

The effect of different preservation methods on the colour and active substance content of Summer Savory (*Satureja hortensis* L.) leafy shoots

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Introduction

Summer savory (*Satureja hortensis* L.) is a well known annual, herbaceous spice plant belonging to the *Lamiaceae* plant family with significant importance in culinary and herbal medicine. Flowering leafy shoots (*S. hortensis* herb) are the most important parts of the plant where essential oil containing glands are present along with many other active substances. This study aims to find the best preservation methods in order to conserve the organoleptic properties and the most important active substances present in summer savory plant.

Materials and methods

Plant material

A Polish hybrid variety named “Saturn” was used for the examinations. The plant stand was established in the Research Field of the Department in Soroksár, Hungary in 2020. Approximately 5 kg of flowering leafy shoots were harvested at the beginning of August, in full flowering stage. The homogeneous plant material was divided into ten parts for the different treatments.

Preservation methods

In our experiment the effect of sun drying, shade drying, oven drying at 40°C and 60 °C,

lyophilization, microwave drying at 250 and 700 W, slow freezing and fast freezing was investigated compared to the freshly harvested plant material. The duration of drying for different drying methods were as follows:

Sun drying: 2 days

Shade drying: 12 days

Oven drying (40 °C): 20 hours

Oven drying (60 °C): 6 hours

Microwave drying (250 W): 15 minutes

Microwave drying (700 W): 6 minutes

Chemical analyses

For essential oil extraction, 40 g fresh (or frozen) and 20 g of each dried samples were distilled for 2 h 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. Determination of total phenol content (TPC) of aqueous extracts prepared from summer savory samples was carried out by the modified method of Singleton and Rossi (1965). Antioxidant capacity (AC) 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.

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Triplicate measurements were carried out from each of the three biological replicates. Values obtained in each chemical analyses were referenced to the dry matter content of the samples.

Colour measurement

Konica Minolta CR-410 tristimulus colorimeter was used for colour determination. L*, a* and b* values were recorded and a*/b* was calculated. The measurements were performed in six replications.

Results and discussion

Essential oil content

In fresh and lyophilized samples, similar amount of essential oil was obtained (1.96 mL/100 g). The highest essential oil content was recorded in the shade dried and oven dried at 40 °C samples (2.50 and 2.44 mL/100 g, respectively), but we found high values in slow and fast frozen samples too (2.23 mL/100 g). In case of oven dried (60 °C) and sun dried samples, the essential oil content significantly decreased (1.40 and 0.97 mL/100 g, respectively), and in case of microwave dried samples it was almost completely lost (250 W: 0.40 mL/100 g and 700 W: 0.17 mL/100 g).

Essential oil composition

The essential oil composition of fresh summer savory flowering leafy shoots and samples dried in shade, at oven 40 °C, frozen slowly and fastly were very similar: the major compounds were carvacrol (63.2-70.4%), γ -terpinene (19.6-22.3%) and p-cymene (3.5-4.9%). We also obtained rather similar essential oil composition in case of samples dried in the sun, in oven at 60 °C and after lyophilization (carvacrol: 67.8-69.1%, γ -terpinene: 17.1-18.8% and p-cymene: 4.2-5.1%), although in lyophilized sample some new minor compounds also appeared (e.g. trans-anethole in 0.81%). But in case of microwave dried samples we experienced significant changes: the γ -terpinene (2.3-4.1%) and p-cymene (0.7-1.1%) content significantly decreased, possibly because these compounds evaporated during drying, while the content of carvacrol (85.3-86.4%) increased in their essential oil.

Total Phenolic Content (TPC)

The significantly highest TPC was measured in the fresh and shade dried samples (302.0 and 231.6

mg GAE/g, respectively), but slow frozen, lyophilized, microwave dried at 700 W, sun dried and oven dried at 40 °C samples also contained a lot of phenolic compounds (176.4-208.2 mg GAE/g). The lowest TPC was recorded in the summer savory sample dried in the oven at 60°C (113.8 mg GAE/g).

Total antioxidant capacity (TAC)

The significantly highest antioxidant capacity was recorded in fresh sample (283.5 mg AAE/g), while the lowest AC was observed in leafy shoots dried at 60 °C (66.5 mg AAE/g). In case of shade dried, lyophilized and microwave dried (700 W) samples, we found similar, and rather high antioxidant potency too (166.5, 163.7 and 157.3 mg AAE/g, respectively).

Colour measurement

Freezing and lyophilization could preserve the fresh sample's original colour the best. However, lyophilized sample was paler green. Sun drying and oven drying at 60 °C caused spectacular colour degradation.

Conclusion

According to the data of this experiment, the gentle drying methods (shade drying, oven drying at 40 °C, lyophilization) and freezing proved to be the most effective preservation methods among the applied treatments. Microwave drying at 700 W was a very fast and cheap drying technique, the sample thus preserved contained appreciable amount of TPC and TAC but most of the essential oil evaporated from the plant parts during drying.

References

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