10th Brazilian Conference on Natural Products
XXXVI RESEM
4-7 November 2025, Belo Horizonte, MG, Brazil

Section: 02

NADES AS A SUSTAINABLE ALTERNATIVE FOR ANTHOCYANIN EXTRACTION FROM AÇAÍ (*EUTERPE OLERACEA* MART.)

Rafael Pignoli Alvares[1], Gabriela Cremasco[1], Mirella Thaisa Ferreira Ranzeti[2],* ***Daniel Rinaldo[1,2]***

daniel.rinaldo@unesp.br

1-Green Biotech Network, School of Sciences (FC-UNESP - Bauru); 2-Institute of Chemistry (IQ-UNESP - Araraquara)

Brazil is the world's leading producer of açaí (*Euterpe oleracea* Mart..), with approximately 93% of its annual production of 1.7 million tons concentrated in the state of Pará. Rich in anthocyanins and other antioxidant compounds, açaí has gained prominence in the food, cosmetic, and pharmaceutical industries. However, the large-scale extraction of these compounds using conventional methods can generate substantial volumes of toxic waste, increase treatment costs, and lead to environmental impacts. As an alternative, nine Natural Deep Eutectic Solvents (NADES) were prepared and used as extraction media, applying a miniaturized Microwave-Assisted Extraction (MAE) technique. HPLC-DAD analyzed the extracts obtained, and extraction efficiency was evaluated based on the total integrated area of the chromatographic bands corresponding to anthocyanins. The larger the area, the higher the extraction efficiency. The most promising NADES (lactic acid: glycerol, 1:1 mol/mol) was optimized using a Central Composite Design (CCD), considering three independent variables: plant/solvent ratio (mass/mass), temperature (°C), and extraction time (min). Extractions were performed using an advanced microwave system (Ethos Easy), with the plant/solvent ratio being the only variable with a significant effect. The optimal conditions were a ratio of 1:25 (mass/mass), a temperature of 40 °C, and an extraction time of 65 min. The method was compared to two conventional ultrasound-assisted extraction (UAE) procedures: the first using 80% (v/v) methanol, ratio 1:5 (m/v), 45 °C, 25 min; the second using 75% (v/v) ethanol, ratio 1:7 (m/v), 40 °C, 50 min. The Analytical GREEnness (AGREE) metric was used to assess the environmental performance of all methods. Results showed that the lactic acid:glycerol-based NADES achieved the highest extraction efficiency (1.4 times greater than the most efficient conventional solvent) and the best environmental profile. It is concluded that the combination of lactic acid: glycerol NADES (1:1 mol/mol) with MAE constitutes an effective and sustainable strategy for extracting anthocyanins from açaí, promoting the valorization of plant by-products based on Green Chemistry principles and the United Nations Sustainable Development Goals. The authors gratefully acknowledge financial support from the CNPq, grant #303887/2024-9, and the FAPESP, grant # 2025/03036-3, Brazil.

Keywords: *Experimental Design, Green Extraction, Microwave-Assisted Extraction.*