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ABSTRACT

Accelerated solvent extraction (ASE) is one of the novel techniques that have been developed for the extraction of phytochemicals from plants in order to shorten the extraction time, decrease the solvent consumption, increase the extraction yield and enhance the quality of extracts. This technique combines elevated temperatures and pressure with liquid solvents. This paper gives a brief overview of accelerated solvent extraction technique for sample preparation and its application to the extraction of natural products. Through practical examples, the effects of operational parameters such as temperature, volume of solvent used, extraction time and extraction yields on the performance of ASE are discussed. It is demonstrated that ASE technique allows reduced solvent consumption and shorter extraction time, while the extraction yields are even higher than those obtained with conventional methods.

INTRODUCTION

Medicinal plants contain curative bioactive compounds which have proven to be valuable as primary or supplementary therapies when applied carefully (Chang et al, 2008). The phytochemical investigation of a plant may involve following steps: authentication and extraction of the plant material, separation and isolation of the constituents of interest, characterization of the isolated compounds and quantitative evaluation (Evans, 2008). Extraction method plays a vital role in separation and characterization of different phytochemicals from herbs, and screening plant extracts for novel leads. Accelerated solvent extraction have been developed for the extraction of phytochemicals from plants in order to shorten the extraction time, decrease the solvent consumption, increase the extraction yield, and enhance the quality of extracts (Wang & Weller, 2006).

OBJECTIVE

To evaluate accelerated solvent extraction technique for sample preparation and its application to the extraction of natural products

MATERIALS & METHODS

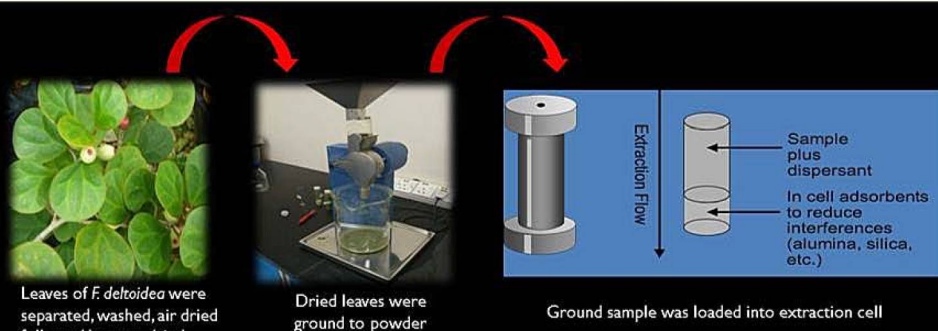


Figure 2: Preparation of plant materials for ASE run

Table 1: ASE conditions for *F. deltoidea* water extraction procedure

Parameter	Condition
Solvent	Water
Temperature	100°C
Pressure	1500 Psi
Heating	4 Minutes
Static Time	5 Minutes
Static Cycles	2
Rinse Volume	60%
Purge Time	90 Seconds
Cell Size	100 mL
Total Time	17 Minutes

Accelerated Solvent Extraction (ASE) System

- Automated extraction technique that uses liquid solvents and solvent mixtures
- Extracts solid or semisolid samples
- Uses elevated temperature (40–200 °C) and pressure (1500 psi)
- Elevated temperature and pressure accelerate the extraction process
- Requires small quantities of solvent in short periods of time
 - ASE: 15 mL and 15 min for 10-g samples
 - Soxhlet: 8-48 h and 300-500 mL
 - Sonication: 1-2 hours and 200-500 mL
- Supports a wide range of sample sizes (mg–100 g)
- Can be used to prepare samples for GC, GC-MS, HPLC, LC-MS, gravimetric methods, IC, and IC-MS analytical methods



Figure 1: ASE System

RESULTS & DISCUSSION



Figure 5: Water extracts of *F. deltoidea* leaf samples using ASE at variable temperature

Table 2: Effect of temperature on *F. deltoidea* water extraction percent yield

Temperature	Percentage Yield
40°C	18.87%
60°C	21.10%
80°C	23.19%
100°C	25.72%

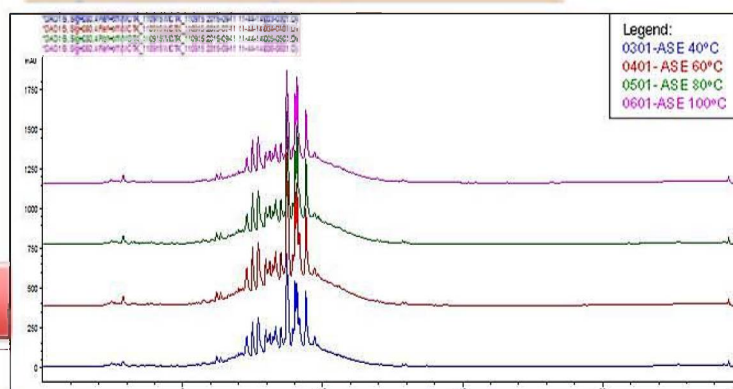


Figure 6: UHPLC chromatogram showing the profiling of phytochemicals in *F. deltoidea* water extracts at variable temperature applied in ASE

Based on UHPLC profiling shown in Figure 6, the results demonstrated that there were no changes in phytochemicals distribution of *F. deltoidea* extracts suggesting that no thermal degradation was observed for *F. deltoidea* extracts at temperatures as high as 100 °C with the ASE method under optimized conditions.

Table 3: Comparison of ASE technique to conventional method in the extraction of *F. deltoidea*

Parameter	Accelerated Solvent Extraction at 100°C	Conventional Method (Decoction technique)
Time	20 minutes	3 hours
Solvent Consumption	150 mL	573 mL
Sample weight	16.02 g	57.3g
Extract weight	4.12	7.27 g
Percent Yield	25.72%	12.69%

At elevated temperature.....

- Higher analyte solubility
- Helps overcome matrix effects
- Viscosity of solvent is lowered
- Analytes diffuse into solvent more quickly

High pressure.....

- forces solvent into pores that are blocked at low pressure
- Pressure needed to keep solvents liquid at high temperatures
- Cells fill faster with high pressures

CONCLUSION

Accelerated solvent extraction (ASE) is an innovative sample preparation technique that combines elevated temperatures and pressures with liquid solvents to achieve fast and efficient extraction process. With proper sample preparation and optimization of extraction parameters, nearly any sample currently extracted with a liquid solvent can be performed in less time and with smaller quantities of solvent using accelerated solvent extraction.

REFERENCES

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Figure 4: Process Schematic in ASE

