HIGH PRESSURE AND ULTRASOUND-ASSISTED EXTRACTON OF BIOACTIVE COMPOUNDS FROM *Santolina chamaecypatissus*

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Abstract
The objective of this study was to determine the most adequate process, using a green approach, which ensures maximal exploitation of *Santolina chamaecypatissus* and attainment of high quality extracts rich in bioactive compounds and with strong antioxidant activity. Two environmentally friendly techniques were applied, supercritical carbon dioxide for isolating volatile compounds and ultrasound-assisted extraction for obtaining extracts rich in polyphenolic compounds.

Introduction
S.chamaecypatissus L. (cotton lavender) is a flowering plant in the family of *Asteraceae* native to the Mediterranean region. It is a herbal special of medicinal significance due to its analgesic, bactericidal, and fungicidal properties. Cotton lavender is rich in volatile components which makes it a reliable source of commercial essential oils. Although it is most commonly for isolating oil, cotton lavender also represents a great source of hydrophilic antioxidant compounds which usually remain unutilized because the common and traditional methods for separating oil are not adequate for isolating non-volatile antioxidant compounds [1].

Experimental
The first step was the extraction with CO_2 in supercritical state at a pressure of 300 bar and a temperature of 40°C. Residue after supercritical CO_2 extraction was subjected to ultrasound-assisted extraction. Extraction parameters for the most optimal quality of extracts were investigated: ethanol at concentrations of 30, 50, and 70% (v/v), temperature 30, 50, and 70°C, and extraction time 10, 20, and 40 min. In obtained extracts the content of total phenols, total flavonoids, and antioxidant activity were determined.

Results and discussion
The yield of supercritical extraction was 3.98% (m/m). The highest ultrasound-assisted extraction yield (28.48%) was achieved by using 50% ethanol at temperature of 50°C during a period of 40 min, while the lowest yield was achieved with 30% ethanol, 50°C, and 20 min. Using the one-variable-at-a-time technique, where one parameter is varied while the other two remain constant, it was recorded that all investigated factors had a positive effect on the extraction yield. The increase of concentration of ethanol resulted in extracts with a higher content of phenols and the highest measured concentration of total phenols was 2.45 mg equivalent of gallic acid/mL of extract. Temperature exerted a negative impact on phenolic fraction content. However, higher content of total flavonoids was obtained with an increase in temperature and decrease in ethanol concentration. The extract with the highest antioxidant activity was the one with the shortest extraction time (10 min, 50°C, and 50% ethanol), while the highest IC_{50} value was measure in the extract obtained with 70% ethanol (20 min and 50°C). Additionally, compared to extracts obtained by ethanolic ultrasound-assisted extractions, the extract obtained by supercritical extraction showed a significantly lower antioxidant activity.

Conclusion

Based on the obtained results, cotton lavender represents a significant and rich source of bioactive compounds with widely ranging polarities. The applied extraction approach including combining different green technologies for isolating volatile and non-volatile compounds proved to be an adequate method for obtaining high-quality extracts of cotton lavender and efficient utilization of this natural material.

References

[1] L.L. Niu, Q. P. Qin, L.T. Wang, Q. Y. Gai, J. Jiao, C.J. Zhao, Y.J. Fu, Chemical profiling of volatile components of micropropagated Santolina chamaecyparissus L. Industrial Crops and Products, (2019) 137, 162-170.