



Optimization of the recovery of phenolic compounds from Algerian grape by-products



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ABSTRACT

Grape seeds and skin are by-products of wine making or juice making operations which are considered as a good source of bioactive compounds. In this study, the total phenolic content (TPC) from *Vitis vinifera* L. cv. *Ahmar Bou-Amar* seeds and skin was optimized by conventional solvent extraction (CSE) and microwave-assisted extraction (MAE) using response surface methodology (RSM), then a comparative study was carried out. The optimal conditions for seeds extracted by CSE were: 74.33% v/v of ethanol concentration, 65.23 min extraction time, 0.1 g/70.86 ml solid/liquid ratio, and for those extracted by MAE were: 59.88 s irradiation time and 373.15 W microwave power. The extract obtained under these conditions showed a TPC of 96.56 ± 1.29 mg GAE/g and 73.15 ± 0.20 mg GAE/g DW for CSE and MAE, respectively. Concerning skin, the optimal conditions for CSE were: 51.46% v/v of acetone concentration, 89.80 min extraction time, 0.1 g/32.25 ml solid/liquid ratio and for MAE were: 113.74 s irradiation time and 384.44 W microwave power. The extract obtained under these conditions showed a TPC of 39.57 ± 0.23 mg GAE/g and 54.84 ± 0.41 mg GAE/g DW for CSE and MAE, respectively. The TPC of seeds extract obtained with MAE was 24% lower than that of the CSE extract; also, the antioxidant activity of CSE extract is better than that of MAE extract. While, the TPC of skin extract obtained with MAE was 28% higher than that of the CSE extract and the antioxidant capacity was significantly higher than that of the CSE extract. The results indicate that the extracts of cv. *Ahmar Bou-Amar* seeds and skin contain a high quantity of polyphenols; therefore, they can be considered as a good source of natural antioxidants.

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1. Introduction

Grapes (*Vitis vinifera* L.), are the world's largest fruit crop (Ghafoor et al., 2010; Yang et al., 2009), with a total production of approximately 75.1 million tons in 2013 (O.I.V., 2015). Although, a high part of grapes is made into wine, another part is dried into raisins, a significant part is consumed as table grapes (Nelson, 1979). The cv. *Ahmar Bou-Amar* grape is originated in Algeria, it is widespread in the Kabily region with a low commercial value, and is generally consumed as a fresh fruit.

Vitis vinifera L. contains large amounts of phytochemicals such as phenolic compounds (Yang et al., 2009) which offer health benefits via their important antioxidant activity (Andjelkovic et al., 2013).

The grape polyphenolic compounds are found essentially in seeds and skins with approximately 75% (Ghafoor et al., 2010); these levels are influenced by the grape variety and environmental factors (Cadot et al., 2008; Cheynier et al., 1998; Katalinic et al., 2010).

Grape seeds and skins which are a low-value by-products of wine making or juice making operations are considered to be a cheap and a good source of the high-quality phenolic compounds (Bucić-Kojić et al., 2007; Spigno et al., 2007), so they can be exploited as natural antioxidant agents to neutralize free radicals in biological systems (Bucić-Kojić et al., 2007; Ghafoor et al., 2010).

Extraction is a critical step in the isolation of active compounds from plant material (Afoakwah et al., 2012; Dragović-Uzelac et al., 2012). Different extraction methods have been investigated in this regard; conventional extraction methods are generally based on choosing the accurate solvent in order to enhance the solubility of active compounds (Dragović-Uzelac et al., 2012; Ravalji et al.,

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