EVENT ABSTRACT

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Silk fibroin-spider silk-like protein biomaterials for preventing microbial infections

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Introduction: Microbial contamination of medical devices, such as sutures, are one of the major causes of hospital infections despite improvements in medical healthcare[1]. Thus, it is important to explore new biomaterials with antimicrobial properties in order to overcome microbial colonisation and biofilm formation. Spider silk has been considered an excellent biomaterial because of its toughness, strength and outstanding elasticity[2]. Also, through recombinant DNA technology, we can bioengineer and functionalize spider silk-based materials with antimicrobial peptides (AMP), thus evolving a new type of biomaterials[3]. Herein, the aim of this study was to develop silk-based fibers with antimicrobial properties by combining silk fibroin (SF) with recombinant spider silk proteins functionalized with AMP.

Materials and Methods: Silk-based sutures were produced by combining spider silk chimeric proteins SSP (6mer and 6mer-HNP1) with different ratios of SF extracted from Bombyx mori through wet-spinning. The structure and topography of the sutures were characterized by scanning electron microscopy (SEM) and the tensile properties and knot strength of the sutures was assessed using an INSTRON 5540 Universal Machine. The formation of biofilm on the fibers was assessed and hemolytic effects of the materials were evaluated.

Results and Discussion: Silk fibers containing spider silk 6mer or 6mer-HNP1 showed improved tensile behaviour when compared to silk fibers without SPP (Figure 1). The results suggest that the combination of spider silk chimeric proteins with SF increased the tensile stress of the fibers, when compared to those without spider silk chimeric proteins.

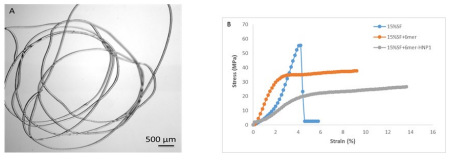

Figure 1. A- Silk based fiber with 15% silk fibroin; B- Stress-strain curves of the fibers.

No bacterial biofilm was observed on the fibers containing SSP functionalized with AMP, suggesting that the presence of the 6mer-HNP1 prevented the formation of biofilm.

Conclusions: The outcomes suggest that silk-based fibers functionalized with AMP showed better mechanical properties when compared to silk fibers alone. The data also demonstrate the positive effect of the presence of AMP in preventing biofilm formation on the fibers, suggesting that the functionalized silk fibers could be used as a new strategy to produce sutures capable of preventing microbial proliferation, while retaining useful mechanical properties. Further investigation is still need in order to understand the in vivo performance of sutures and their physical changes during wound healing.

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