Área: ORG

Release of polyphenols from açaí seeds (*Euterpe oleracea*) incorporated in silicate hydrogels

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Highlights

Açaí seed hydrogels enable controlled polyphenol release; The release kinetics follow Michaelis-Menten function; Higher extract concentrations (25-50%) yield sustained antioxidant activity.

Abstract

Hydrogels, porous polymeric structures that mimic the extracellular matrix (1), were integrated with bioactive compounds extracted from açaí seeds (*Euterpe oleracea*), an agroindustrial residue (2). This combination represents a sustainable strategy for developing functional biomaterials with potential biotechnological applications in the future. The study investigated the release of polyphenols from açaí seeds incorporated into silicate hydrogels in Milli-Q water.The release of polyphenols from açaí seed hydrogels was concentration-dependent, with a proportional increase in the amount released according to the extract content. The 50% açaí formulation showed the highest release (575.69 µg), followed by 25% (206.4 µg), 10% (39.57 µg), and 5% (9.34 µg) formulations. The kinetics followed the Michaelis-Menten model, with maximal release (R_{max}) ranging from 9.34 µg (5%) to 598.0 µg (50%). The time required to release Rmax/2 (T_{50} increased from 8.32×10^{-17} h (5%) to 1.290 h (50%), indicating a transition from superficial release to matrix-controlled diffusion. Significant linear correlations between concentration-R_{max} (R^2=0.99) and concentration-T_{50} (R^2=0.96) confirmed the predictability of the release system according to the extract concentration. The antioxidant activity varied significantly among the formulations. The 50% açaí formulation maintained high activity (417.76-460.10 µM of Trolox equivalents (TEQ)/g) for 24 h. The 25% formulation reached its maximum peak (462.76 µM TEQ/g) at 12 h. The 10% and 5% formulations showed marked decay, reaching 137.00 and 70.67 µM TEQ/g at 96 h, respectively. The fit to the biphasic model was excellent for 10% (R^2=0.97) and 5% (R^2=0.96), and moderate-low for 25% (R^2=0.73) and 50% (R^2=0.61). The results demonstrated that hydrogels loaded with açaí seed extracts showed a time-controlled release of polyphenols. The amount of polyphenols released and their antioxidant activity were directly related to the initial concentration of the açaí extract in the hydrogel. Further studies will consider the in vivo antioxidant response in worms (*Caenorhabidtis elegans*) exposed to hydrogel-loaded açaí polyphenols.

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