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ANALYSIS OF HIGH VALUE-ADDED POLYPHENOLS SUBSTANCES PRESENT IN BANANA BIOMASS RESIDUES USING DESIGN OF EXPERIMENTS (DoE) ALLY WITH MACROPOROUS POLYMERIC RESINS (MPR)

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The valorization of residual biomass into high-value products represents a sustainable approach to improving the manufacturing process of agricultural systems. Banana peels are rich in flavonoids and phenolics with recognized anti-inflammatory and antioxidant activities, which are increasingly being explored for applications in food supplements, pharmaceuticals, and cosmetics. Epigallocatechin gallate (EGCG) is a bioactive flavonoid that holds substantial market value in these applications. The application of macroporous polymeric resins (MPR) and Design of Experiments (DoE) are methods utilized as a substitute for purification and recovery procedures of bioactive chemicals, mostly for the extraction of compounds like polyphenols. Obtaining concentrated extracts with flavonoids and phenolics from large-scale biomass waste is a sustainable and viable approach. The purpose of this work is to extract high added-value flavonoids, such epigallocatechin gallate, from banana peels selectively using macroporous polymeric resins. Four different resin types were tested: XAD-2, XAD-4, XAD-7, and XAD-16. To perform the extractions, *Chemoface* software was used to organize experimental designs. Initially, a 2^2 full factorial design was applied to select the best macroporous polymeric resin. Subsequently, a 2^3 design with two central points was used to optimize the extraction of epigallocatechin gallate using the previously selected resin. The particle size was fixed at 1.20 cm in both experiments (> 1/2 mesh). In the 2^2 design, the studied variables were: crude extract/dry resin ratio (1:2; 1:4; 1:10) and agitation speed in the shaker (100–200 rpm). In planning 2^3, the following parameters were investigated: extraction temperature (30–50 °C), extraction time (1–3 h) and ethanol concentration in the desorption solvent (60–80%).The use of full factorial design combined with resins Amberlite XAD-7 line allows the optimization extraction of high-value flavonoids, such as epigallocatechin gallate, from banana peels.

Keywords: *sustainable extraction, design of experiments, epigallocatechin gallate, enzymatic tests*