



Statistical optimization of ultrasound-assisted extraction of polyphenols from olive pomace

Ouahiba Soufi^a, Lamia Medouni-Haroune^{b,*}, Mostapha Bachirbey^c,
Sonia Medouni-Adrar^a, Farida Idir^d, Tinhinane Heddad^d, Linda Ouldsaadi^c,
Concepcion Romero^e, Khodir Madani^b, Lila Makhoul-Boulekbache^a

^a Laboratory of Biochemistry, Biophysics, Biomathematics and Scientometrics, Faculty of Natural and Life Sciences, University of Bejaia, 06000, Bejaia, Algeria

^b Centre de Recherche en Technologies Agroalimentaires, Route de Targa Ouzemmour, Campus Universitaire, Bejaia, 06000, Algeria

^c Laboratory of Applied Biochemistry, Faculty of Natural and Life Sciences, University of Bejaia, 06000, Bejaia, Algeria

^d Department of Food Sciences, Faculty of Natural and Life Sciences, University of Bejaia, 06000, Bejaia, Algeria

^e Food Biotechnology Department, Instituto de La Grasa (IG-CSIC), Ctra. De Utrera Km1, Edificio 46, 41013, Sevilla, Spain

ARTICLE INFO

Handling Editor: Vania Zuin

Keywords:

Olive pomace
Ultrasound-assisted extraction
Optimization
Polyphenol

ABSTRACT

Ultrasound-assisted extraction (UAE) is a technique commonly used in combination with solvent extraction and effectively enhances the extraction of polyphenols. This technique has successfully solved the problem of polyphenols in biotechnology. The present study was carried out to optimize the extraction of phenolic compounds (total phenols, flavonoids, orthodiphenols, and flavonols) and the evaluation of antioxidant activities (reducing power and antiradical activity) from oil mill waste (OP, olive pomace). The three independent variables selected were sonication amplitude (20–100%), extraction time (2–20 min), and solvent acetone concentration (40–80%). The optimization study was carried out using the Box-Behnken design. The results revealed that all developed models regarding phenolic contents and antioxidant activities, through experimental design, expressed high levels of significance (F -values = 0.0004–0.0210) with good concordance between predicted and experimental data (R^2 = 0.929–0.987). The optimal conditions for phenolic extraction and antioxidant activity were achieved using 57.34% acetone, 83.69% sonication amplitude, and 2 min of extraction. Under these conditions, the obtained contents for TPC, flavonoid, orthodiphenol, and flavonol were 23.43 g GAE/kg, 10.33 g CE/kg, 17.72 g GAE/kg, and 5.43 g QE/kg, respectively, resulting in a global desirability of 84.41%. Moreover, the predicted optimal conditions were experimentally validated. Considering all statistical parameters, it can be concluded that the developed models are suitable for achieving the highest recovery of polyphenols from OP.

1. Introduction

Olive cultivation plays a significant role in the agricultural sector of the Mediterranean region, resulting in the annual production of 7549446 tons of OP (FAO, 2022). The main challenge faced by the olive industry lies in effectively managing these residues, as they can be a source of pollution in certain cases and the associated costs of their proper disposal can be substantial (Pagnanelli et al., 2010). Olive pomace is composed of a lignocellulosic matrix, phenolic compounds, uronic acids, and oily residues (Pagnanelli et al.,

* Corresponding author.

E-mail address: lamia.medouni@crtaa.univ-bejaia.dz (L. Medouni-Haroune).