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NOTE

Extraction of Essential Oil from Albanian *Salvia officinalis* L. and its Characterization by FTIR Spectroscopy

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Albania is rich in biological and ecological diversity and it is well-known for its natural bio-resources such as medicinal and aromatic plants. It is a significant producer and exporter of herbs and in particular of *Salvia officinalis* L. The extraction of essential oil from *Salvia officinalis* L. is carried out by a Soxhlet technique and the obtained oil is characterized by means of FTIR spectroscopy. IR analysis indicated presence of monoterpenes such as thujones, camphor, 1,8-cineole and pinene.

Keywords: *Salvia officinalis* L., Essential oil, Soxhlet extraction, FT-IR spectroscopy.

Albania is one of the largest producers of salvia species such as *Salvia officinalis* L. and *Salvia fruticosa* Mill. [1]. Both species are rich in essential oil and they are the most important aromatic and medicinal herbs [1,2]. Albania is the main exporter of *Salvia officinalis* L. and *Salvia fruticosa* Mill [1]. It is reported, the US imported in 2009, *e.g.*, 2295 metric tons of *Salvia officinalis* L. 55 % of which was exported by Albania [1]. Moreover, the real percentage is reported to be much higher (up to 85 %) by re-export of Albanian sage by other countries to the US [1].

Traditionally, the extraction of essential oils from herbs has been carried out by steam distillation and organic solvent extraction using a Soxhlet technique [3,4]. Following our previous studies of the essential oils extraction from Albanian herbs [4,5], we further extended this work by utilizing a Soxhlet extractor to obtain essential oil from *Salvia officinalis* L. The FTIR application in essential oils characterization is rather limited. Therefore, we report in this work characterization of *Salvia officinalis* essential oil by FTIR spectroscopy. FTIR analysis indicated presence of thujones, camphor, 1,8-cineole and pinene in the essential oil of *Salvia officinalis* L. This outcome is in good agreement with the reported data by Schulz *et al*. [6].

The origin of *Salvia officinalis* L. used in this work is from local Albanian herb. The herb (10 g leaves of the herb) is dried at 40 °C until constant weight and subjected afterwards to grinding process and then used such as for the Soxhlet extraction [7]. The amount of the solvent (hexane) used was 300 mL.

In the Soxhlet extraction, the herb is placed inside a thimble (herb container) made of thick filter. The thimble is located into the main chamber of the Soxhlet extractor. The latter is placed onto a flask which contains the extraction solvent, *i.e.* hexane. The Soxhlet is afterward equipped with a condenser, whereas the solvent is heated and allowed to reflux [7]. The solvent vapour goes up to a distillation arm and overflows into the chamber which contains the thimble with the herb in it. The condenser makes sure that the solvent vapour cools down and drops back down into the chamber. As the chamber slowly gets filled with warm hexane, some of compounds dissolve in the solvent. Whilst the Soxhlet chamber is almost full, the chamber automatically gets emptied by a siphon side arm, with the solvent going back down to the distillation flask. This cycle may be allowed to repeat over several hours [7]. In the current work the extraction process was allowed to run 3 h. During each cycle non-volatile compound dissolve in hexane. After repeated cycles the desired compounds are concentrated in the distillation flask. Subsequently, the extraction is stopped and the solvent is removed, by means of a rotary evaporator, yielding though the extracted compounds.

FTIR spectra were obtained by Nicolet 6700 spectrometer, manufactured by Thermo Electron. In this study, measurements were carried out in the transmission system in the range mid

infrared (4000-400 cm^{-1}). The spectra were analyzed using OMNIC program.

Fig. 1 displays FTIR spectrum of essential oil of *Salvia officinalis* L. In the insert are presented chemical structures of the main compounds as reported in the literature [1,6]. These compounds are also identified in the IR spectrum as well. The band positioned at about 1734 cm^{-1} is attributed to camphor and thujone [8] (stretching vibration of C=O). In this respect Schulz *et al*. [6] reported that IR spectrum of essential oil of S*alvia officinalis* L. was characterized by a peak positioned at about 1734 cm^{-1}. The authors attributed this peak to camphor [6]. However, our former TLC analysis [9] indicated presence of thujone as well in the oil extract of *Salvia officinalis* L. Therefore, we have assigned the band at 1734 cm^{-1} to both camphor and thujone. Additionally, the diagnostic IR band of pinene (-C=C-, alkene) appears at about 1640 cm^{-1} [8]. Schulz *et al*. [6] also reported appearance of a band at about 1640 cm^{-1} in IR spectrum of the oil extract of *Salvia officinalis* L.

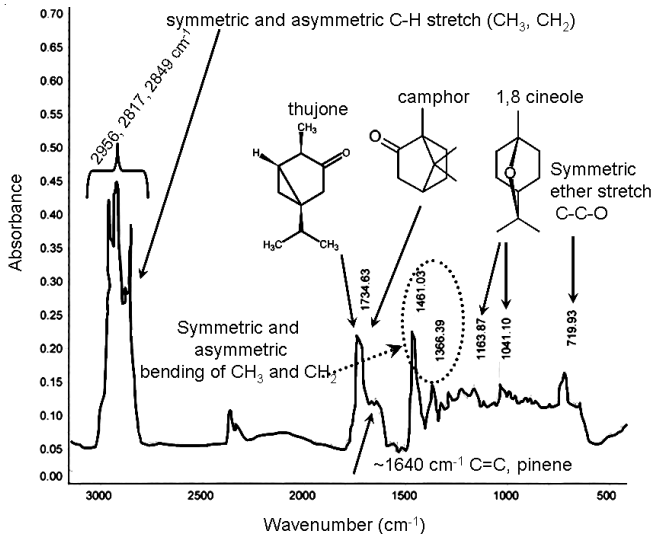

Fig. 1. FTIR spectrum of oil extract of *Salvia officinalis* L. obtained by Soxhlet extraction. Inset figure presented chemical structures [1,6] of the main compounds identified in IR spectrum

To this end, ethers give rise to two or more bands in the region 1210-1070 cm^{-1} (saturated, branched) [8]. In the FTIR spectrum of Fig. 1 two minor bands appear in the region about 1164-1042 cm^{-1}. We have attributed them to 1,8-cineole. Furthermore, our former TLC analysis for oil extract of *Salvia officinalis* L. obtained by different extraction methods indicated presence of 1,8-cineole too [9]. In addition, the peak positioned at about 720 cm^{-1} is assigned to C-C-O symmetric ether stretch [8], whereas the bands in the regions 2956-2849 cm^{-1} and 1461-1366 cm^{-1} are assigned to symmetric, asymmetric C-H stretches (CH_3, CH_2) [8] and symmetric, asymmetric bending of CH_3, CH_2, respectively [8]. The calculated yield of the obtained oil extract for this work was 8.63 % for 10 g herb which is also in good agreement with our former work [9].

Conclusion

The extraction of essential oil from *Salvia officinalis* L. leaves was performed by utilizing a Soxhlet extractor. The acquired oil was characterized by FTIR spectroscopy. IR analysis indicated presence of monoterpenes such as thujones, camphor, 1,8-cineole and pinene in good agreement with reported data [6]. Schulz [10] has also concluded that salvia species contain mainly camphor and 1,8-cineole.

REFERENCES

1. C. Schmiderer, P. Torres-Londoño and J. Novak, *Biochem. Syst. Ecol.*, **51**, 70 (2013) and references therein.
2. S.E. Kintzios, Sage-The Genus Salvia. Harwood Academic Publishers, Amsterdam (2008).
3. E. Reverchon and F. Senatore, *J. Agric. Food Chem.*, **42**, 154 (1994).
4. K. Taraj, A. Delibashi, A. Andoni, P. Lazo, E. Kokalari (Teli), A. Lame, K. Xhaxhiu and A. Çomo, *Asian J. Chem.*, **25**, 7361 (2013).
5. A. Andoni, K. Xhaxhiu, K. Taraj and A. Çomo, *Asian J. Chem.*, **26**, 6833 (2014).
6. H. Schulz, G. Özkan, M. Baranska, H. Krüger and M. Özcan, *Vib. Spectrosc.*, **39**, 249 (2005).
7. F. Soxhlet, *J. Polytechnisches (Dingler's)*, **232**, 461 (1879).
8. B. Smith, Infrared Spectra Interpretation, A Systematic Approach, CRC Press LLC (1999).
9. A. Dama, K. Taraj, L. Ciko and A. Andoni, *Int. J. Ecosystems Ecology Sci.*, **5**, 421 (2015).
10. H. Schulz, in eds.: C. Roberts, J. Workman and J. Reeves, Near-Infrared Spectroscopy in Agriculture, Application in Analysis of Coffee, Tea, Cocoa, Tobacco, Spices, Medicinal and Aromatic Plants, and Related Products, American Society of Agronomy/Crop Science of America/ Soil Science Society of America, Madison, USA, Agronomy Monograph No. 44, pp. 345-376 (2004).