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# Comparison of Different Isolation Methods of Essential Oil from *Oliveria decumbens* Vent. : Hydrodistillation and Microwave-assistHydrodistillaton

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ABSTRACT

Microwave-assisted hydrodistillation was applied to separate an essential oil from the aerial parts of Oliveria decumbens Vent., and the results werecompared with the composition of the extracted essential oil obtained by conventional hydrodistillation. The composition of extracted oil indicated that some difference between the amounts and number of these components in microwave-assisted hydrodistillation oil, compared with the hydrodistillation oil.



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## INTRODUCTION

The essential oil can be isolated using a number of isolation methods, e.g. hydrodistillation, steam distillation and organic solvent extraction[1]. Nowadays Microwave-assisted hydrodistillation became a widely used method for obtaining essential oils from different medicinal plants, due to its advantages (e.g. more effective heating, shortened extraction time) in comparison with the classical hydrodistillation [2].The essential oil isolation based on this technique was successfully tested in isolation of essential oil from plants [3]. hydrodistillation method suffers from several disadvantages, including losses in the volatile compounds and long extraction time this study is the identification of the volatile oil components.

Since ancient times, the essential oil extracted from herbs and plant species have been added to different types of food to improve their flavor and organoleptic properties. Currently, there is much research performed on antimicrobial compounds from plant extracts and essential oils, the goal being to identify novel lead structures with significant biological activities [4].The use of herbal medicines in Asia represents a long history of human interactions with the environment. A vast knowledge of how to use the plants against different illnesses may be expected to have accumulated in areas where the use of plants is still of great importance [5]. *Oliveriadecumbens*Vent. Belongs to Umbelliferae family and is an endemic plant of Flora Iranica that grows in high temperature areas of south and west of Iran with the common Persian names of *Mooshkorok*, *Den* and*Denak*. In traditional medicine, it is used for digestion, diarrhea, abdominal pain andFever [6]. The family umbelliferae is rich in secondary metabolites andembodies numerous genera of high economic and medicinalvalue, yielding flavonoids, coumarins, acetylenes, terpenes andessential oils [7]. The essential oil of aerial parts of *Oliveria decumbens* was obtained by hydrodistillation and analyzed by GC-MS and 10 components were identified in the essential oil of *Oliveria decumbens*. The main components were γ-terpinene, myristicin, thymol, ρ-cymene and carvacrol[8].

In this study, Microwave-assisted hydrodistillation was applied as a new and green technology. Despite many studies reported on the extraction of essential oils from different *Oliveria* species, there were no reports on the extraction of essential oils from *O. decumbens* using Microwave-assisted hydrodistillation. Therefore, the aim of this work was to use the Microwave-assisted hydrodistillation technique for the extraction of essential oil from dried *O. decumbens* to compare the composition of the extracted essential oil with that obtained by conventional hydrodistillation.

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## MATERIAL AND METHODS

*Plant Material:*

The aerial parts of *O. decumbens* were collected in May 2013 from the Genou protected area, at an altitude of 880 m, Bandar Abbas, Hormozgan. Samples of the plant were identified by Dr. Bahmani, Medicinal Plants Research Institute Herbarium, Islamic Azad University, Firoozabad, Iran. Aerial parts of plants were air-dried at room temperature (25°C) in the shade.

*Essential Oil Extraction:*

70 g of the aerial parts of the plant were powdered and subjected to hydrodistillation, using a Clevenger-type apparatus for 2 h. typical microwave assist hydrodistillation procedure performed at atmospheric pressure. The microwave oven was operated at 990 W power levels for a period of 30 min. This period was sufficient to extract all the essential oils from the sample [9]. In both cases 70 g of dried *O. decumbens*powder were placed in the distillation flask of the apparatus. In case of microwave assist hydrodistillation the volume of introduced water was 50 mL. The extracted essential oils by both methods, were separately collected and dried over anhydrous sodium sulfate and stored in sealed vials, protected from the light at 4 °C until analysis.

*GC and GC Mass:*

Oil was analyzed by GC and GC/MS. Gas chromatography analysis was carried out on a Perkin-Elmer 8500 gas chromatograph with FID detector and a BP-1 capillary column (30 m × 0.25 mm; film thickness 0.25 μm). The carrier gas was helium with a flow rate of 2 ml/min, the oven temperature for first 4 min was kept at 60 °C and then increased at a rate of 4 C/min until reached to the temperature of 280 °C, injector and detector temperature were set at 280 °C. The identity of the components was achieved from their retention indices, calculated by linear interpolation relative to retention times of a series of n-alkanes, and their mass spectra, which were compared with those from our own library and from literature data[9]. the percentage of peak area relative to the total peak areas from all compounds was determined and reported as relative amount of that compound.

## RESULTS AND DISCUSSION

The chemical composition of the volatile fractions obtained from *O. decumbens* during two extraction processes are represented together with the retention indices in Table 1. Essential oil extraction withmicrowave-assisted hydrodistillation started at a much earlier time than that with normal hydrodistillation (10min vs. 70 min, respectively). This is due to the moreefficient heat flow involved with microwaves. The GC–MS analysis ofthe oil samples revealed the presence of a total of 27 components.

The total yield of the volatile fractions obtained through conventional hydrodistillation and microwave-assisted hydrodistillation was 0.79 % and 0.96 %, respectively. 11 compounds were identified in the hydrodistilled oil which accounted for 99.9% of the total oilcomposition. 14 compounds were identified from the microwave extracted oilwhich accounted for 99.86 % of the total oil composition.

The two oils recovered from hydrodistillation and microwave-assist hydrodistillaton extraction contained the same dominant components: Carvacrol (28.80%, 34.80%); Thymol (26.90%, 34.36%); myristicin (7.57%, 20.88%) andp-Cymene (16.59%, 2.04%) respectively. The chemical formula of these compounds are shown in Figure 1.

The method of essential oil extraction affects their chemical compositions and biological activities. Recently, some studies [10,11] showed that Microwave-assist hydrodistillation oil was more active against microorganisms than the oil obtained through HD. This may be partly due to the fact that the microwave extracted oil and these clases of compounds have been proved to possess strong antibacterial and antifungal activities [12,13].

The application of microwave for hydrodistillation to separate an essential oil from *O. decumbens*showed another example of the benefits of applying microwave irradiation as a heat source in separating essential oils, viz. the much shorter time used in the separation process to give the same yield of oil. However, the use of the microwave as a heat source for distillation might be the cause for a slight difference in the composition of the oil from that of the conventionally obtained oil.

*Conclusion:*

Microwave-assisted hydrodistillation offered substantial advantages over conventional hydrodistillation. A similar extraction yield was achieved at a significantly shorter extraction time when using microwave-assisted hydrodistillation instead of conventional hydrodistillation. Therefore, considering the operation cost, microwave-assisted hydrodistillation could be carried out using half of the expenses required by hydrodistillation. GC–MS results indicated that some difference between the amounts and number of these components in microwave-assisted hydrodistillation oil, compared with the hydrodistillation oil. A possible

reason for these minor differences may be the different heat sources applied in the two methods. It is known that a solution in the microwave is sometimes superheated, with the temperature of the solution being as much as 20 degrees higher than normal.

**Table 1:** Chemical composition of *O. decumbens* essential oils obtained by hydrodistillation HD andmicrowave extraction MAHD.

| No. | Compound | KI | HD% | MAHD% |
|---|---|---|---|---|
| 1 | α-Pinene | 979 | 3.15 | --- |
| 2 | p-Cymene | 1026 | 16.59 | 2.04 |
| 3 | α-Limonene | 1030 | 4.28 | --- |
| 4 | Moslene | 1060 | 10.68 | 0.81 |
| 5 | verbenone | 1216 | 0.34 | 0.43 |
| 6 | Thymol | 1287 | 26.90 | 34.36 |
| 7 | Carvacrol | 1288 | 28.80 | 34.80 |
| 8 | Hydroxyl-p-cymen | 1302 | 0.42 | 0.73 |
| 9 | Myristicin | 1526 | 7.57 | 20.88 |
| 10 | β-Elemene | 1553 | 0.33 | 0.74 |
| 11 | spathulenol | 1583 | --- | 0.64 |
| 12 | Caryophyllene oxide | 1590 | 0.87 | 0.41 |
| 13 | Torreyol | 1647 | --- | 0.55 |
| 14 | α-Eudesmol | 1657 | --- | 0.83 |
| 15 | γ-Cadinene | 1660 | --- | 1.62 |
| 16 | zizanal | 1697 | --- | 0.98 |
| | *Total* | | 99.9 | 99.86 |

KI: Kovat's index, HD: Conventional hydrodistillation, MAHD: Microwave-assisted hydrodistillation.

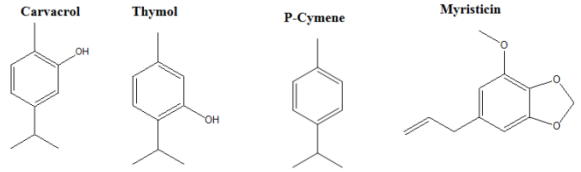


**Fig. 1:** Four major compounds of *O. decumbens.*

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