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UTILIZATION OF ULTRASONIC-ASSISTED EXTRACTION FOR BIOACTIVE COMPOUNDS FROM FLORAL SOURCES

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INTRODUCTION

Bioactive compounds from floral sources have diverse applications in pharmaceuticals, cosmetics, and food industries due to their antioxidant, antimicrobial, and anti-inflammatory properties. Ultrasonic-Assisted Extraction (UAE) has emerged as a promising, green technology that enhances the efficiency of extracting these valuable compounds from plants. UAE offers a rapid, cost-effective, and environmentally friendly alternative to conventional extraction methods.

Figure 1. UAE extraction bath

OBJECTIVE

Evaluate the effcetiveness of Ultrasound assisted extraction (UAE) for obtaining bioactive compounds from floral sources, emphasizing its potential application in the pharmaceutical and food industries

ULTRASOUND-ASSISTED EXTRACTION (UAE)

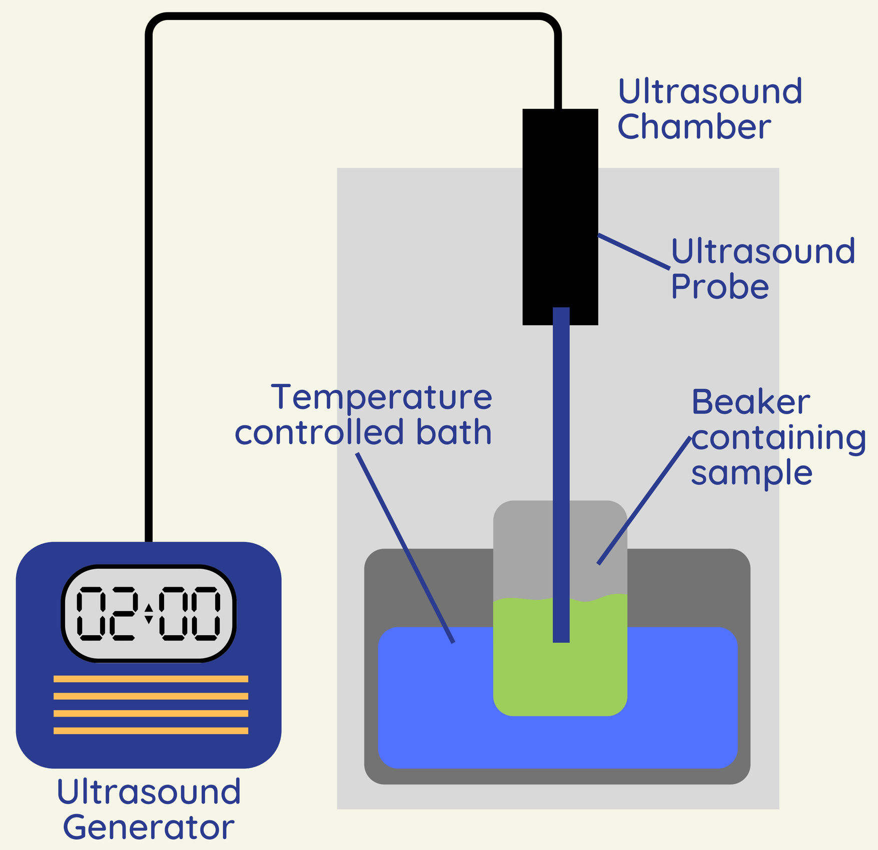


Figure 2. Example of an Ultrasound-Assisted Sample Processing Setup with Temperature Control

How does UAE work?

- High-frequency sound waves (ultrasound) to create microscopic bubbles in a liquid medium (Cavitation)
- When the bubbles collapse, they generate intense localized pressure and temperature, disrupting the cell walls of plant materials.
- This disruption increases the permeability of the cell membranes, facilitating the release of bioactive compounds into the surrounding solvent.

UAE enhances mass transfer, speeds up the extraction process, and requires less solvent and energy compared to traditional extraction methods, making it an efficient and eco-friendly technique.

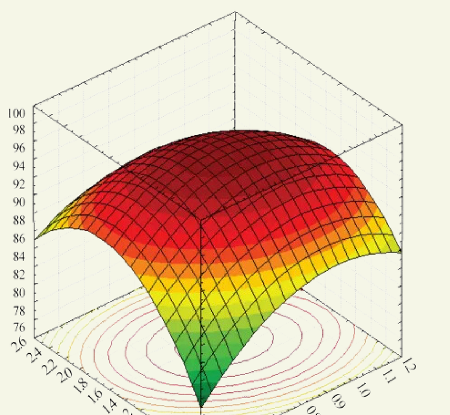
Flower	Results	UAE parameters	Ref.
Acca sellowiana Burret	18.36-25.33 β g/g of isoquercitrin and quercetin	Amplitude: 29.15%; Liquid-solid ratio: 23.65 mL/g; Solvent concentration: 63.45% (Butylene glycol)	[1]
Camellia sinensis	291.47 ± 3.34 mg of Quercetin/g; 65.37 ± 1.78 mg TAE/g; 163.58 ± 2.76 mg TEAC/g	Temperature: 70°C; Time: 30 minutes; Solvent: 40% or 60% EtOH/H2O	[2]
Magnolia × soulangeana	35.42-65.73 mg GAE/g; DPPH inhibition: 94.29%; Quercetin, rutoside, protocatechuic and lignans found	Ethanol concentration: 66.8% (V/V); duration: 55.2 minutes; Liquid-solid ratio: 46.8 mL/g; Temperature: 75°C	[3]
Verbascum thapsus L.	Extracted Polysaccharides, including mucilaginous materials; DPPH inhibition: 67.66%.	Temperature: 67.52°C; Time: 60 minutes; Ultrasound Power: 371.03 W; Liquid-solid ratio: 40 v/w (volume/weight)	[4]
Feijoa sellowiana Berg.	Crude extraction yield (CEY): 53.22 mg/g; DPPH inihibition 78.43%; Gallic acid: 123.15 mg/g	Ultrasonic intensity: 1569.10 W/cm²; Duty cycle: 89.00%; Extraction temperature: 46.00°C	[5]

Table 1. Experiments on extraction of bioactives from flowers using ultrasound-assisted extraction

[1] Gil, K. et al.(2023). Comparison of Different Green Extraction Techniques Used for the Extraction of Targeted Flavonoids from Edible Feijoa (Acca sellowiana (O.Berg) Burret) Flowers.
[2] Myo, H., et al. (2023). Butylene Glycol Used as a Sustainable Solvent for Extracting Bioactive Compounds from Camellia sinensis Flowers with Ultrasound-Assisted Extraction. ACS Omega, 8, 4976 - 4987.
[3] Zgórka, G. et al (2023). Response Surface Methodology in Optimising the Extraction of Polyphenolic Antioxidants from Flower Buds of Magnolia × soulangeana Soul.-Bod. var. 'Lennei' and Their Detailed Qualitative and Quantitative Profiling. Molecules, 28.
[4] Babamoradi, N.et al, (2018). Optimization of ultrasound-assisted extraction of functional polysaccharides from common mullein (Verbascum thapsus L.) flowers. Journal of Food Process Engineering.
[5] Poodi, Y., et al. (2018). Intensification of bioactive compounds extraction from Feijoa (Feijoa sellowiana Berg.) leaves using ultrasonic waves. Food and Bioproducts Processing, 108, 37-50.

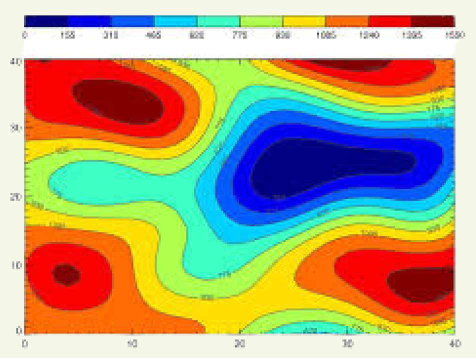
OPTIMIZATION OF UAE

Response surface plots



A 3D plot that represents the relationship between two independent variables (e.g., ultrasonic intensity, temperature) and the dependent variable (e.g., yield of bioactives). These plots can help identify the optimal conditions for UAE by showing where the maximum or minimum value occurs in the response surface.

Contour plots



A 2D plot with contour lines that represent levels of the response variable (e.g., bioactive yield). This is helpful for visualizing the effects of two variables on a third (the response) and identifying optimal regions.

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BIOACTIVES IN FLOWERS

Phenolic Compounds and Antioxidant Activity

Edible flowers are rich in phenolic compounds, which contribute to their antioxidant properties. Flowers like Rosa damascena, Calendula officinalis, and Centaurea cyanus have shown significant phenolic content and antioxidant potential

Flavonoids and Carotenoids

Flavonoids such as quercetin, kaempferol, and myricetin are prevalent in many edible flowers, contributing to their antioxidant and anti-inflammatory properties. For instance, Rosa 'Sun City' petals, marigolds and daisies are rich in flavonols and carotenoids

Vitamins and Other Bioactive Compounds

Edible flowers also contain significant amounts of vitamins, particularly vitamin C, which further enhances their antioxidant capacity. Primula veris, for example, has a high vitamin C content

Antimicrobial and Antiproliferative Properties

Certain flowers also possess antiproliferative properties, which can be beneficial in cancer prevention and treatment. Dahlia and rose extracts have demonstrated such effects in specific cell lines

Hypoglycemic and Anti-aging Effects

Edible flowers like Malva sylvestris and Sambucus nigra have shown hypoglycemic effects by inhibiting enzymes like α-amylase and α-glucosidase, which are involved in carbohydrate digestion. Anti-aging properties have been observed in flowers with high isoprenoid content, which can inhibit enzymes like acetylcholinesterase, potentially benefiting cognitive health

[1] Pires, T.et al. (2018). Edible flowers as sources of phenolic compounds with bioactive potential.. Food research international, 105, 580-588 .
[2] Demasi, s. et al. (2021). Exploring wild edible flowers as a source of bioactive compounds: New perspectives in horticulture. Folia
[3] Kozicka, M., & Hallmann, E. (2023). Identification and Quantification of Bioactive Compounds in Organic and Conventional Edible Pansy Flowers (Viola × wittrockiana) and Their Antioxidant Activity. Plants, 12.
[4] Albien, A., & Stark, T. (2023). (Bio)active Compounds in Daisy Flower (Bellis perennis). Molecules, 28.
[5] Coyago-Cruz, E., et al. (2023). Exploring Plants with Flowers: From Therapeutic Nutritional Benefits to Innovative Sustainable
[6] Loizzo, M. et al. (2016). Edible Flowers: A Rich Source of Phytochemicals with Antioxidant and Hypoglycemic Properties.. Journal of agricultural and food chemistry, 64 12, 2467-74
[7] Nowicka, P., & Wojdyło, A. (2019). Anti-Hyperglycemic and Anticholinergic Effects of Natural Antioxidant Contents in Edible Flowers. Antioxidants, 8.
[8] Wan, H. et al.(2018). Flavonols and Carotenoids in Yellow Petals of Rose Cultivar (Rosa 'Sun City'): A Possible Rich Source of Bioactive Compounds.. Journal of agricultural and food chemistry, 66 16, 4171-4181 .