

## **Chitosan/alginate hydrogels containing phenolic-enriched extracts from saffron (*Crocus sativus* L.) flowers using Natural Deep Eutectic Solvents (NaDES) as green extraction media**

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The current saffron production system is generating several hundreds of tons of tepal waste, since in order to obtain the spice only stigmas are used. Consequently, the valorization of saffron floral by-products by developing stable functional ingredients could lead to the environmental impact minimization. Thus, the main aim of this research was to evaluate the implementation and optimization of innovative green extraction processes from saffron floral by-products by using Natural Deep Eutectic Solvents (NaDES) and ultrasound-assisted extraction (UAE), to provide new information of an efficient environmental-friendly process which could be scaled up at an industrial level. Response surface methodology was used to optimize process parameters (Box-Behnken Experimental Design). To improve the stability of the optimal extracts, they were incorporated into chitosan/alginate hydrogels, studying their swelling behavior and water retention capacity and the total phenolic content (TPC) during the in vitro digestion. The results indicated that the optimal conditions for the extraction of bioactive compounds, at laboratory scale, were the employment of the NaDES Pro/Gly (1:2) at a NaDES/water ratio 90:10, 20 min extraction time and 180 W ultrasound irradiation. The results of the DPPH assay revealed the potent antioxidant activity of saffron floral by-products. The chitosan/alginate hydrogels incorporating the as-obtained NaDES extracts showed favorable properties whereas the TPC remained stable under intestinal conditions. Therefore, NaDES combined with UAE was an efficient technique to obtain high added-value compounds from saffron flowers, succeeding also the valorization of discarded waste by using green and low-cost strategies, contributing to the improvement of the sustainability of the saffron spice production and profitability of this industrial sector. Furthermore, these novel hydrogels showed favorable properties and were suitable matrices to incorporate bioactive extracts which may be used as promising candidates for various applications like food or cosmetic, among others.