

1.ABSTRACT:

The growing global interest in plant-based therapeutics has led to advancements in extraction technologies for isolating bioactive phytoconstituents from medicinal plants. *Calotropis gigantea*, a widely used medicinal plant, contains a variety of secondary metabolites such as flavonoids, phenolics, tannins, alkaloids, saponins, and glycosides, all of which contribute to disease prevention and health promotion. However, conventional extraction methods like maceration, percolation, and Soxhlet extraction often involve prolonged processing times, high solvent and energy consumption, and potential degradation of heat-sensitive compounds.

This study evaluates the effectiveness of Ultrasound-Assisted Extraction (UAE) in enhancing the yield and quality of phytoconstituents from *Calotropis gigantea* leaves. UAE uses high-frequency ultrasonic waves to create cavitation, which disrupts plant cell walls, improves solvent penetration, and promotes efficient release of intracellular compounds. The primary objective was to optimize UAE parameters and compare the results with conventional extraction techniques in terms of yield, efficiency, and phytoconstituent quality.

Phytochemical analysis, including UV-Visible spectrophotometry, was performed for both qualitative and quantitative assessment of total phenolic and flavonoid content, along with antioxidant activity across different extract batches. The results demonstrated that UAE significantly increased the yield of phenolics and flavonoids compared to traditional methods, while preserving thermolabile compounds due to its non-thermal nature. Among the solvent systems tested, Methanol and hydroalcoholic mixtures proved most effective, underscoring the importance of solvent polarity in extraction efficiency.

In addition to improved extraction yield, UAE extracts showed enhanced antioxidant activities. Although the initial investment in ultrasonic equipment is relatively high, UAE offers long-term benefits including reduced processing time, lower solvent consumption, and superior extract quality.