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ENHANCED RECOVERY OF FLAVONOIDS FROM SUGARCANE BAGASSE USING GREEN EXTRACTION WITH NADES: ANTIOXIDANT BIOACTIVITY IN *DROSOPHILA MELANOGASTER*

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Sugarcane is the second-largest agricultural crop worldwide, with Brazil as its principal producer. Despite its significance to the sugar–energy industry, this production chain generates large volumes of solid residues, such as bagasse (250–280 kg per ton). The utilization of this byproduct remains limited, although it is a rich source of flavonoids with well-recognized antioxidant activity. Conventional extraction of these compounds employs toxic solvents, such as methanol, which restricts their application in biological systems and contravenes the principles of green chemistry and the Sustainable Development Goals. In this context, Natural Deep Eutectic Solvents (NADES) have emerged as sustainable, biodegradable, and safe alternatives for the valorization of agroindustrial residues. Ten NADES systems were evaluated for the extraction of flavonoids from sugarcane bagasse using Microwave-Assisted Extraction (MAE) at 50 ºC and 60 min, a miniaturized and efficient technique. Extraction yields were evaluated and compared with those obtained using methanol by HPLC-DAD. The bioactivity of the extracts was assessed using *Drosophila melanogaster in vivo* model, through survival and locomotor performance assays, parameters associated with the antioxidant response. Among the ten NADES tested, nine demonstrated higher extraction efficiency than methanol, with the choline chloride: lactic acid (CL:LA) (1:1 mol/mol) system proving most promising. In biological assays, the extract obtained with this NADES led to an increased lifespan and enhanced locomotor performance in the flies, whereas the methanolic extract significantly diminished these parameters. The combination of NADES and MAE was effective for the recovery of flavonoids from sugarcane bagasse, yielding superior results compared to methanol both in terms of extraction efficiency and biological activity. . These findings underscore the viability of this approach as a sustainable strategy for valorizing agroindustrial residues, in alignment with global targets for responsible consumption and production. The authors acknowledge financial support from the CNPq, grant #303887/2024-9, and the FAPESP, grant #2025/03036-3 and #2025/14225-1, Brazil.

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