PREPARATION AND CHARACTERIZATION OF NANOHYDROXIAPATITE REINFORCED BIOPOLYMER-BASED SCAFFOLDS FOR BONE REGENERATION
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Nowadays, tissue engineering is one of the research areas of fastest growing. The materials used in this application must meet a large number of requirements, among which may be noted adequate biodegradability according to the time required for regeneration of tissue, mechanical properties for the intended application, biocompatibility (adhesion, proliferation and differentiation osteoblasts), osteoinduction and no cytotoxicity. In our group we probed that ultrasound methodology is a useful method to prepare a compatibilized blend of polyelectrolyte complexes (PEC), via creation of covalent bond that gives more stability and better properties to the result scaffold. Despite the fact that this is a promising material for cartilage tissue regeneration, the mechanical properties are not accurate for bone tissue repairing. In the present work we aim to reinforced the mechanical properties of PEC based on carboxymethyl cellulose (CMC) and chitosan (CHI) [1]. In order to improve the properties of the scaffolds, we prepared polymeric blends of CMC-CHI and add as a ceramic filler nano Hap (nano hydroxyapatite). Hap is a natural component of the bone and highly biocompatible, and has shown to improve the cell adhesion and the enhancement of the osteogenic and mechanical properties in polymeric blends [2]. This nano Hap has an average diameter of 24.5 ± 0.2 nm, and was obtained by a procedure developed in our laboratory [3], combining mechanical/ultrasonic processing. The biocomposite was prepared from 1% w/v CHI solutions in 0.25% w/v acetic acid and 1% w/v CMC; the nano HA was added at different percentages from 0 to 10%. The biocomposite samples were obtained by dropping CMC into a solution of CHI-HA under constant stirring and in the presence of ultrasound. Finally, the composites were freeze-drying until constant weight was achieved. The morphology (by scanning electron microscopy), polyelectrolyte interactions (by FTIR), swelling and mechanical properties of these composites were analyzed. In addition, we evaluate the in vitro cytotoxicity of the scaffolds using macrophage cells in culture, and evaluated Nitric Oxide production. The SEM results show a three-dimensional porous structure of the CHI-CMC-nanoHa scaffolds with a mean pore size suitable for cell proliferation. FTIR-ATR analysis showed specific interactions between the components in the biocomposite and the presence of the HA in the structure. The swelling studies and mechanical test indicate that the composite displays hydrogel properties with enhanced mechanical properties. Finally, no cytotoxicity was found for any scaffold. These results let us concluded that CMC-CHI-nanoHap composite is a promising candidate for bone regeneration.