Antimicrobial Silver Nanoparticles Containing Cellulose Sponge Scaffold

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Scaffold is a three-dimensional matrix used for Tissue Regeneration applicattions. Scaffolds can be simulating an extracellular matrix and regulating factors that promote conduction, differentiation, growth and tissue formation. An ideal scaffold for the tissue engineering must has adequate porosity, surface properties, good mechanical properties in order to recognize the requirements of the host tissue, thereby contributing to cell adhesion, proliferation, differentiation and extracellular matrix formation. In recent years, cellulosic based-materials have been highlighted as scaffolds due to its peculiar properties. A particular focus can be given to regenerated cellulose. Regenerated cellulose has interesting properties such as biodegradability and biocompatibility. The numerous possibilities of chemical modification of cellulose added to the control processing from the so-called viscose process make this material is a promising scaffold. An important modification can be accomplished in a traditional scaffold to improve its functions and make it more efficient, like it is to provide antimicrobial properties. Among the antimicrobial agents that can be added to the scaffold structure, silver nanoparticle is the most promising. This work involves preparation and characterization of antimicrobial scaffolds based on regenerated cellulose modified with silver nanoparticles using hydrothermal process. The cellulose sponge was provided by the company Coopercell Ind. Paper Cellophane (São Paulo, Brazil). Regenerated cellulose sponges were cut into size 1 x 1 x 0,5 cm. Then, they were rinsed in water for two weeks. After, they were used in the hydrothermal process. Regenerated cellulose sponges containing Ag nanoparticles have been characterized by different physico-chemical tests techniques. SEM results show the presence of silver nanoparticles of size 48 to 85 nm deposited over the entire surface of regenerated cellulose sponge (CR) homogeneously. The Swelling profile showed a "burst" uptake in the first five minutes for all samples, but the sample had a higher percentage of swelling was the control sample, while samples with silver particles swelled in the following order: $AgNO_3 10^{-2}$> $AgNO_3 10^{-1}$> $AgNO_3 10^{-3}$. Infrared spectra showed the presence of silver nanoparticles didn't cause structural changes in regenerated cellulose (RC). The UV-vis spectra showed that, as there is an increase in the silver concentration in the silver plasmon band shifts to longer wavelengths. Finally TG curves allowed the quantification of silver deposited on the cellulose sponge. Biological tests like cytotoxicity, mutagenicity, adhesion and cells proliferations are underway.

References

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