



Development and optimization of microwave-assisted extraction of *Satureja bachtiarica* Bunge. essential oil using response surface methodology and its comparison with traditional method

Sayedeh Mansoureh Memarzadeh, Ali Gholami*, Abdollah Ghasemi Pirbalouti, Saeed Masoum

Department of Analytical Chemistry, Faculty of Chemistry, Kashan University, Kashan, Iran
E-mail address : memarzadeh8291@gmail.com



Introduction

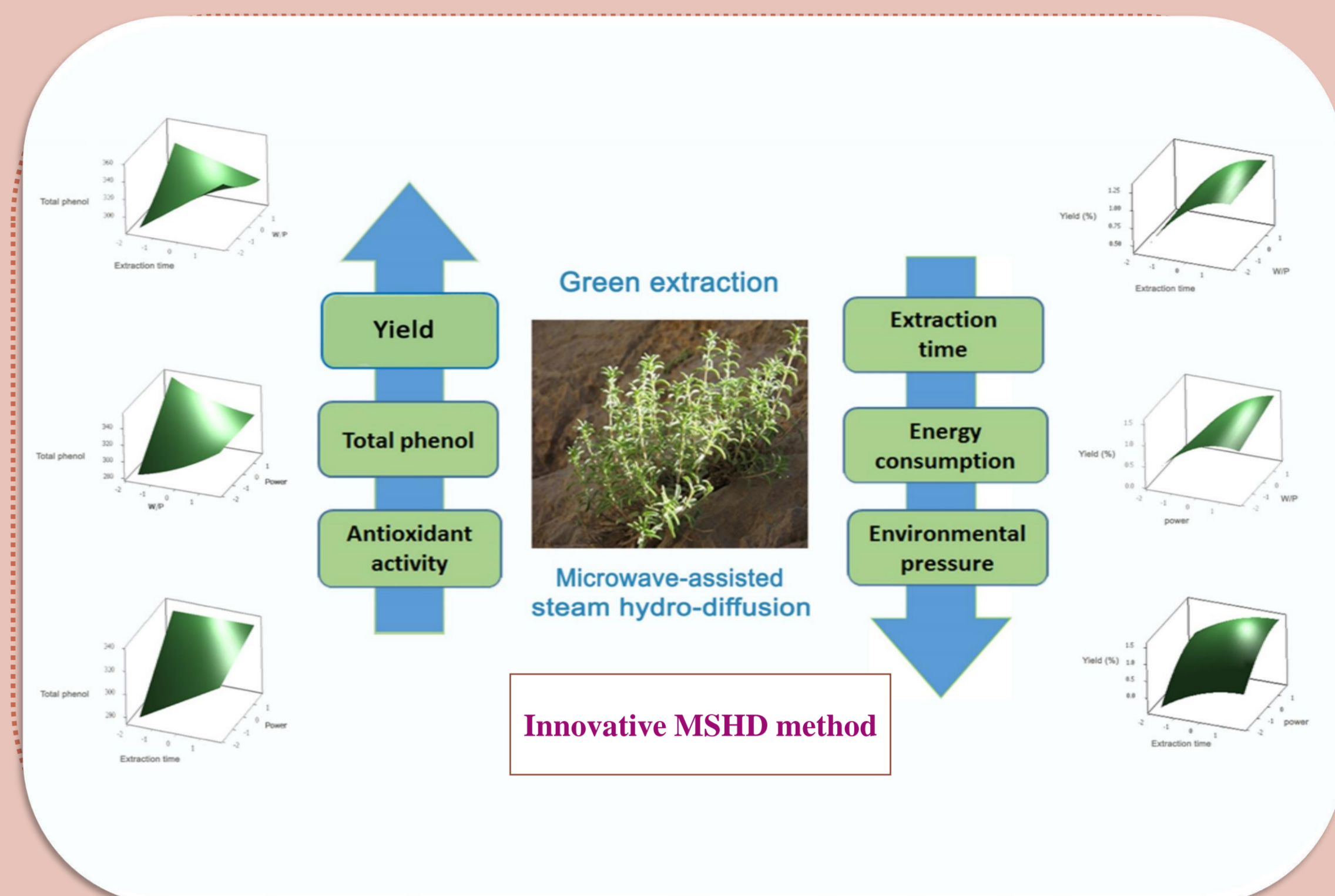
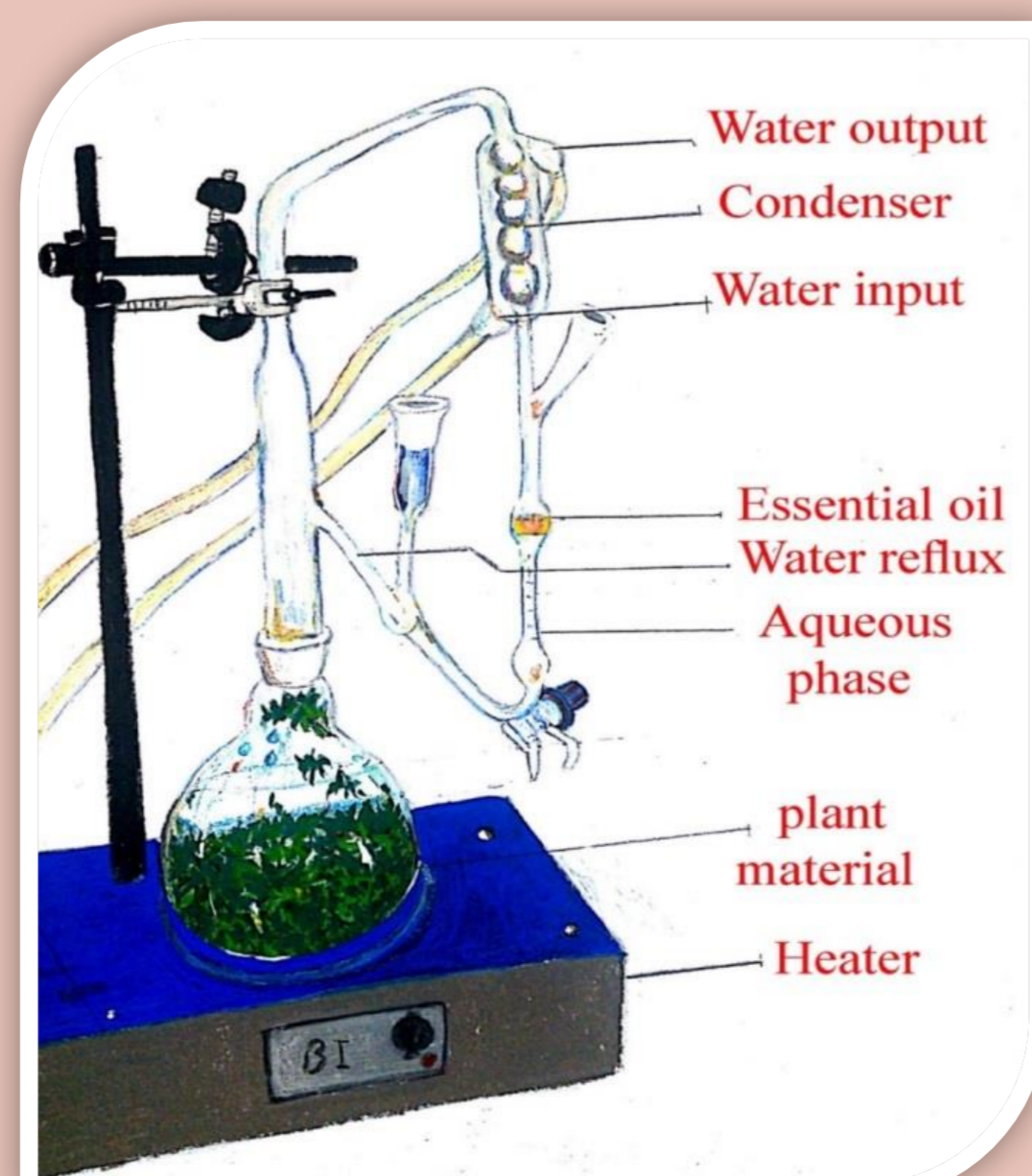
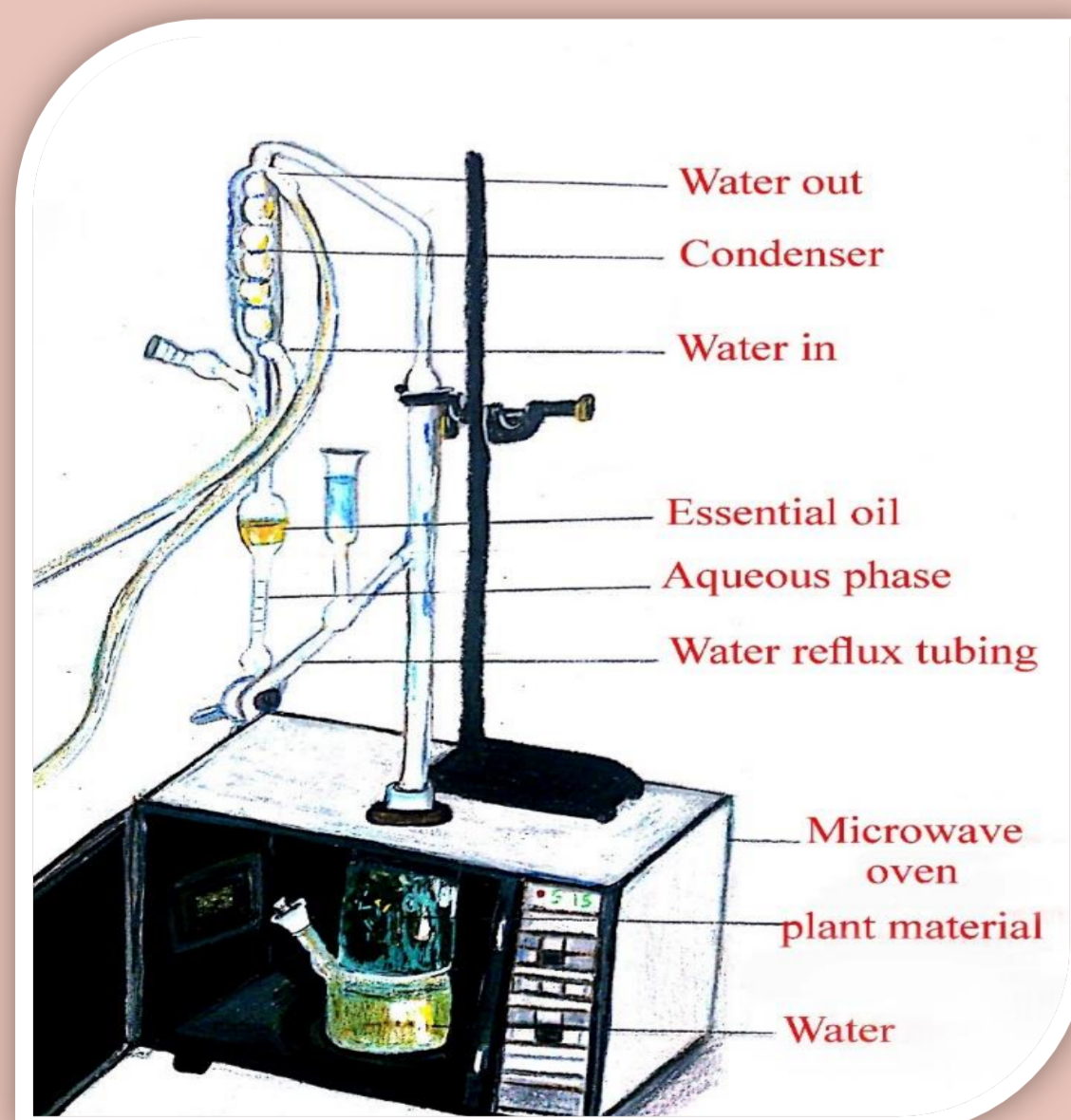
Satureja bachtiarica Bunge (Bakhtiari savory) is a fragrant herb that is distributed at the middle Zagros Mountains in southwestern of Iran. Indigenous people of Bakhtiari use the brewed and boiled of the aerial parts of this plant as a painkiller, disinfectant and anti-cold drug. Extracted essential oils from aerial parts of this plant by hydrodistillation method have biological and pharmacological properties containing antimicrobial, antioxidant and immunomodulatory enhancement (1,2). The promising biological compounds in different species of savory encourage us to further researches on *S. bachtiarica* to focus on enriching essential oils from active compounds and extraction yields. Due to the different polarities of these active compounds, the type of extraction method has great importance (3). In this research, the effects of some factors like extraction time, microwave irradiation power and volume of water to plant material ratio W/P under MSHD technique and the effects of two factors like extraction time and W/P under THD method were compared on the yield and TPC from *S. bachtiarica* essential oil by using RSM as a robust statistical technique. Presence of major phenolic constituents such as thymol and carvacrol have provided unique antioxidant and biological properties in the savory oil. The chem profile of *S. bachtiarica* essential oil at the optimum points of TPC from two extraction methods (MSHD and THD) were determined by applying GC/MS analysis and compared. According to the researches, no such study has been done on the different species of *Satureja* genus.

Satureja bachtiarica Bunge.



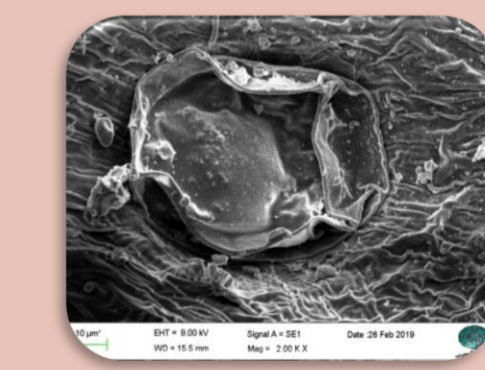
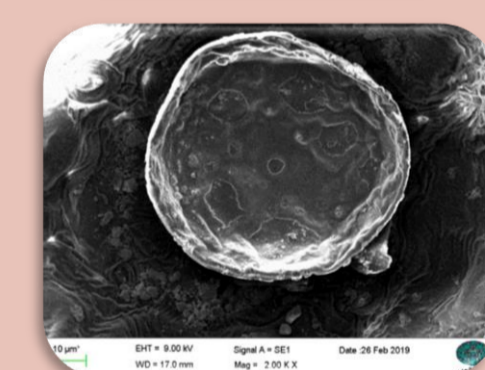
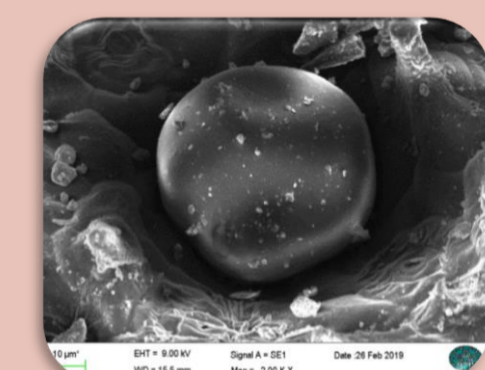
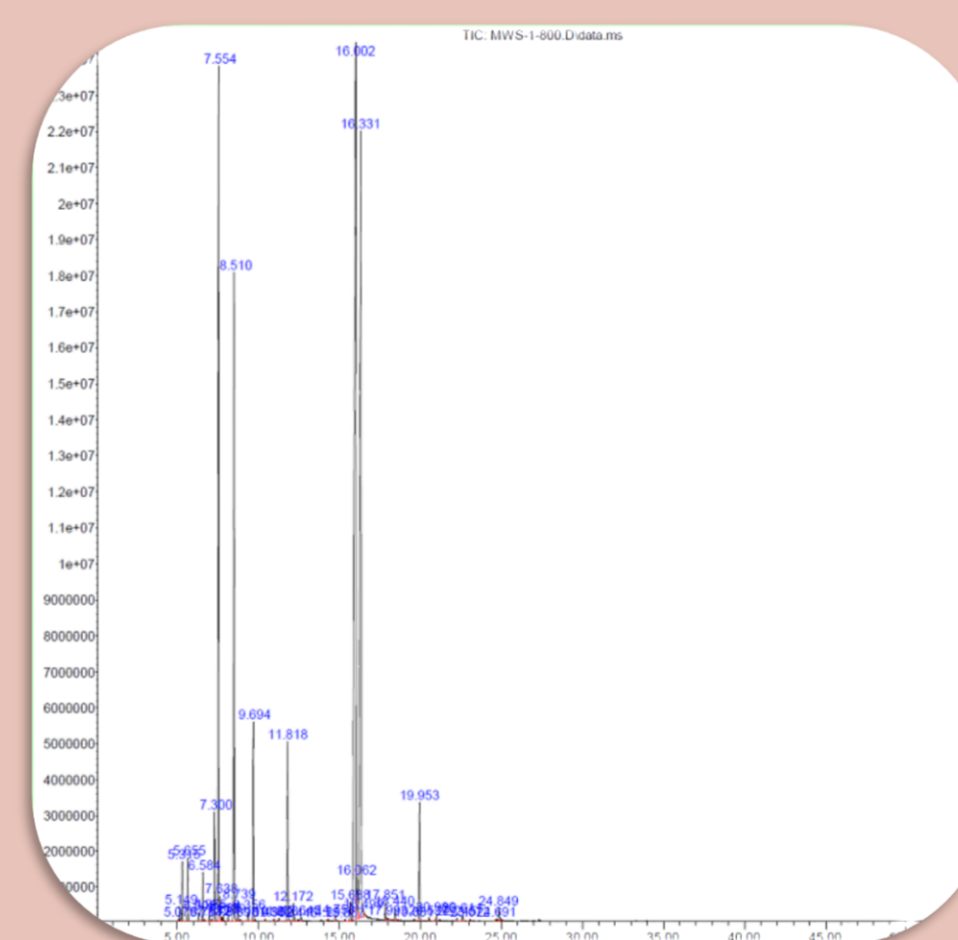
Material s and Methods

Essential oils are one of the most secondary metabolites in therapeutic herbs, rich in oxygenated compounds. The proficiencies of traditional hydro-distillation (THD) and microwave-assisted steam hydro-diffusion (MSHD) techniques in extraction of Bakhtiari savory oil were evaluated. In order to obtain the golden yield and total phenol (TPC) in MSHD method, three factors were examined at 5 levels by applying central composite design under RSM technique: extraction time (15, 25, 35, 45, 55 min), microwave power (200, 400, 600, 800, 1000 W) and water volume to plant ratio (W/P) (0, 0.5, 1.5, 2.5, 3 ml/g) (4).



Results

The results of RSM in THD method showed, extraction time and (W/P) separately affected on yield and TPC without interaction. The best yield was 1.64 V/W% that collected at conditions [54.16 min, 872.42 W, 2.09 ml/g for extraction time, microwave power and (W/P)]. By using folin-ciocalteu method, the maximum of TPC was 344.07 mgGAE/g that was obtained at points [19.7 min, 1000 W, 3 ml/g for time, power and (W/P)] in MSHD technique. The highest amount of oxygenated fraction ($63.24 \pm 0.442\%$) were produced in the microwave method.



Conclusions

The MSHD method is the economic technique for green extraction of essential oil from pharmaceutical and fragrant herbs.

References

- [1] Memarzadeh, S.M., et al., Bakhtiari savory (*Satureja bachtiarica* Bunge.) essential oil and its chemical profile, antioxidant activities, and leaf micromorphology under green and conventional extraction techniques. *Industrial Crops and Products*, 2020. **154**: p. 112719.
- [2] Ghasemi Pirbalouti, A., et al., Antioxidant Activity, Total Phenolic and Flavonoid Contents of Some Medicinal and Aromatic Plants Used as Herbal Teas and Condiments in Iran. *Journal of Medicinal Food*, 2014. **17**(10): p. 1151-1157.
- [3] Emami Bistgani, Z., et al., Application of combined fertilizers improves biomass, essential oil yield, aroma profile, and antioxidant properties of *Thymus daenensis* Celak. *Industrial Crops and Products*, 2018. **121**: p. 434-440.
- [4] Akhbari, M., et al., Optimization of microwave assisted extraction of essential oils from Iranian *Rosmarinus officinalis* L. using RSM. *Journal of Food Science and Technology*, 2018. **55**: p. 2197-2207..

