00386 Sterile Scaffolds for Wound Dressings, Tissue Engineering & Regenerative Medicine

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Aims: With rising incidence of antibiotic-resistant bacterial strains, it is of paramount importance to look into alternative chemical strategies to design benign antimicrobial nanofibrous scaffolds for wound dressings and tissue engineering applications. In the present study, we designed antibiotic free antimicrobial gelatin scaffolds taking advantage of polydopamine (pDA)-metal ion interactions that conferred long-term antimicrobial properties and excellent biocompatibility.

Methodology: Electrospinning technique has been used to design the wound dressings. SEM and TEM have been used to visualize the morphology, whereas, FT-IR and XPS for the structural analysis of the samples. Contact angle studies, thermogravimetric analysis and mechanical testing have been performed to examine the water wettability, thermal stability and tensile properties of the dressings, respectively. Radial disc diffusion assay and MTS studies have been performed to evaluate the antimicrobial potential and biocompatibility of the scaffolds.

Result: SEM and TEM results show successful pDA mediated crosslinking of gelatin nanofibers which appears to be further improved in the presence of $Ag+$, $Mg2+$ and $Ca2+$ ions as supported by mechanical and thermal studies. FT-IR and XPS results confirmed the formation of pDA and the presence of metal ions in the composite nanofibers. The interaction between pDA and metal ions conferred broad-spectrum antibacterial activity for Gel_pDA_Ag, Gel_pDA_Mg and Gel_pDA_Zn mats, whereas, Gel_pDA_Ca showed an antimicrobial effect against gram-positive strains.

However, mats without pDA did not confer any antimicrobial properties. Interestingly, pDA-metal ions interactions help to retain the long-term antimicrobial activity of the mats for more than 5 weeks. In addition, the silver ion–pDA interactions also attenuated the cytotoxicity of silver ions for primary human dermal fibroblasts.

Conclusion: Overall, the results suggest the potential of pDA-metal ions interactions for designing advanced nanofibrous wound dressings and tissue engineering scaffolds that can confer antimicrobial activity for an extended period of time.