

**OPTIMIZATION AND COMPARISON OF HEAT, MICROWAVES, AND
ULTRASOUND-ASSISTED EXTRACTION TECHNIQUES TO OBTAIN
POLYPHENOL COMPOUNDS FROM HAWTHORN FRUIT (*CRATAEGUS
MONOGYNA JACQ.*)**

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Abstract

The objective of this study was to evaluate the effectiveness of several extraction methods such as UAE, MAE, and HAE for maximizing the recovery of phenolics and flavonoid compounds from hawthorn fruit. Chemical methods and UV-VIS spectrophotometers were used to analyze extracts obtained by these extraction methods. Response surface methodology was used to maximize the extract contents of TP and TF and the antioxidant activity in these extracts.

The experimental results showed the highest TPC and TFC (87.1 ± 5.42 mg GAE/g and 29.87 ± 2.09 mg QUE /g of dry weight, respectively) can be obtained from the extract of UAE. In the case of MAE extracts, the highest experimental values of extracted TPC (54.11 ± 5.93 mg GAE/g DW), TFC (12.82 ± 1.55 mg QUE/g DW). With HAE the supreme amounts of TPC (80.65 ± 6.08 mg GAE/g DW), TFC (19.93 ± 1.68 mg QUE/g DW). Similarly, antioxidant activity consistent with TPC and TFC was obtained, where the highest AA could be obtained using UAE all the assays. These response values were improved by RSM models, where the actual values calculated from the regression equations modeled by RSM were slightly higher than experimental values. Accordingly, the efficiency of the extraction method from hawthorn fruit was in order UAE > HAE > MAE. In addition, using UAE reduced used-ethanol concentration by around 50% compared to both other extraction methods, and reduced the extraction time by 90% compared to HAE.

Keywords: Hawthorn, Heat-assisted extraction, microwaves- assisted extraction, ultrasound-assisted extractions, Response surface methodology.