

# Betaine-based Solvents for a Green Polyphenols Extraction from Date Seeds



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## Introduction

Date seeds (*Phoenix dactylifera* L.) are a rich source of polyphenols, offering potential for revalorizing this food waste. Conventional extraction methods often utilize synthetic solvents, raising health and environmental concerns. Natural Deep Eutectic Solvents (NADES), as natural and biodegradable solvents, provide a safer and more efficient alternative to synthetic solvents, promoting sustainable extraction processes.

## Objectives

- Investigate the efficacy of betaine-based NADES and ethanol-water in extracting polyphenols from date seeds.
- Compare conventional (heating and stirring, HS) and non-conventional (ultrasound-assisted, probe-type and bath, UAEp and UAEb, respectively) extraction methods.

## Material and methods

### 1. Preparation of solvents

#### Solvent Mixtures

Prepare five NADES in specific molar ratios

Betain:Malic Acid (Bet:MA, 1:1)

Betaine:Urea (Bet:U, 1:2)

Betaine:Ascorbic Acid (Bet:AA, 1:1)

Betaine:Glucose (BetGlu, 1:1)

Betaine:Glycerol:Glucose (Bet:Gly:Glu, 4:20:1)

**Control Solvent** Ethanol 50% (EtOH 50%) solution

Figure 1 : NADES solvents and control solvent

### 2. Extraction of dates seeds

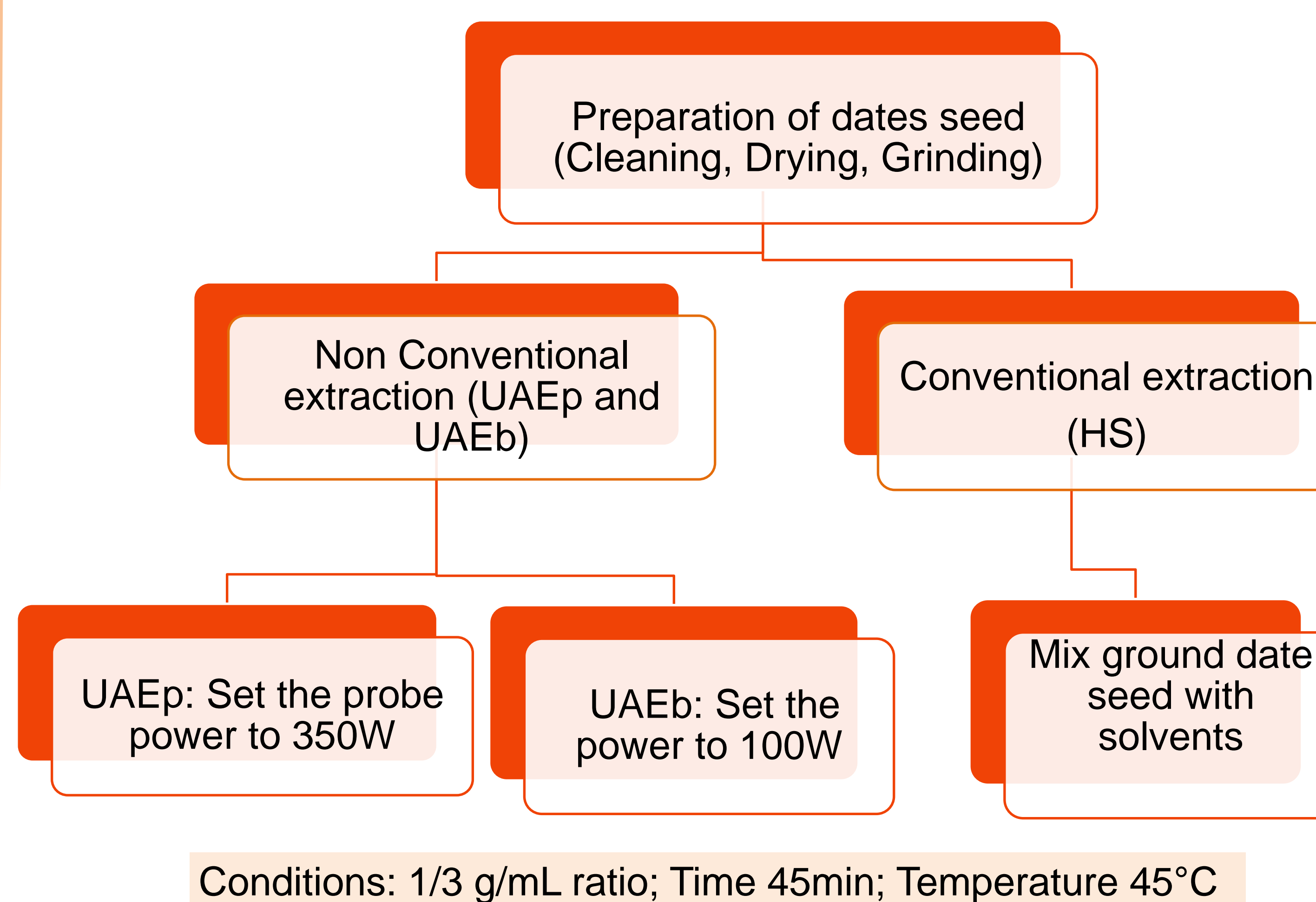


Figure 2 : Diagram of extraction of dates seeds

### 3. Total Phenolic Content (TPC) Analysis

Mix the extract with the Folin-Ciocalteu reagent and sodium carbonate, and incubation for 60 min

Measure the absorbance at 765 nm using spectrophotometer (Wallac 1420 Victor multilabel counter)

Calculation by expressing the results as milligrams of Galic Acid Equivalents (GAE) per 100 grams of date seed powder

Figure 3 : Diagram of Total Phenolic Content (TPC) Analysis

## Results & Discussion

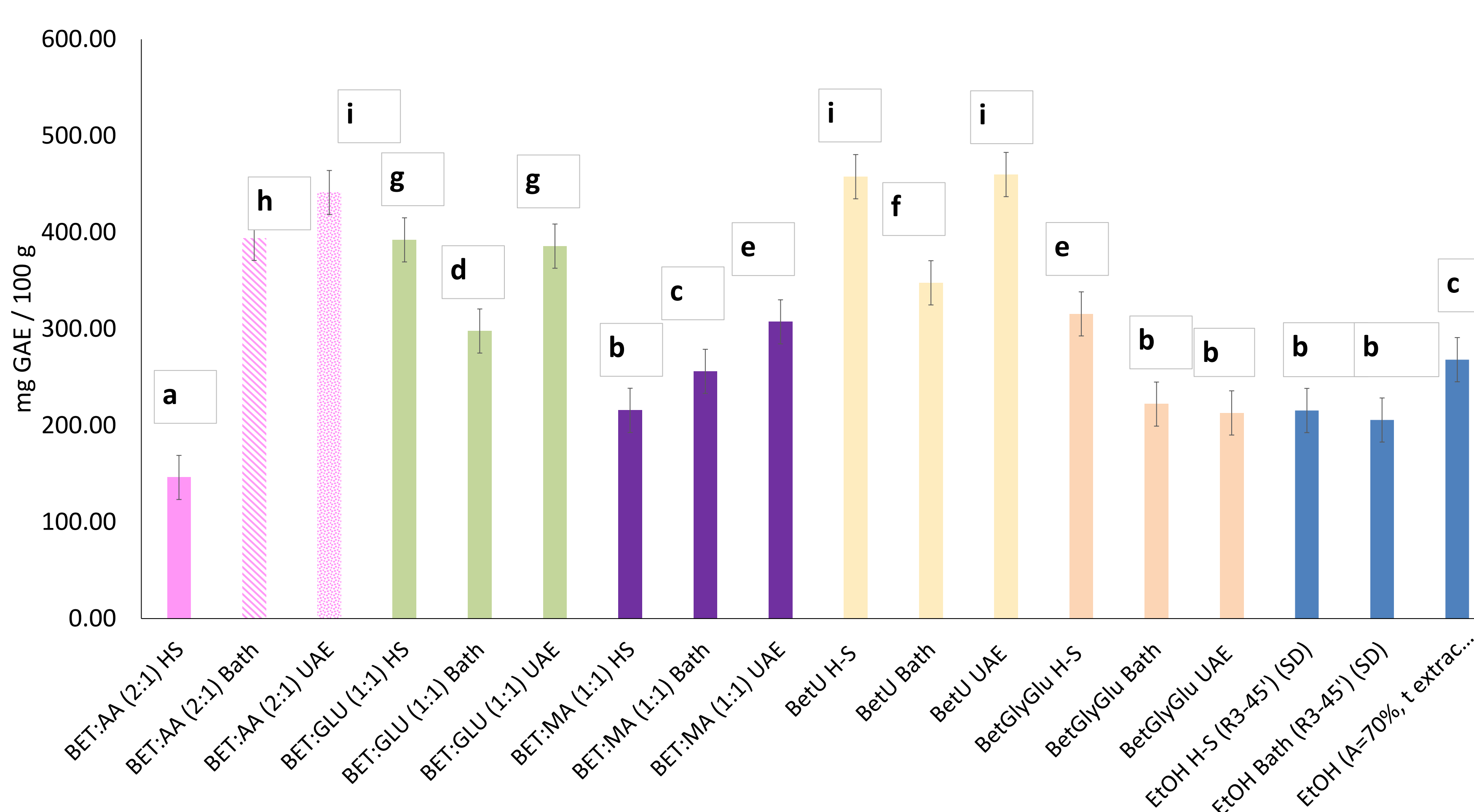


Figure 3: Total phenolic content of different solvents tested from 3 extraction methods

Among all solvents tested, the UAEp method proved to be the most effective, yielding higher amounts of polyphenols. The extraction yields ranged from 460 mg GAE/100 g using Bet:U to 213 mg GAE/100 g using Bet:Gly:Glu.

Notably, Bet:U consistently demonstrated superior extraction efficiency across all methods, achieving yields of 460 mg GAE/100 g for UAEp, 457 mg GAE/100 g for HS, and 348 mg GAE/100 g for UAEb.

A study by Airouyuwa et al. highlights that NADES combined with ultrasound-assisted extraction (UAE) offer a sustainable and efficient green extraction approach for the optimal recovery of bioactive compounds from date seed powder, outperforming conventional extraction solvents.

## Conclusion

The TPC depends on the type of solvent and the extraction method. For all extraction methods, Bet:U, Bet:AA and Bet:Glu are the best options as effective and sustainable solvents for the extraction of polyphenols from date seeds. NADES presents natural components and environmentally friendly properties with potential for green extraction processes.

## Acknowledgments

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Our work is based on the sustainability of date seeds, because it's a food waste that can provide to population, both nutritional and multiple nutraceutical applications in food and cosmetic industries.

## References

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