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Extraction of essential oils from *Bunium persicum* Boiss. using superheated water

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ABSTRACT

A comparative study of superheated water extraction (SWE) with two conventional volatile isolation methods including hydrodistillation and Soxhlet extraction was performed on *Bunium persicum* Boiss. Influence of operating conditions such as temperatures from 100 to 150 °C, mean particle size from 0.5 to 1.0 mm and flow rates from 2 to 4 mL/min on the extraction process was investigated. The experiments were carried out using a laboratory-built apparatus. Separation and identification of the components were carried out by GC-FID and GC/MS. The optimum extraction efficiency for SWE was determined at 125 °C, 4 mL/min and 0.5 mm. At these operating conditions, the extraction efficiency was lower than hydrodistillation and Soxhlet extraction methods, but SWE was quicker and with respect to the valuable oxygenated components, it was more selective.

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Keywords: Superheated water extraction; *Bunium persicum* Boiss.; Essential oil; Cumin aldehyde

1. Introduction

Volatile concentrates and essential oils are currently being isolated from natural products either by conventional methods such as steam distillation, hydro distillation or solvent extraction or by more advanced methods such as dynamic and static headspace, microwave assisted extraction (MAE) and supercritical fluid extraction (SFE) (Fakhri et al., 2005) and more recently superheated water extraction (SWE). SWE is a new and powerful technique based on the use of water, at temperatures between 100 and 374 °C and pressure high enough to maintain the liquid state (Ayala and Luquede Castro, 2001). Under these conditions water is much less polar and organic compounds are much more soluble in it than at room temperature (Miller and Hawthorne, 1998). The SWE is rapidly emerging as an alternative for the extraction of volatile compounds (Luquede Castro et al., 1999). It has been shown that the SWE is cleaner, faster and cheaper than the conventional isolation methods. It has been shown to be feasible with par-

ticular interest in avoiding the need for organic solvents. The equipment required is relatively simple and avoids the need for the high pressures employed in supercritical fluid extraction (Smith, 2002; Herrero et al., 2006). In 1998, the superheated water was used for the extraction of rosemary leaves by Basile et al., for the first time (Basile et al., 1998). Since that time, the SWE from the other plants has been investigated.

Bunium persicum Boiss. or black cumin is a plant in the family *Apiaceae*. In Iran, *B. persicum* seeds are called “zireh kuhi”, meaning “wild cumin”, and are used as a culinary spice. It is reported to contain an essential oil (up to 7%) rich in monoterpene aldehydes; the main components are cuminaldehyde, *p*-mentha-1,3-dien-7-al and *p*-mentha-1,4-dien-7-al (up to one third each) (Thappa et al., 1991).

The aim of this research work was to extract essential oil from *B. persicum* Boiss. as an essential oil-bearing material by SWE method. The results of SWE of *B. persicum* seeds were compared by two conventional techniques including hydro distillation and Soxhlet extraction.

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