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Short communication

Active substances and colour characteristics of Peppermint (*Mentha* x *piperita* L.) leaves influenced by different preservation methods

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Introduction

Peppermint (*Mentha* x *piperita* L.) is a well known rhizomatous perennial herb belonging to the *Lamiaceae* plant family with significant medicinal and aromatic attributes. The most important parts of the plant are the leaves (*Menthae piperitae folium*) where essential oil containing glandular trichomes are present along with many other active substances. The main aim of this study was to find the best preservation methods in order to conserve the colour characteristics and the most important active substances present in peppermint leaves.

Materials and methods

Plant material

This study was conducted on a Hungarian peppermint variety named "Mexián". The plant stand was established in the Experimental Field of the Department in Soroksár, Hungary in 2021. In full flowering stage (in late July), approximately 5 kg of leaves were harvested. The homogeneous plant material was divided into ten parts for the different treatments.

Preservation methods

In our experiment, nine preservation methods (sun drying, shade drying, oven drying at 40 and 60ºC, lyophilization, microwave drying at 250 and 700 W, slow freezing and fast freezing) were investigated in comparison to the freshly harvested plant material (control). The time span of drying for the different drying methods was as follows:
Sun drying: 3 days (Day temp.: 38-41ºC, Night temp.: 25-27ºC)
Shade drying: 8 days (Day temp.: 24-27ºC, Night temp.: 18-20ºC)
Oven drying at 40ºC: 30 hours
Oven drying at 60ºC: 5 hours
Microwave drying at 250W: 15 minutes
Microwave drying at 700W: 6 minutes

Chemical analyses

In order to determine the essential oil content of peppermint leaves, 60 g fresh and frozen (slow and fast) leaves, furthermore 20 g of each dried samples were hydro distilled for 1 hr in a Clevenger-type apparatus in 3 replications. For GC-MS analysis, an Agilent Technologies 6890 N chromatograph equipped with HP-5 and HP-5ms capillary columns was used. Measurements were taken in three replications. The total phenolic content (TPC) was determined from the aqueous extracts prepared from peppermint samples by using the modified method of Singleton and Rossi (1965). The total antioxidant capacity (TAC) of the same extracts was measured using FRAP method according to the modified method of Benzie and Strain (1996). The extracts were prepared in three replications for each treatment. Three parallel measurements were carried out from every biological replicates. Values obtained in each chemical analysis were referenced to the dry matter content of the samples.

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Colour measurement

Colour of peppermint leaves was measured in six replications using a Konica Minolta CR-410 tristimulus colorimeter. L* (lightness), a* (±red/ green) and b* (± yellow/ blue) values were recorded and a*/b* data was calculated.

Results and discussion

Essential oil content

In fresh sample 3.58 ml/100 g EO content was found. Oven drying at 40ºC and freezing treatments could preserve the EO content the most (3.10-3.35 ml/100 g), but natural drying methods (sun and shade drying) and lyophilization also resulted in rather high values (3.06, 2.90 and 2.69ml/100 g, respectively). However, in oven dried sample at 60ºC the EO content significantly decreased (1.82 ml/100 g), and the volatiles were almost completely lost during microwave drying (at 250W 0.14 ml/100 g, while at 700W only 0.09 ml/100 g EO content remained).

Essential oil composition

The EO composition of fresh and samples conserved by different preservation methods were quite similar, except in microwave dried (at 250 and 700W) peppermint leaves.

The major EO compounds were menthone (35.5-43.5%), menthol (30.2-35.0%), methofuran + isomenthone (5.9-6.7%), 1,8–cineol (4.5-6.7%), limonene (2.7-7.6%) and menthyl acetate (2.6-3.6%).

In microwave dried samples significant changes were observed: the limonene (0.1-0.3%), 1,8-cineol (0.2-0.3%), menthone (9.7-14.9%) and methofuran + isomenthone (3.9-4.0%) ratio significantly decreased (these compounds presumably evaporated during microwave drying), while in parallel with this the ratio of menthol (49.2-40.2%), methyl acetate (8.2-9.9%) and the proportion of sesquiterpenes present (germacrene D, bicyclogermacrene and viridiflorol) considerably increased in the EO.

Total Phenolic Content (TPC)

The highest TPC was measured in the fresh sample (292.4 mg GAE/g). Every treatment significantly reduced the TPC, but peppermint leaves dried in shade, at 40°C, in microwave at 700W or by lyophilization could preserve a relatively lot of phenolic compounds (145.4-166.8 mg GAE/g). The lowest TPC was recorded in samples dried at 60ºC and microwaved at 250W (70.2 and 68.7 mg GAE/g, respectively).

Total antioxidant capacity (TAC)

In case of TAC a trend similar to TPC could be observed. The significantly highest antioxidant capacity was found in the fresh sample (314.3mg AAE/g), while the lowest values were measured in the leaves oven dried at 60ºC and microwaved at 250W (95.8 and 97.1mg AAE/g, respectively). In lyophilized, oven dried at 40ºC, shade dried and microwave dried (700 W) samples, a relatively higher TAC could be detected (231.7, 211.9, 210.2 and 203.9 mg AAE/g, respectively).

Colour measurement

Freezing and lyophilization proved to be the best methods in preserving the original colour of fresh peppermint leaves. Although lyophilized sample was pale green in colour. During oven drying at 60ºC and microwave drying at 250W, the green colour of leaves is almost completely lost.

Conclusion

According to the results it can be concluded that the gentle methods (shade drying, oven drying at 40ºC, lyophilization and freezing) proved to be the most effective preservation methods among the applied treatments. The fastest and cheapest drying technique, microwave drying at 700W can also preserve the colour, TPC and TAC of peppermint leaves very well, but it causes a significant EO loss.

References

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