SANTOS

XXII B-MRS Meeting 2024

September 29th to October 3rd

PROCEEDINGS

Sociedade Brasileira de Pesquisa em Materiais

Proceedings of the XXII B-MRS Meeting

Santos, SP 2024

Conteúdo, revisão textual e gramatical: Resposanbilidade dos respectivos autores.

ISBN: 978-85-63273-63-5

Innovations in Cassava Starch Processing: Dual Thermal Modification for Enhanced 3D Printing Capabilities and Potential in Bone Scaffold Fabrication

Samile Bezerra de Aguiar[1], Renan Nascimento Araújo[2], Bianca Chieregato Maniglia[1]

[1]Instituto de Química de São Carlos - Universidade de São Paulo (*Físico-química*) ,
[2]Universidade de São Paulo (*Instituto de Química de São Carlos*)

e-mail: samile@usp.br

The 3D printing process can be applied to develop precisely shaped biomaterials such as bone tissue regeneration. Starch as raw material, for example, can be used in tissue engineering to mimic bone tissue, facilitating osteoinductive cell growth. However, native starch hydrogels have limitations in terms of their mechanical and functional properties [1]. Intending to overcome these deficiencies, thermal modifications (dry heating treatment – DHT, and heat moist treatment – HMT) were applied, combined in different orders, for modifying cassava starch. The native starch was modified through DHMT and HMDT, with DHT step at 130 °C for 4 h, and the heat moist step conducted with adjusted moisture (27%) at 100 °C for 4 h. The modified starches were characterized by FTIR spectroscopy, and the granules morphology was analyzed by SEM. The starch hydrogels (inks) were prepared by the gelatinization of 10 % (w/w, d.b.) of starch at 85 °C for 30 min, and then stored (24 h, 4 °C). The viscosity of starch hydrogels was characterized by RVA, firmness by penetration assay using a texturometer (TA.XT Plus Instruments), and printability by image analysis of the printed samples using Image J software. Scaffolds based on these hydrogels were printed (BioedPrinterV4, BioEdTech - Brazil), freeze-dried, and characterized by XRD. Their mechanical properties were evaluated by compression tests, and the morphology and porosity by SEM. In general, the dual modifications (DHMT and HMDT) promoted oxidation and fractures in the granules, resulting in firmer hydrogels and porous materials. Finally, the combined methodology improved hydrogel printability and the final properties of the starch-based scaffolds, enhancing the potential of these source to be used in the production of bone scaffolds by 3D printing.

Acknowledgements:
FAPESP (2020/08727-0) and CAPES.

References:

[1] B. C. Maniglia; D. C. Lima; et al. Food Research International vol. 128, 2020.