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STUDY OF PEG-ALGINATE-LAPONITE COMPOSITE HYDROGELS AIMS 3D EXTRUSION-BASED PRINTING

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Hydrogels are cross-linked polymeric networks able to absorb and retain a large amount of water reversibly due to their hydrophilic nature, which draws attention to application on Tissue Engineering. Also, these materials offer the potential to design shear-thinning inks for three-dimensional (3D) extrusion-based printing. The addition of Laponite, a disk-shaped two-dimensional nanosilicate used as a rheology modifier, improve the rheological behavior of some hydrogels, allows suitable to be an ink. In this study, we proposed a relatively simple composition based on PEG-Alginate-Laponite composite aims 3D-printing of bone tissue engineering scaffolds. Initially, the rheological behavior of different concentrations of Laponite on the composites (5, 7.5, and 10 wt.%) was analyzed. It was found that the viscosity increased drastically with significant influence in the viscosity of PEG-400 solution (80%v/v) so that a strong shear-thinning and solid-like rheological behavior were observed, as a function of Laponite addition. Also, all composites showed time-dependence, analyzed through thixotropy tests. The rheological behavior is an important parameter to have a proper filament formation during 3D extrusion-printing. After that, the composition of 5:1 wt.% PEG-Laponite/Alginate (varying Laponite concentration) was defined as the optimal hydrogel ink. Scaffolds contained until 10-layers were obtained onto glass slides using an open-source 3D printer, at room temperature, and placed into a CaCl2 solution to promote cross-linking of Alginate chains. Subsequently, a degradation in vitro test was conducted under an immersion of the samples into phosphate buffered saline solution (PBS) at 37 °C. PEG-Alginate-10% Laponite samples showed a better printability, although the time degradation was inappropriate for bone tissue application, due to the fast dissolution of the PEG chains.