Supercritical Fluid Extraction of Sesquiterpene Lactones from Laserpitium archangelica.

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2018

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Sesquiterpene lactones (STLs) make a diverse and huge group of bio-active constituents that have been isolated from several plant families. However, the greatest numbers are present in Asteraceae family having more than 3000 different reported structures. STLs exhibit a wide range of biological activities, such as antitumor, anti-inflammatory, analgesic, antimigraine, antiulcer, antibacterial, antifungal, antiviral and antiparasitic. There is much potential for STLs in the treatment of cardiovascular diseases, ailments such as diarrhoea, flu, and burns and in the prevention of neurodegeneration [1]. In addition to their pharmacological importance and potential therapeutic applications, most STLs display a wide range of protective activities in plants, including acting as antiherbivory and antimicrobial substances or inhibiting growth of competing plants [2]. Due to the fact that most STLs are thermolabile, less volatile compounds, they present no specific chromophores in the molecule and are sensitive to acidic and basic mediums, their identification and quantification can be difficult.

A promising method for isolation of the STLs from plants is supercritical fluid extraction with carbon dioxide (SFE) [3]. The high biological activity of STLs remains unchanged in extracts due to the application of low temperatures. SFE is an advanced separation technique which complies with green chemistry principles, and represents a valid alternative to traditional extraction methods. SFE can generate added value products without thermal degradation like in hydrodistillation or massive use of organic solvents, as in organic solvent extraction.

The aim of the work was to describe the SFE of two STLs, archangelolide and trilobolide, from seeds of *Laserpitium archangelica* (Apiaceae). The objectives consisted in: (a) optimizing, investigating the SFE condition (pressure, temperature and concentration of modifier in $scCO_2$) effect on the yield and concentration of STLs in extract, (b) determination of the SFE kinetics of major components in the extracts and (c) comparing the SFE with pressurised liquid extraction (PLE) and Soxhlet extraction.

Using the benefit of variable solvent power of supercritical carbon dioxide, several types of extracts were prepared at temperatures from 40 to 60°C and pressures from 9 to 63 MPa. The extract enriched with polar components was extracted at pressure of 30 MPa and temperature of 40 °C with ethanol added to $scCO_2$ as modifier (5 – 20 wt. %). To describe the extraction kinetics of individual components, the consecutively collected extract samples were analysed using HPLC.

Out of the operation variables, the modifier concentration showed the strongest effect on the extraction. The initial concentrations of both archangelolide and trilobolide in the solvent and their final yields were increasing with rising modifier concentration in $scCO_2$. The PLE using ethanol as solvent at 100°C and 10 MPa was the most efficient method for isolating of STLs in terms of their yields and concentration in the extract. Higher temperatures have already caused heat degradation of both archangelolide and trilobolide.

Acknowledgements. The financial support of the Ministry of industry and trade (project no. FV-30300) is gratefully acknowledged.

[1] Ivanescu B. et al. J. Anal. Met. Chem. 2015, 2015, 1-21.
[2] Chadwick M. et al. Int. J. Mol. Sci. 2013, 14, 2780-12805.
[3] Kery A et al. Chromatographia 1999, 49, 503-508.