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Production and characterization of potential 3D printed bone scaffold based on modified potato and hydroxyapatite

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Bone scaffolds can provide a model for reconstructing defects, promoting cell fixation, proliferation, and generation of extracellular matrix. It can be produced by 3D printing, which allows personalization of the material and processability involving a wide range of composition possibilities. In this sense, modified starches have shown one interesting potential for this application, mainly considering its rheological properties. Among the various modification methods, dry heating treatment (DHT) is a simple, safe, and environmentally friendly method to improve starch properties [1]. Within this context, this work produced bone scaffolds based on modified potato starch by DHT added with hydroxyapatite (HA), one active compound present in the bones. HA were synthed following an adapted methodology from Nassif et al. (2019) [2]. The potato starch was modified by DHT for 1 h at 130 oC [1]. The formulations (inks) were based on hydrogels based on native (N) and modified (M) potato starch by DHT (10% w/w, d.b.) added of HA (5% w/w starch, d.b.). The scaffolds (N, M, N_HA, and M_HA) were printed using a 3D printing extrusion (BioedPrinterV4, BioEdTech - Brazil). The inks were characterized concerning rheology and printability. The printed scaffolds were characterized in relation to biodegradability (7 and 14 days), mechanical properties, and morphology (Micro-CT and SEM). The M_HA inks showed more adequate rheological properties which can be confirmed by its superior printability. The scaffolds M_HA presented higher rigidity and lower biodegradability, and the HA was well dispersed in both matrix (N or M), and it was visible that the scaffolds M and M_HA showed higher porosity than the N and N_HA. Finally, these materials showed great potential as bone scaffolds.

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