Influence of Drying Methods, Extraction Time, and Organ Type on Essential Oil Content of Rosemary (*Rosmarinus officinalis* L.)

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Abstract: Rosemary (*Rosmarinus officinalis* L.) is belonging to *Lamiaceae* family which grows wild in most Mediterranean countries. In order to investigate the influence of different methods of drying, extraction time, and type of organ on the essential oil percentage of this plant an experiment was carried out in college of agriculture of Karaj during the year 2009. Three drying methods investigated were oven drying (45ºC), shade drying and sun drying. Four extraction times were: 1, 2, 3, 4 hours and three organ type were leaf, stem, mixed leaf and stem. Essential oil was obtained by water distillation method. Results showed that effect of drying methods, extraction time, and organ type on the essential oil percentage were significant. The maximum essential oil percentage (1.8%) was obtained to leaf sample, 3h of extraction, and shade drying. While the minimum essential oil percentage (0.12%) was obtained to stem sample, 1h of extraction, and oven drying. [Nature and Science. 2009;7(11):42-44]. (ISSN: 1545-0740).

Key words: *Rosmarinus officinalis* L.; Drying Methods; Extraction; Essential oil

1. Introduction

Rosemary (*Rosmarinus officinalis* L.) is a spice and medicinal herb widely used around the world. Of the natural antioxidants, rosemary has been widely accepted as one of the spices with the highest antioxidant activity (Wang et al, 2008., Peng et al, 2005., Oluwatuyi et al, 2004). Rosemary essential oil is also used as an antibacterial, antifungal and anticancer agent. Major constituents described for the oil are α-pinene, 1, 8-cineole and camphor. The post-harvesting process of medicinal plants has great importance in the production chain, because of its direct influence on the quality and quantity of the active principles in the product sold. Drying has been one of the most important processes in pre-processing of agricultural products. Aromatic plants are often dried before extraction to reduce moisture content. The aim of drying is to reduce the moisture content of the product from actively growing in the field to a level that prevents deterioration of the product and allows storage in a stable condition. Proper drying of medicinal plants is fundamental to the achievement of a high quality product. A literature search was undertaken on effects of different methods of drying on essential oil content and chemical composition of the essential oil plants. The results showed that drying method had a significant effect on oil content and composition of aromatic plants (Okoh et al, 2008., Asekun et al, 2006., Ahmadi et al, 2008., Ronicely et al, 2008., Diana et al, 2008). Also duration of essential oil extraction affected on the quantity and quality of essential oil. Jamshidi et al. (2004) reported that essential oil percentage and essential oil component of fennel were affected by duration of essential oil extraction. The objective of this study was to evaluate the influence of drying methods, extraction time, and type of organ on essential oil content of *Rosmarinus officinalis* L.

2. Materials and Methods

Rosmarinus officinalis L. were collected in college of agriculture of Karaj in during the year 2009 (longitude: 50° 59´E, Latitude: 35° 47´N, height of sea level (m): 1312/5, average annual rainfall (mm): 230, and mean annual temperature: 14.3 °C). The fresh plant materials were carefully separated into leaves, stems, and mixed of stems and leaves. Three drying methods investigated were oven drying, shade drying and sun drying. One of samples (100gr) was dried at room temperature and shade for 5 days. One of samples (100gr) was dried at sun for 3 days and other sample (100gr) was dried at oven (45ºC) for 24 hours. This work performed for each sample with three replications. In order to extraction of essential oil, 100gr from each sample powdered and then essential oil isolated by water distillation for 1, 2, 3, 4 hour and to three replications. The essential oils were separated from the aqueous layer, dried over anhydrous sodium sulfate and calculated average of essential oil yield for three replications.

3. Results and Discussion

Results showed that drying methods, extraction time, and type of organ had a significant effect on the essential oil content of Rosemary. The maximum essential oil percentage (1/8%) was obtained in leaf,

shade drying, and 3h. The minimum essential oil percentage (0.12%) was obtained in stem, owen drying, and 1h. The samples that dried in shade had the higher essential oil as compared to samples that dried in sun and owen. Also leaf samples as compared to stem and mixed leaf and stem had the higher essential oil (Table 1). The oil content of shade-dried *Roman chamomil* flowers was found to be larger (1.9% w/w) than there of sun-dried (0.4%) and oven-dried at 40 ºC (0.9%) (Omidbaigi et al, 2004). The drying method also had a significant effect on the proportion of the various components. It was also reported that the chemical composition, physical properties and antioxidant activities of yam flours were affected by drying methods to different extents. Yuan Zhang and Zhezhi Wang (2007) reported that in *Glechoma longituba* different drying methods caused some variation of the relative proportions of the components and the higher amount of germacrene D (19.0%) was obtained by shade-drying. Only sun drying brought about significant losses of the major compounds (a-cadinol, germacrene B, germacrene D-4-ol, and a-caryophyllene) in the essential oil when compared to the fresh plant material. Yuan Zhang and Zhezhi Wang showed that it could be concluded that drying of leaves of *G. longituba* under normal air and at room temperature conditions is most suitable for a high-percentage of sesquiterpene, especially for germacrene D, but the oven-drying and silica gel-drying method are recommended for fast drying and similar components compared to the fresh plant material. Fatemeh Sefidkon et al. (2006) reported that the highest essential oil content of *Satureja hortensis* (1.06%) was obtained to owen- dried sample and the lowest essential oil content (0.87%) was obtained to sun- dried sample. In the *Mentha longifolia* L. only oven drying brought about significant losses of the major compounds (menthone, pulegone and 1,8-cineole) in the essential oil when compared to the fresh plant material (Asekun et al, 2007). The maximum essential oil percentage was obtained at 3h duration of extraction and with increasing duration of extraction not observed increasing in essential oil percentage. Barazandeh, M.M. (2005) reported that duration of essential oil extraction had significant effect on essential oil content in *Eucalyptus globules* and essential oil percentage was increased with the increasing of duration of extraction. Jamshidi et al. (2004) suggested that in *Foeniculum vulgare* Mill the highest essential oil percentage was obtained in 2.5hour.

Table 1. Effect of drying methods, extraction time, and type of organ on the essential oil content of *Rosmarinus officinalis* L.

Time (hour)	Shade drying			Sun drying			Owen drying		
	Leaf	Stem	Mixed leaf and stem	Leaf	Stem	Mixed leaf and stem	leaf	Stem	Mixed leaf and stem
1	0.9	0.21	0.7	0.8	0.19	0.5	0.7	0.12	0.4
2	1.3	0.3	0.9	1.2	0.26	0.7	1.1	0.22	0.7
3	1.8	0.45	1.3	1.62	0.35	1.1	1.5	0.3	0.9
4	1.8	0.46	1.3	1.63	0.36	1.1	1.5	0.3	0.9

4. Conclusions

Rosmarinus officinalis L. is one of the most interesting research plants because it is between medicinal and aromatic plant. The post harvesting process (drying methods and extraction time) have a great importance in the production of essential oil and influenced on the quantity and quality of essential oil. Generally results showed that by shade drying, leaf samples and 3 hour a highest of essential oil percentage was obtained.

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