11º COLAOB
11º Latin American Congress of Artificial Organs and Biomaterials
17th Congress of Lantin American Society of Artificial Organs, Biomaterials, and Tissue Engineering

BIOMINERALIZED CELLULOSE ACETATE MEMBRANES WITH STRONTIUM APATITE FOR GUIDED BONE REGENERATION.

Ana Lorena de Brito Soares [1]
Fábia Karine Andrade [2]
Rodrigo Silveira Vieira [3]

ABSTRACT

Bone problems, such as congenital malformations, accidents, tumors and osteoporosis, are becoming increasingly common. The replacement of compromised limbs by implants is a widely used form of treatment, however the materials commonly used in this area present low osseointegration and great difference in the elasticity module between alloys and bone (SONI *et al.*, 2008; ZHAO *et al.*, 2019). Hybrid biomaterials, composed of an organic and an inorganic component, have proved to be strong competitors to replace traditional implants, presenting in addition to biocompatibility other properties of interest, such as biodegradability and osteoinduction. In this context, the present work describes the production of a hybrid material composed of porous membranes of biomineralized cellulose acetate (CA) with strontium apatite (SrAp) through the biomimetic method, using a modified simulated body fluid (m-SBF) solution containing ions strontium (Sr^{2+}) instead of calcium. The membranes were produced in two different immersion times (7 and 14 days) in m-SBF. The incorporation of SrAp in the membranes was evaluated quantitatively by Atomic Absorption Spectrometry (AAS) and it is possible to observe that the maximum strontium incorporation was reached in 7 days. Fourier transform infrared spectroscopy (FTIR) was used to identify changes in the chemical structure of the material resulting from the immobilization of SrAp, which was confirmed by the peaks present in the 850 and 1570 cm^{-1} ranges, which refer respectively

[1]Ph.D. student of the Chemical Engineering course at the Federal University of Ceará - UFC, lorena.soares@gpsa.ufc.br;
[2]Co-advisor: Ph.D. in Biomedical Engineering, Federal University of Ceará – UFC, fabiakarine@gmail.com;
[3]Advisor: Ph.D. in Chemical Engineering, Federal University of Ceará – UFC, rodrigo@gpsa.ufc.br.

to the elongation of the phosphate group (PO_4^{3-}) and the asymmetric elongation C=O of the carbonate group (CO_3^{2-}), both directly related to the presence of Sr^{2+} in these membranes. Scanning electron microscopy (SEM) was investigated to study the influence of SrAp biomineralization on the porosity of the analyzed membranes, showing that its morphology presents a greater organization and standardization of the pore size with the increase of days immersed in m-SBF. The cytotoxicity of the materials was studied using mouse osteoblast cells (MC3T3-E1 Subclone 14), according to ISO 10993-12 (2012), in which cell viability was measured after exposure to sample extracts (indirect method). The results showed that the cells presented high viability after exposition to both hybrid materials extracts, even at 48h of exposition. On the other hand, the cells viability decreases after 48h when exposed to AC membrane extract. The presence of SrAp decrease the membrane degradability and seems to induce the proliferation of osteoblasts, since the cell viability was over the 100% when compared to cells exposed only to culture medium. Overall, the results showed the potential of hybrid membranes based on cellulose and SrAp for bone regeneration applications.

REFERENCES

ISO 10993-12. *In*: BIOLOGICAL EVALUATION OF MEDICAL DEVICES - PART 12: SAMPLE PREPARATION AND REFERENCE MATERIALS. 2012.

SONI, Jamil Faissal *et al.* Análise comparativa em modelo computadorizado bidimensional com simulação do emprego de hastes flexíveis de aço e titânio, na fratura do fêmur da criança, utilizando o método dos elementos finitos. **Revista Brasileira de Ortopedia**, v. 43, n. 5, p. 183–192, 2008. Disponível em: https://doi.org/10.1590/S0102-36162008000400005

ZHAO, Danlei *et al.* Improvement on mechanical properties and corrosion resistance of titanium-tantalum alloys in-situ fabricated via selective laser melting. **Journal of Alloys and Compounds**, v. 804, p. 288–298, 2019. Disponível em: https://doi.org/10.1016/j.jallcom.2019.06.307