ABSTRACT SUBMISSION

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Antibacterial sponge as a local drug delivery device for the treatment of diabetic foot infection – Impact of Thermal Treatment

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ABSTRACT

Foot infections are typical complications of diabetes with a high risk of amputation and mortality when bone is involved. Systemic administration of antibiotics is inadequate because of their low diffusion in the infected site. Many researches are focused on local drug delivery systems allowing efficient drug concentrations without toxic side effects. Among these systems, lyophilized hydrogels, i.e. sponges, are very interesting due to a large choice of polymers [1]. In this context, we developed a sponge for the sustained release of antibiotics based on two polysaccharides, *i.e.* chitosan (CS), a cationic polymer in acid conditions and cyclodextrin polymer (PCDs), an anionic polymer obtained by a cross linking reaction between CD and citric acid [2]. The specific objective of this work is to evaluate the impact of a thermal treatment (TT) on the properties of the sponges.

The two powders (<125µm), were co-milled in different ratio CS:PCDs (3:0 (control), 3:1, 3:3, 3:5 and 3:7 (w/v%)), then suspended in distilled water and acidified with acetic acid to obtain an hydrogel characterized by rheology. Sponges were obtained by freeze-drying (0,06 mBar, -55 °C) and a TT (140°C, 90 min) was applied. Microstructure, swelling and degradation of sponge (with and without TT) were analyzed by SEM, humid weight gain and dry mass loss respectively. Cytocompatibility was evaluated by the AlamarBlue® assay according to ISO 10993-5 with osteoblast cells (MC3T3). Finally, sponges were impregnated in a ciprofloxacin (CFX) or a rifampicin (RFP) solution to evaluate the drug release profile and the antibacterial activity.

An immediate gelation was observed with all CS:PCDs ratios but 3:1 and 3:3 were more reproducible and exhibited good viscoelastic properties. A high porous architecture of sponges was observed by SEM, favorable for biological fluid circulation and for drug sorption/release. Thermal treatment improved the stability of sponges, swelling properties and drug sorption. An important CFX sorption and a sustained CFX release was observed for ratio 3:0 with TT compared to other sponges containing PCDs, indicating a better interaction of CFX with cationic functions of CS. On the contrary rifampicin sorption and release profile were better with sponges containing PCDs suggested an inclusion complex and/or interactions with anionic groups of PCDs. No cytotoxicity was observed for all sponges (survival rate >70%) and a prolonged antibacterial activity against *Staphylococcus aureus* and *Escherichia coli* was obtained for up to 48 hours.

References:

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