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EVALUATION OF DEEP EUTECTIC SOLVENTS FOR ENHANCED POLYPHENOL EXTRACTION AND ANTIBACTERIAL ACTIVITY OF *Hypericum androsaemum* EXTRACTS

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This study investigated the application of deep eutectic solvents (DESs) for extracting polyphenols from *Hypericum androsaemum*, a plant valued for its culinary, cosmetic, and pharmacological potential, particularly for its hepatoprotective, anti-inflammatory, and diuretic properties. The research explored a green approach using various DESs based on betaine and lactic acid, including betaine/ethylene glycol (Bet/Eg), betaine/glycerol (Bet/Gly), lactic acid/menthol (La/Men), lactic acid/proline (La/Pro), lactic acid/glucose (La/Glu), and lactic acid-betaine (La/Bet). These DESs were employed in ultrasonic extraction at varying temperatures (30, 45, and 60°C) and extraction times (30 and 60 minutes), with conventional solvents ethanol and water used as control. The extracted polyphenols were analyzed using HPLC and assessed for antibacterial activity against both Gram-negative and Gram-positive bacteria, including *Escherichia coli*, *Pseudomonas aeruginosa*, *Bacillus subtilis*, and *Staphylococcus aureus*. Chlorogenic acid was the most abundant compound, with concentrations ranging from 16.90 to 796.99 µg/mL, peaking in the La/Glu extract obtained at 60°C for 60 minutes and in the Bet/Eg extract obtained at 60°C for 30 minutes (767.84 µg/mL). Other identified compounds included hyperoside, quercetin, quercitrin, and isoquercitrin. The Bet/Eg system at 60°C for 30 minutes was particularly effective in extracting hyperoside, quercitrin, and isoquercitrin, while the La/Glu extract at 60°C for 60 minutes favored quercetin recovery. Although water demonstrated similar efficiency to the most effective DESs for extracting chlorogenic acid, its efficiency for other polyphenols was significantly lower. In terms of antibacterial activity of selected extracts, water extracts showed the weakest activity despite high chlorogenic acid content, with minimum inhibitory concentrations (MICs) of 12.500-25.000 mg/mL. The La/Glu extracts exhibited more pronounced antibacterial activity, particularly against Gram-positive bacteria (MICs of 0.391 and 0.781 mg/mL for Gram-positive and Gram-negative bacteria, respectively). The most potent antibacterial activity was observed in the Bet/Eg extracts at 60°C for 60 minutes, with MICs of 0.195 mg/mL against B. subtilis and S. aureus and 0.012 mg/mL against E. *coli* and P. *aeruginosa*. This study highlights the effectiveness of DESs in enhancing the extraction of bioactive compounds from H. *androsaemum*, presenting a promising green alternative for obtaining extracts rich in high-value polyphenols with significant antibacterial properties. These findings have potential applications in the food, pharmaceutical, and cosmetic industries.

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