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From food source to functional biomaterials: 3D printing of potato starch-based hydrogels activated with HNADES-annatto seed extract

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Starch-based hydrogels is able to form biocompatible three-dimensional structures with potential to be applied from food to biomedical sectors. 3D printing can be used to produce these materials in a customized way [1]. The functionalization can be further improved by adding active compounds, such as annatto (*Bixa orellana* L.) seed extract, rich in carotenoids. Also, Natural Deep Eutectic Solvent (NADES) are eco-friendly solvents with low toxicity and tunable polarity, offering superior extraction of active compounds [3]. In this sense, this study evaluated the effects of potato starch and hydrophobic NADES (HNADES)-annatto seed extract (HNE) concentrations on starch-based hydrogels for 3D printing bone scaffolds and gummies for dysphagic individuals. The starch-based hydrogels were produced with different concentrations of potato starch (8, 10, and 12 g/100 g, d.b.) [1] and annatto seed extract (4 and 8 g/100 g potato starch) obtained with C12:C8 (1:3) [2], a HNADES. The HNE was characterized by pH, polarity, viscosity, density, active compounds, and antioxidant activity. The starch-based hydrogels were analyzed for rheological behavior, firmness, and printability. The printed bone scaffolds were analyzed for mechanical properties, swelling, biodegradability, and antioxidant activity. The printed gummies were analyzed for texture, color, and antioxidant activity. The addition of the HNE provided uniform color and improved the geometric fidelity of the starch-based hydrogels, but reduced firmness, mainly in the lowest concentrations of potato starch. Biomaterial: as the HNE content increased, there was a reduction of firmness and biodegradability, and increased swelling and the antioxidant activity. Food: as the HNE content improved texture for people with dysphagia, attractiveness, and conferred higher active properties. Finally, HNADES-annatto seed extract shows potential to functionalize starch-based hydrogels for 3D printing applications.

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References
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