-phenylindol dihydrochloride (DAPI) for nucleic acid staining. Nearly negligible cytotoxicity of all the EFMs was observed according to the MTT study. Furthermore, it was observed that the L929 cells grew well on the Lyso-EFMs, especially those with the modification of polyethylene glycol (PEG) that was added to improve the hydrophilicity of EFMs. This study demonstrated that the electrospray/electrospinning processes are suitable for loading biomacromolecules to produce functionalized wound dressings to promote wound healing.