Original Article

The Influence of Different Drying Methods on Essential Oil Content and Composition of Peppermint (*Mentha piperita L.*) in Çukurova Conditions

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ABSTRACT

Objective: Peppermint (*Mentha piperita L.*) is largely cultivated and commercialized in several countries to produce peppermint oil and its medicinal compounds, cosmetic products and food purposes.[1,2] In this study, the influence of different dying methods on essential oil content and composition of peppermint was determined. **Material and Methods:** The plants were dried separately in the sun, shadow and oven at 38oC for 48 h. The dry material was then submitted to hydro distillation in order obtain to essential oil. The chemical composition of essential oil from the flowering aerial part of peppermint analyzed by GC/MS. **Results:** Plant height (22.7 – 31.8 cm), fresh (750-992 kg da^{-1}) and dry herbage yield (245 - 351 kg da^{-1}) were measured. The highest essential oil content (3.68 %) was obtained from shadow drying method, the lowest value (2.78 %) was obtained from drying under sun. The major compounds (menthone and menthol) showed no sharp difference among the three drying methods. **Conclusion:** The drying method affected strongly the essential oil composition of dry peppermint.

Keywords: Peppermint, Drying methods, Yields, Essential oil, Menthol.

INTRODUCTION

Peppermint (*Mentha piperita* L.) is a valuable essential oil and spice plant from the Lamiaceae family. Peppermint is largely cultivated with commercial purposes in several countries for the production of peppermint oil and its medicinal constituents, having applications in cosmetic and food industries.[1] Peppermint leaves are harvested several times in a year. Herbs are naturally dried under sunlight and this drying method is widely used in many countries. Herbs and spices have been exported as dried products for preservation. The method of drying usually has a significant effect on quality and quantity of the essential oils form such plants.[2] The aim of the present study was to determine the influence of different drying methods (sunshine, shade and oven-drying at 38 °C) on dry herbage yield and essential oil content and composition of peppermint (*Mentha piperita* L.).

MATERIALS AND METHODS

This study was conducted at the Department of Field Crops, Faculty of Agriculture, University of Çukurova, Adana, Turkey. Field trial was conducted in a randomized complete block design, with three replications. Plants were rooted in greenhouse from December (2015) until March (2016). The seedlings were transplanted to experimental field at 31th March, 2016. In the flowering

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stage, plants were harvested (July 25, 2016). Each plot consisted of 7 rows, and the distance between plants within rows was 30 cm, and the spacing between rows was 70 cm. Three drying methods (sun-drying, shade-drying and oven-drying at 38 °C) were investigated in order to find the most suitable method for drying. In each method, 0.5 kg of fresh aerial parts were used. The plants were dried separately for 48 h. The dry material was then submitted to hydro distillation in Clevenger for two hours in order to determine the essential oil. The chemical composition of essential oil from harvested aerial part of peppermint was analyzed at the flowering stage through GC/MS method (attached to HP-5MS capillary column (30 m x 0.25 mm x 0.25 μm film thickness, %5 phenyl methyl poly siloxane, the carrier gas by Heat flow rate was 1 ml/min, split ratio 1:30, oven temperature program was started at 50°C (held for 3 min.) while column temperature was linearly programmed from 50-240°C, at rate of 3°/min, diluted with dichloromethane, split ratio was 1:25, injected 1 μl). The constituents were identified by comparison of their mass spectra to those from Agilent Flavor libraries. The variance analysis of data was analyzed with MSTAT-C software by using LSD's test.

RESULTS AND DISCUSSION

Results of variance analysis showed that fresh and dry herbage yields and essential oil contents were affected significantly by the drying treatments (Table 1). The highest dry herbage yield (351 kg da^{-1}) was observed in the shade dried plants, while the lowest (245 kg da^{-1}) was obtained from sun-dried plants. The highest level of essential oil was observed in the shade-dried plants, albeit with no significant differences from that of oven-dried plants. The lowest level of essential oil was observed in sun-dried plant. That results are in agreement with earlier work done by previous researchers.[2,3] In spite of all technical developments, the choice of the correct drying temperature remains as central economic and ecological criterion in the drying of medicinal plants.[4,5] Chemical composition of essential oils varied according to drying methods (Table 2). Content of dominant component (Menthone) was 39.138 %, along with Menthol 17.337% in the sun drying method. In the essential oil obtained from shade-dried herb, contents of menthone was 37.178 %. In the essential oil obtained from the oven- dried herb,

Table 1: Fresh and Dry herbage yield and Essential Oil content of *Mentha piperita L.* by different drying methods.

Drying method	Plant Height (cm)	Fresh Herbage Yield(kg da-1)	Dry herbage yield (kg da-1)	Essential oil (% DM)
Sun-drying	22.9	753.3 b	245 c	2.78 b
Shade-drying	31.8	992.0 a	351 a	3.68 a
Oven-drying	24.1	905.0 a	321 b	3.49 a
F-test	-	*	**	*
LSD (5 %)	-	18.39	124.5	0.683
CV (%)	-	2.65	6.22	9.07

*and**: Statical significance at alpha level 0.05 and 0.01, respectively, means followed by different letters in the same column are statically different.

Table 2: Chemical composition of essential oils of herb *Mentha piperita L.* dried by different methods (%)

RT	Constituents	Drying method		
		Sun Drying	Shade Drying	Oven Drying
7.031	α-phellandrene	0.101	-	0.125
7.238	α-pinene	1.071	0.967	1.142
8.767	sabinene	0.403	0.469	0.552
8.842	β-pinene	1.262	1.112	1.287
9.542	Myrcene	0.333	0.436	0.542
10.866	p-Cymene	0.121	-	0.072
11.035	limonene	1.523	1.264	1.496
11.114	Eucalyptol	6.603	5.712	6.442
11.554	Ocimene	-	-	0.135
12.714	Linalyl butyrate	0.328	0.284	0.330
14.280	linalool	0.084	-	0.096
16.219	Farnesol (Z,E-)	0.135	-	-
16.683	Menthone	39.138	37.178	40.390
17.055	Isopulegol	7.608	11.175	10.307
17.531	Menthol	17.337	17.976	16.078
18.286	α-terpineol	0.109	-	0.116
20.462	Trans-2,4-Decadienal	17.288	15.496	13.975
21.069	D-piperitone	0.739	0.746	0.779
22.117	Citronellyl butyrate	0.173	-	0.128
22.939	Menthyl acetate	0.749	1.467	1.420
27.025	Guaiyl acetate	-	-	0.084
28.050	β-Caryophyllene	0.530	1.166	0.892
30.568	Farnesol (Z,E-)	-	0.258	0.226
34.440	Farnesol (E,E-)	0.225	0.153	0.161
	Sum of contents %	95.86	95.86	96.77

contents of Menthone and Menthol were 40.390 % and 16.078 %, respectively.

Many articles have reported menthol as the main component of peppermint essential oil[1], according to this study, the main component of peppermint essential oil was menthone.

Changes in the concentrations of essential oil compounds during drying process depend on several factors, such as drying method, age of plants and cultivation conditions[2]. Quantities of the different components of essential oil were not affected by drying methods, there were little differences between the values of the first four components, the highest menthone value (40.39 %) was obtained from oven drying method. The major compounds, menthone and menthol, showed statistically non-significant d di erence among the three drying methods, nevertheless, a higher amount of menthone was obtained by oven-drying method

CONCLUSION

From the results it can be concluded that the highest essential oil contents was observed in plant material dried under shade followed by oven drying methods. The drying methods did not affect the composition of the essential oil. However, shade- drying method could be suggested as the more convenient method to isolate peppermint essential oil.

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CONFLICT OF INTEREST

None

ABBREVIATIONS USED

GC/MS: Gas Chromatography/ Mass Spectrometry; MSTAT-C: Analysis of variance; C: Celsius; LSD: Least Significant Differences; CV: Coefficient of Variation; RT: Retention Time.

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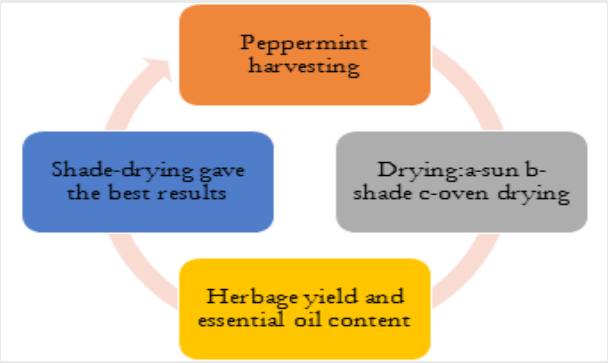

SUMMARY

- This study reports the influence of different dying methods on essential oil content and composition of peppermint.
- Three drying methods (sun-drying, shade-drying and oven-drying at 38°C) were investigated in order to find the most suitable method for drying.
- The highest dry herbage yield and essential oil content were observed in the shade-dried plants.
- Chemical composition of essential oil changed in small quantities according to drying methods.

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