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Effect of Post Harvest Storage on the Oil Constituents of *Laurus Nobilis* L. Plant

E. W. Hend[1,*] M. E. Ibrahim[1] and M. A. Mohamed[1]

[1]*Research of Medicinal and Aromatic Plants Department, National Research Centre, Giza, 12622, Egypt.*

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Hendwahba
hend_wahba@yahoo.com+2010 06224477

Abstract

The final product of medicinal and aromatic plants depends on the quality of farming systems and manufacturing processes, in addition to the treatment of post-harvest. Storage is an important factor to maintain the quality and safety of medicinal and aromatic plants. This study focused on the comparison of the best ways to store *Laurusnobilis* L. essential oil, whether to store it in the form of essential oils or keep it inside the dry herb until extracting by hydrodistillation. This experiment consists of two parts, the first is storing the distilled oil under cool conditions, while, the second is the volatile oil which stored inside the herb in bags of cartoon and stored in a dry place until extracting. In all cases the essential oil was analyzed by GC/MS every four months for one year. The fresh essential oil (at zero time) consist of approximately 56.83% 1,8-cineole. Other major constituents of oxygenated monoterpens were α-terpenyl acetate (13.47 %), *trans*-beta-terpineol (4.96%) and terpinen-4-ol (3.19). while, α-pinene and sabinene were (4.09 and 6.94%) respectively. On the other hand the constituents of *cis* linalool oxide, isobornyl acetate and β--elemene were identified in concentrations above 1%. The essential oil constituents changes during storage time depend on the storage conditions. The largest change in essential oil constituents for the dry herb was observed after storage period of one year, while this change was less after storage period of four month.Also, oil compounds were more stable during the first eight months of the herb storage, then it reduced after that. At the same time, some changes have been recorded in the chemical composition of *L. nobilis* essential oil stored under cooling conditions due to the duration of storage.

1. Introduction

*Laurusnobilis*L. (bay laurel), family Lauraceae is an evergreen shrub or small tree usually growing to height of 20-30 feet, native to the southern Mediterranean region and is grown on a large scale, particularly in Europe and the United States as an ornamental plant [1-5]. Bay laurel is a plant of industrial importance, used in foods, drugs, and cosmetics.The*Laurusnobilis* leaves have a strong, fragrant, balmy, redolent and sweet aromatic scent. So, the fresh or dried leaves are used as household culinary herb in soups, stews, sauce, fishes and sausages .Also the dried leaves and essential oil are used in the food industry for seasoning of meat products and food preservative, and also in pharmaceutical industries. In addition, volatile oil is used in cosmetic industry such as soap and toiletries production. Bay leaves volatile oil are antioxidant, antibacterial, antifungal, anti-inflammatory and have wound healing properties.[6-13].Traditionally, bay laurel leaves are used in herbal medicine to treat rheumatism, indigestion, earaches, sprains, to promote perspiration [14], More recently, they have been used in the treatment of diabetes and migraines [15]. They have antiepileptic and anticonvulsive activities [16].There are several studies on the chemical composition of the essential oils isolated from the leaves of *L. nobilis* from Turkey[17]; Iran[18], Lebanon [19] and Tunisia[20]. The main components of the reported essential oil were cineole, eugenol, sabinene, 4-terpineol, α-pinene, methyl eugenol and α-terpineol. 1,8-Cineole and α-terpenyl acetate were found as the major constituents of bay laurel oil from Egypt. Also terpinen-4-ol, γ-eudesmol and α-terpineol,were identified in concentrations above 1%[21]).Some of pharmgological activities and quality of laurel volatile oil are related to the major compound [10, 22]. So, it was necessary to know the variation of 1,8-cineole and some other volatile oil components during storage conditions. The influence of drying conditions on the essential oils quality during storage has been investigated by a number of researchers. It has been recorded that the amount of essential oil decreased during the storage time in mint species[23], *Majoranahortensis,*[24], wild ginger (*Siphonochilusaethiopicus*and

Vernoniacolorata)[25]. Heat, light, humidity and air are the most important factors that affecting the content of the herbs and spices of essential oils [26]. Revealing them to those elements that deeply decrease their quality, flavor, color, and volatile oil content. There are a few reports about the effect of storage on quality of *L. nobilis* leaves essential oil for these reasons, storage is important factor to identify the most appropriate way to get a high-quality product, whether in the form of distilled or herb store oil. This study focused on the comparison of the best ways to store *Laurusnobilis* essential oil, whether to store it in the form of essential oils or keep it inside the dry herb until extracted by hydrodistillation.

2. Material and methods

Plant materials and isolation of essential oils.

The leaves of 15-year-old *L. nobilis* shrubs grown in the National Research Centre at Cairo-Egypt were collected in January month at vegetative growth stage. The leaves were dried in the shade. Dried leaves divided into three groups, the volatile oil of the first group extracted by hydrodistillation using a Clevenger- type apparatus for 4h. and analysis after isolation directly (zero time), while the second group packed in bags of cartoon and stored in a dry place after drying directly .The oil of third group was extracted by hydrodistillation after drying directly and placed in tightly closed dark vials then stored in the refrigerator at 4- 5˚C.The oil of the 2nd group was extracted every four months for one year and analysed, as well as the oil stored under cold conditions at the same time interval (every four months for one year) by GC/MS

Chemical analysis

Chromatography/Mass Spectrometry

Hewlett-Packard 5989) equipped with library software (Wiely138 and NBS75 database) was used. A capillary DB5 (methyl-silicone containing 5% phenyl groups) column (30 m × 0.25 mm i.d.) was used. Temperature program: 2 min at 60°C, 60-100°C (2°C/min) and 100-250°C (5°C/min). Helium was used as the carrier gas at a flow rate of 1.0 ml/min. Injection vol- ume: 1.0 µl at a 1:50 split. A mass spectrometer (EI-MS 70 eV) was used with a scan mass range of 40-350 u.

Identification of components

The chemical constituents of *L. nobilis*essential oil were identified based on the data base of mass spectra from the MS library (software Wiely138 and NBS75 database). The obtained data were confirmed by injecting authentic samples of the different components in GC-MS under the same conditions and in comparison with the data obtained from the literature [27].

3.Resulats and Discussion

3.1. Oil percentage

The percentage of essential oils of *Laurusnobilis*L. (bay laurel) leaves recorded 0.67 and 1.14 % (v/w) Based on fresh and dry weight, respectively , while, the percentage of essential oils on a dry weight recorded (0.78%), (0.68%) and(0.54% (v/w)) after 4,8 and 12 months from harvest respectively Fig 1.

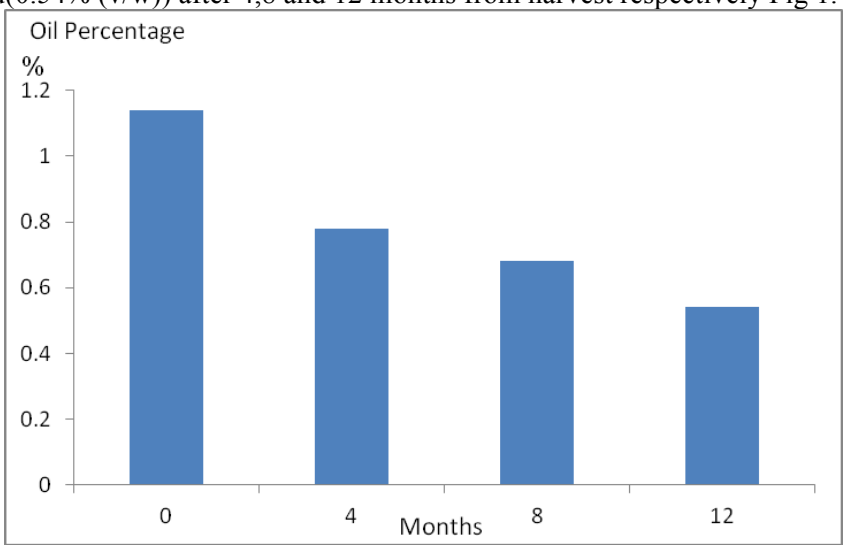

Fig 1 Percentage of *Laurusnobilis*L oil extracted from dry leaves stored for different periods

3.2. Chemical constituents

The volatile components of *L. nobilis* from Egypt were identified by GC/MS.fifteen components have been identified that represent nearly 98.45% of the essential oil constituents (Table, 1, 2). The zero time volatile oil of *L. nobilis* was characterized by high amounts of 1, 8-cineole (56.83%), α-terpinenyl acetate (13.47%), sabinene (6.94%), *trans*-beta-terpineol (4.96%), α-pinene (4.09%) and terpinen-4-ol (3.1%). Significant values of some other terpenoids constituents such as *cis*-linalool oxide (1.38%). iso- bornyl acetate (1.02 %) and β-elemene (1.61) were detected. Lower amounts of α–pinene (0.45%), linalool (0.92 %), *trans*pinocaveol (0.77%), α-terpineol (0.46%), γ–eudesmol (0.8%), phytol (0.81%) and tetracosane (0.75%) were found. The obtained data showed that fresh volatile oil of the Egyptian *L. nobilis*was rich in oxygenated monoterpenes, which recorded 83% (Table 3). The oil components showed variable response to storage conditions; some increased while the others decreased during the course of storage up to one year. In addition, they were affected by the storage methods. The volatile oil composition changes during storage time depending on the storage conditions. There were obvious changes between the essential oil components of the oil stored during storage period. The major component (1,8 cineol) increased markedly during storage up to 8 months , it amounted to 61.59 % in stored herb as compared to other treatments. Also, the same treatment gave the maximum value of oxygen containing monoterpenes (87.19) against (83.0 and 77.45) for dry leaves stored on zero time and 12 months from the beginning of the storage. Monoterpene hydrocarbons showed decreased dramatically from 11.48% at zero time to (9.39, 7.62, and 8.34%) after 4, 8 and 12 months of storing oil in dry herb respectively. Also , the same group(MH) of distilled essential oil decreased under cool temperature conditions from 11.48% for zero time to 7.03, 10.66 and 9.52% after 4,8 and 12 months from the storage respectively (Table, 3)

Table (1). Variance in percentage of major compounds in volatile oil *Laurusnobilis* L. extracted from leaves stored under room temperture.

Storage period Compound	KI	Group	Zero time	Stored herb		
				4 month	8month	12month
α-pinene	339	MH	04.09	3.41	2.34	2.52
Sabinene	976	MH	6.94	5.98	5.28	5.82
β-pinene	980	MH	0.45	0	0	0
Total (MH)		MH	11.48	9.39	7.62	8.34
1,8-Cineole	1033	OM	56.83	53.77	61.59	49.3
cis-Linalool oxide	1074	OM	1.38	1.08	0.87	1.1
linalool	1089	OM	0.92	1.36	1.06	0.16
trans-Pinocarveol	1139	OM	0.77	0.56	0.75	0.64
trans-beta-terpineol	1163	OM	4.96	6.94	6.08	5.39
Terpinen-4-ol	1177	OM	3.19	4.07	3.16	3.43
α-Terpineol	1189	OM	0.46	0.45	0.49	0.74
Isobornyl acetate	1285	OM	1.02	0.75	0.99	1.46
α-Terpinyl acetate	1350	OM	13.47	15.31	12.2	15.23
Total (OM)			83	84.92	87.19	77.45
β–Elemene	1375	SH	1.61	1.43	0.99	1.95
γ–Eudesmol	1630	SO	0.8	0.57	0.21	0.65
phytol	1949	VC	0.81	0.54	0.31	0.92
Tetracosane	2400	VC	0.75	0.44	0.24	0.32
Total (VC)		VC	1.56	0.98	0.55	1.24
Total (all)			98.45	96.66	96.56	89.63

MH = Monoterpene hydrocarbons OM= Oxygen-containing monoterpenes SH= Sesquterpenes-hydrocarbons SO= Oxygen-containing sesquterpenes VC= Various compound

Table (2). Variance in percentage of major compounds in volatile oil*Laurusnobilis* L. Extracted from fresh leaves and stored under cold conditions.

Storage period Compound	KI	Group	Zero time	Stored oil		
				4 month	8month	12month
α-pinene	339	MH	04.09	2.11	3.69	4.13
Sabinene	976	MH	6.94	4.79	6.62	5.39
β-pinene	980	MH	0.45	0.13	0.35	0
Total (MH)		MH	11.48	7.03	10.66	9.52
1,8-Cineole	1033	OM	56.83	52.32	49.02	52.89
cis-Linalool oxide	1074	OM	1.38	0.8	0.98	1.09
linalool	1089	OM	0.92	0.61	0.5	1
trans-Pinocarveol	1139	OM	0.77	0.28	0.71	0.57
trans-beta-terpineol	1163	OM	4.96	6.77	5.04	6.44
Terpinen-4-ol	1177	OM	3.19	4.18	3.52	3.02
α-Terpineol	1189	OM	0.46	1.2	1.95	0.59
Isobornyl acetate	1285	OM	1.02	1.12	1.13	1.32
α-Terpinenyl acetate	1350	OM	13.47	14.22	14.47	12.96
Total (OM)			83	81.5	77.32	79.88
β–Elemene	1375	SH	1.61	2.22	2.21	1.26
γ–Eudesmol	1630	SO	0.8	0.7	0.5	000.47
phytol	1949	VC	0.81	0.47	0.47	0.39
Tetracosane	2400	VC	0.75	0.5	1.11	0.32
Total (VC)		VC	1.56	0.97	1.58	0.71
Total (all)			98.45	92.42	92.47	91.84

MH = Monoterpene hydrocarbons OM= Oxygen-containing monoterpenes SH= Sesquterpenes-hydrocarbons SO= Oxygen-containing sesquterpenes VC= Various compound

Table (3). Percentage of the main chemical classes of essential oil from Laurusnoblis leaves.

Chemical class	Number of months storage						
	Fresh oil	Stored herb			Stored oil		
	Zero time	4	8	12	4	8	12
Monoterpene hydrocarbons (MH)	11.48	9.39	7.62	8.34	7.03	10.66	9.53
Oxygenated monoterpenes (OM)	83.0	84.92	87.19	77.45	81.50	77.32	79.88
Sesquiterpene hydrocarbons (SH)	1.61	1.43	0.99	1.95	2.22	2.21	1,26
Oxygenated sesquiterpenes (OS)	0.80	0.57	0.21	0.65	0,70	0.50	0.47
Various compound (VC)	1.56	0.98	0.55	1.24	0.97	1.58	0.71

Minor qualitative and quantitative differences were also reported in the constituents of *Laurus. nobilis* essential oil under the conditions of storage. SH group recorded 1.61 % in Zero time against 1.43, 0.99 and 1.95 % after 4, 8 and 12 months in the dry herb oil, respectively, while, it recorded 2.22, 2.21 and 1.26 % due to storing the oil in the colorless glass under the cool temperature conditions. At the same time, the same trend was observed with oxygen-containing sesquiterpenes (SO) and various compounds (VC), which gave small amounts of compounds and are not effective in oils constituents.

Generally, the data in (Fig, 2) cleared that the major constituent of this oil were 1,8-cineole reached the maximum value with stored the herb for 8 months against 49.02% and 49.3% where stored the oil for 8 and 12 months in herb and cool temperature conditions. On the other hand, both the constituents α-Terpinenyl acetate, sabinene, *trans*-beta-terpineol and terpinene-4-ol were more stable during storage period (Fig, 1.).Our results are reliable with those recorded in the literature. Many studies such as (Njoroge*et al*.,1996)[28] on *Citrus junos* ((El and (Cesare *et al.,* 2001)[29] on basil oil . They have revealed an increasing of some oil constituents and decreasing of others during storage i.e. Storage affected terpenoids qualitatively and quantitatively, that depended on storage conditions (storage period and temperature).

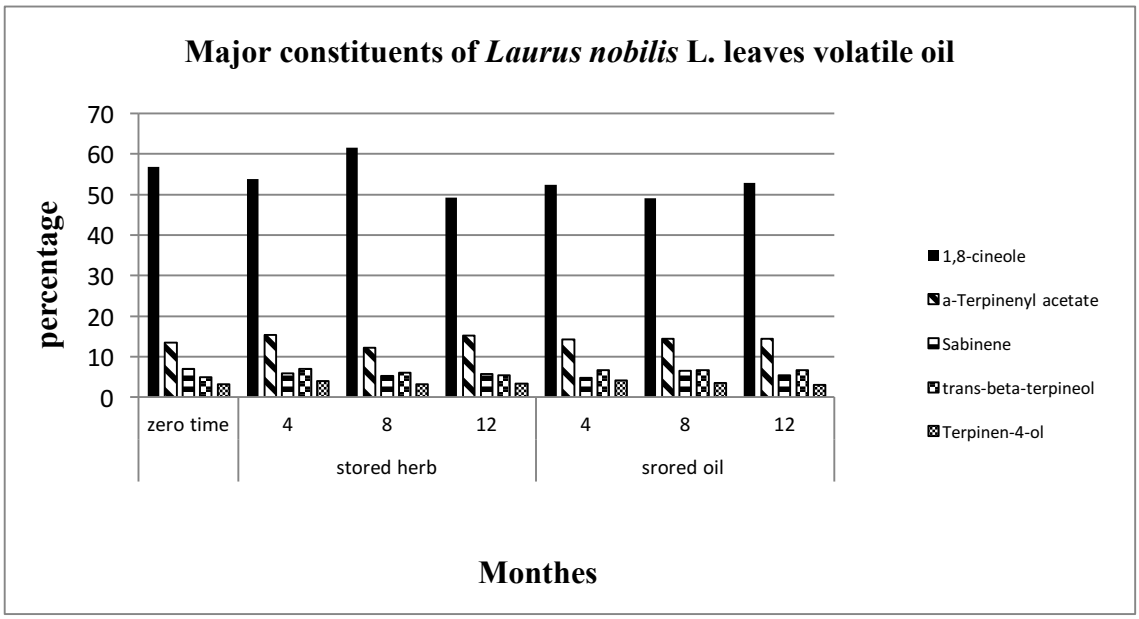

Figure 2. Comparison between the major components of *Laurusnobilis*L.

Conclusion

The major constituent of the essential oil Laurusnobilis L. leaves,(1,8-cineole) reached the maximum value with stored in the herb for 8 months, against stored the oil for 8 and 12 months in herb and cool temperature conditions gave the smallest value . Also, The largest change in essential oil constituents was observed for the dry herb after one year and the smallest was observed in dry herb after four months. Also, oil compounds were more stable during the first eight months of the herb storage, then it reduced after that. On the other hand, both the constituents of α-Terpinenyl acetate, sabinene, *trans*-beta-terpineol and terpinene-4-ol were more stable during storage period.

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