The Selected Method for Drying *Salvia officinalis L.* Plants Under the Climatic Conditions of Arish

Dina Abd Al-Aty Soliman Ahmed[1]

ABSTRACT

This study have been conducted in the experimental farm of the department of plant production, faculty of environmental agriculture science, Arish university, during February – May 2022, to evaluate three major methods of sage drying under North Sinai conditions, eg: traditional methods of direct sunlight drying, and shade drying , third method used electric oven-drying at two different temperatures 45c°and 60c°.Postharvest treatments have been achieved using the first cut of sage (*Salvia officinalis* L.) by in order to select a more suitable drying method of preservation.

Some chemical, physical, and biological analyses have been using explants and the extracted sage essential oil. Results indicated significant differences among drying methods, and reported that selection of a drying method is depending on the aim of drying, since, shading recorded highest value of moisture, ash and oil content, while oven-drying improved antioxidant activity and inhibited microbial activity, as well as enriched both of fat, carbohydrates and plant pigment contents. Ranges of (7.89 – 9.00), (8.56 – 9.93), (32.21 – 33.50), (8.09 – 8.79), (4.01 – 4.76), (56.22 – 62.11), and (2.57 – 3.60)%, have been recorded concerning moisture, ash, fiber, fat, protein, carbohydrates and essential oil contents. Highest contents of both of 1.8-cineole (46.25) have been obtained by sun drying, and camphore (19.50) using shading, β-pinene (7.12) at 45c°of oven-drying, and (-)- bronyl acetate (2.79) due to 60c°.

Keywords: Sage ،Salvia officinalis, Drying, Essential oils, Post-harvest treatments, Electric oven.

INTRODUCTION

Sage (*Salvia officinalis* L.) belongs to the Lamiaceae family as an aromatic herb, that has some medicinal properties, and it have been grown widely in several regions of the world, mostly the Mediterranean. Is Sinai peninsula, such these plants have a distinctive importance due to their spread therapeutic features, addition to the famous multi aromatic uses (Farhat *et al* ., 2013; Sharma ;Fagan .& Schaefer,2019;Jahani *et al*.,2022).

Sage takes part in some food and drinks, it has also some beneficial aspects in dyes, biopesticides and perfumes (Bouayay *et al*., (2013). Prakash *et al*., 2015). Using chemical compositions of the essential oil of *Salvia officinalis* acquired a large demand regarding to folk medicine since hundreds of years, and regarding to different pharmacological purposes (Ghorbani and Esmailizadeh, 2017; Lopresti, 2017). It have been undertaken as an anti-inflammatory, antioxidant, antimicrobial, anti-dementia, antibacterial, anticancer and hypoglycemic (Sertel *et al*., 2011; Sellami *et al*; Abu-Darwish *et al*; 2013; Kontogianni *et al*; 2013; Russo *et al*; 2013; Sharma *et al*; 2019). These huge bioactivities are attributed to the essential oil richness of camphor ,1.8-cineole, α- terpineol , β caryophyllene, Cucalyptol , α- humulene , bornyl acetate , borneal , α and β- theiyone (Li *et al* ; 2015 ; Abbas *et al*; 2016 ; Golparvar *et al* ; 2017 ; Mohammed *et al* ; 2021) . Furthermore, fatty acides, terpenes, alkaloids, phenolic compounds caffeic acid, ferulic acid, rosmarinic acid, steroids, diterpenoids, flavonoids, glycosidic derivatines, ployacetaylenes and carbohydrates (Kadhim *et al*., 2016; Radiulovic *et al*., 2017; EL-Rafie *et al* ., 2022).

In view of effectiveness and quality point, chemical components are considered the related extension of good handling and post-harvest practices, that enable them to be created, acted well and safety, moreover, cultivation conditions, techniques and treatments (Baser and Buchbauer, 2016). One of the main post harvest duties is a process of good during in order to preserve herbs, that though the inhibition of the damaging and destroying caused by the microorganisms and enzymatic activity (Rohor *et al* ; 2011; Chua *et al*; 2019).

During as a preservative technique of post-harvest, have been conducted varying into different methods, since, antient methods of sun and shade drying are the wide range processes, meanwhile, oven drying has faster rate in time concerning productivity, and can avoid the possible contaminations of the surrounded conditions (Udomkun *et al* ; 2020).

Many workers discussed several drying methods, some of them interested medicinal and aromatic plants, especially Lamiaceae such as basial (Demirhan and özebk , 2010) , peppermint (Morad *et al*; 2017), in this regard , oven drying have been investigated at different temperatures , Taha *et al* ; 2015 dried peppermint in a range of 40 – 60 c°, meantime, Saeidi *et al* ; 2016 obtained highest oil content of spearmint at 40 c°. Some other workers focused on sage drying, such as Ahmed,

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[1]Plant Prod. Dept., Fac. Sci. Agric. Environ., Arish Univ., Egypt.
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2018 by using microwave drying, meanwhile, Pachura *et al* , 2022 designed a comprehensive study on multiple drying techniques on sage , furthermore , Imam *et al* ; 2023 studied the effect of different drying methods on both essential oil content and leaves of *Salvia officinalis*.

This study aimed to evaluate three methods of sage drying direct sunlight under North Sinai weather conditions, shading theran (70%) under the same weather, and oven drying at both 40 c° and 60 c°. Evaluation throughout plant and oil characters.

MATERIALS AND METHODS

The present study was conduct at Arish university in order to compare some drying methods of sage (*Salvia officinalis* L.) e.g: two common traditional methods (sun and shade) as well as method of electronic oven at different two temperatures (45 c° and 60 c°).

Plant material & Growing conditions:

By mid- February 2022, sage seedling (10 cm in height) obtained from a commercial horticultural nursery, called "Tour Siena", were planted in an experimental farm of faculty of environmental agriculture science.

Soil was sandy -loam in texture, that amained with chicken manure in a rate of $20m^3$/fed. Irrigation supported by ground water in dripping system. Growing spaces were 20 x 40 cm in 3 replicates, with all recommended local growing practices.

Weather data are illustrated in Table (1). Average of monthly temperature and relative humidity (R.H.) measured of Al-Arish during growing seasons at February – May under full sun (open field).

METHODS

First cut of shoots including leaves (only investigated cut in this study) have been harvested in May 25^{th}, three immediate estimations of leaves: thickness (mm), moisture content (%) and fresh weight of 100 leaves (g) have been estimated in five samples replicates like the following records in the present study.

Second step was classification, since, herbal explants (leaves on shoots) have been dried into three categories based on drying method, e.g: first category consisted of 10 kg of sage used in a drying process by direct sunlight, second category (10 kg) for shade drying under theron (70%), and third category (20 kg) have been divided into two equal groups, that used in an electric – oven drying at two different temperatures (45 c° and 60 c°).

Drying procedure:

All drying techniques have been conducted in a single load using a single thin layer of the spread herbage parts, exposing surface of this one layer have been frequently exchanged addition to replacement of container positions.

Concerning both sun and shade drying, treatments have been achieved using 18 wire shelves in a single rack: 120 cm in tall x 70 cm in width x 90 cm in height, at field space without any side walls during daylight period, under emphasizes safeguard control. However, these stand – racks were keeping under room conditions at night. Shading was done beneath a black polyethyene shade net providing 70% shading capacity, net was UV-stabilized to prevent photodegradation and ensure long-term during under field conditions, it was firmly stretched and mounted on a structural framework consisting of galvanized steel pipes that functioned as vertical pillars and horizontal supports, there by maintaining stability and uniform shading a cross the entire drying area. Shading was selected to moderate the intensity of solar radiation and to present excessive heat buildup, thereby reducing risk of rapid pigment loss or mal degradation of phytoconstituents. This arrangement might allowing for adequate air circulation, also, facilitated gradual reduction of moisture content, maintained leaf integrity, and minimized contamination during the drying process.

For Oven-drying, freshly harvested explant of sage have been evenly spread in a thin layer on perforated stainless-steel Rayes to allow a equate air circulation and uniform heat transfer a forced-air electric oven.

Table 1. Weather data

Month	Air temperature (c°) minimum	Air temperature (c°)mximum	Relative humidity(%)	Precipiation (mm)	Wind speed(m/s)
February	9.34	18.44	66.52	25.18	3.29
March	10.21	19.32	71.25	16.22	3.14
April	13.42	23.14	64.16	2.54	3.03
May	17.66	29.50	59.32	0.12	2.84

Table 2. Immediately estimations of the harvested sage(leaves)

Leaves thickness(mm)	100 leaves fresh weight (g)	Leaves moisture content(%)
1.22	34.68	79.08

Drying duration:

Traditional drying (sun and shade) continued until a constant weight have been obtained, defined as a stage at which two successive weight measurements at 24 h intervals showed on further decrease in mass (±0.1 g), foreach measurement, samples were collected, placed in a desiccator to prevent reabsorption of ambient moisture, and weighed on an analytical balance, thin procedure ensured that final weight a accurately reflected complete removal of free moisture under drying conditions.

Likewise, a constant weight, produced through oven-drying (at 45c° and 60c°) was defined as the point at which to consecutive weight measurement, taken after 2h. interval, showed no further reduction in mass (±0.1 g), allowing to cooling in a desiccator.

Records:

Analysis of sage dry leaves:

Samples of dried leaves, outcomes of these tested methods of drying, have been evaluated depending on the following chemical analysis:

According to AOAC (2012)**,** moisture content (%), crude protein (%), crude fiber, crude fat and total ash, as well as total carbohydrates, have been calculated as follows:

Total carbohydrates content (%)= 100- (Ash%% + fat% +fiber% +P %).

Total phenolic content have been determined spectrophotometrically according to **Amin *et al*., 2006** as milligram gallic equivalent per gram of dry weight sample (mg GAE/ 100 d. w).While, total flavonoid content have been determined according to Zhuang , *et al* ., 1992 as mg Quercetin / 100 g d. w .Concerning to the photosynthetic pigments, according to Saric *et al*., 1976 , content of chlorophyll a , chlorophyll b and carotenoids have been analyzed according to Brand-Williams *et al*., 1995 using 1, 1-diphenyl-2-picrylhyazyl (DPPH) radical scavenging method.

Microbial activity analyzed as mean counts (colony forming units, CFU/g) and transformed to logarithm (log), that used for both of total bacterial count and total fungal counts, since, in conical flask, 10 g of each sample of the dried leaves were added to 90 ml of a saline solution (85% Nacl), then placed for 15 min on a mechanical shaker, to cultivate serially diluted portions of samples (up to 10^4), method of pour plate have been used. Thus, nutrient agar was the medium for plates of total bacterial counts, which incubated for 48h at 37c°. For total fungal counts, medium was potato Dexatrose agar and incubation have been done for 5 days at 28c°.

Essential oil analysis:

Oil percentage (v/w%): The essential oil percentage was determined as described in the British Pharmacopoeia (1963)

Oil constituents:

GC-MS: Gas Chromatography -Mass Spectrometry analysis (Agilent 8890 GC system), coupled to mass spectrometer (Agileat 5977 B GC, MS D) at national research center of Egypt according to Adams 1989.

Statistical analysis:

Recorded data have been analyzed using randomized complete design (ANOVA) means have been separated by Duncuns multiple range test (Duncun, 1958; Snedecor and Coechran, 1980). Computations have been fulfilled conformably with MSTATC computer program package V.4 according to Russell 1986.

RESULTS AND DISCUSSION

Analysis of variance, presented in Table (3) obviously indicated that significant differences have been observed concerning the studied characters in a response to the drying methods of the tested *Salvia officinalis* L. ex-plants. Results could be discussed through the effect of drying methods, e.g: direct sunlight drying, shading drying, and oven-drying at two temperatures of 40c°and 60c°on some physical, chemical, and biological analyses, as well as essential oil constituents.

Measurements of moisture content (%), ash content (%), fiber content (%), fat content (%), protein content (%), total carbohydrates (%), total carotenoids, total phenolic content (TPC) (mg GAE/100 g dw), total flavonoids content (TFC) (mg Quercetin/100 g dw), antioxidant activity (%), bacterial count, fungal count and essential oil percentage have been illustrated in Table (4). Results varied significantly because of drying method, in details, data revealed that the most effective drying concerning moisture content (%) was oven-drying at 60c°(7.89), while the highest moisture content (%) (9.00) have been obtained by shade drying.

Table 3. Mean squares of moisture content (%), ash content (%), fiber content (%), fat content (%), protein content (%), carbohydrates content (%), total chlophyll content (mg/g dw), total carotenoids (mg/g dw), total phenolic content (TPC) (mg GAE/100 g dw), total flavonoid content (TFC) (mg Quercetin/100 g dw), antioxidants activity (%), bacterial count (log (CFU/g))), fungal count (log (CFU/g)) and essential oil content (%) of sage *(*Sa*lvia officinalis* L.), affected by different drying methods during Fabuary – May 2022 under North Sinai conditions

Mean squares	**Oil %**		0.96**	0.01	2.34
	Fungal count		4.31**	0.01	14.69
	Bacterial count		6.12**	0.02	3.83
	Antioxidants activity		4.12*	1.13	1.19
	TFC content		0.001**	0.0001	1.95
	TPC content		0.003**	0.0001	0.24
	Carotenoids content		0.001**	0.0001	1.02
	Chlorophyll content		0.005**	0.0001	0.91
	Carbohydrates %		32.00*	1.63	2.14
	Protein %		0.39**	0.01	1.68
	Fat %		0.46**	0.01	1.34
	Fiber %		1.45*	0.23	1.46
	Ash %		1.68**	0.01	1.06
	Moisture %		1.21**	0.02	1.68
Df		4	3	12	19	**CV %**
SOV		**Replicates**	**Methods**	**Error**	**Total**	

Otherwise, the highest ash content (9.93%) was recorded in a method of shade drying, while the lowest value have been recorded in oven-drying method at 60c°. In this regard, oven-drying at 45c°produced the highest fiber content (33.50%). Meantime, highest fat content (8.79%) have been observed at 60c° in the oven-drying method, this method also produced the highest records of both protein content (4.76%) and total carbohydrates content (62.11%) at 40c°and 60c°, respectively. Similar results have been recorded by Sadowska *et al*., 2016 and Imam *et al*., 2023, they attributed such variation in the composition of moisture, ash, fiber, fat, protein and total carbohydrates content to the method effect of drying.

Data of plant pigments (mg / g d.w): total chlorophyll and total carotenoids have been tabulated in Table (4), which demonstrated that a temperature level of 60c° presented the highest values (0.799 and 0.284 mg/g dw) of both of total chlorophyll and carotenoids, respectively. These results are go on line with those obtained by several investigators using microwave technique or oven-drying method, such as Sellami *et al* ., 2012 on sage ; Mirmostafaee *et al* ., 2014 on peppermint ; Taha *et al* ., 2015 on mint and Yilmaz *et al* ., 2021 on thyme.

In this context, Data in Table (4) also illustrated the response of total phenolic content (mg GAE /100g dw), total flavonoid content (mg Quercetin /100g dw), and antioxidant activity (%) of dried sage (Salvia *officinalis* L.) explants by different methods of drying. Whereas, the most heated method of oven-drying at the temperature at 60c° recorded the highest total phenolic content of (1.983 mg GAE /100 g dw). This trend of high temperature have been reported regarding microwave drying method, Inchuen *et al*., 2010 stated that intense heat and high vapor pressure were disrupted leaves cell wall polymers in sage, that increased the extraction of phenolic compounds. Meanwhile highest content of total flavonoids have been determined (0.202 mg Quercetin /100 g dw) by the exposure to the direct sun light in a process of drying. These results are semi agree with the findings of Sadowska *et al*., 2016 on sage, Saifullah *et al*., 2021 on lemon – scented tea tree leaves and Yilmaz *et al*., 2021 on thyme. It is worthy to note that both of total of phenolic content and total flavonoid content affected the antioxidant activity (%), hence, highest percentage of antioxidant activity (90.44) have been estimated in oven-drying method, followed by (89.02 %) that have been recorded regarding to sunlight method. Miranda *et al* ., 2009 attributed the increment in antioxidant activity under high temperature to the generation and accumulation of Maillard-derived melanoidins , with a variation of the antioxidant activity, which enhance antioxidant activity. Hihat *et al* ; 2017 on coriander leaves and Imam *et al* ; 2023 on sage described similar trend.

Data included in Table (4) clearly indicated the impact of each tested drying technique on the microbial activity in the dried sage explant, that excepresed as total bacterial count (Log (CFU/g)) and total fungal count (Log (CFU/G)). Herein, shading method of drying contained the highest value of the total bacterial count (4.88 log (CFU/g)), followed by 4.07,2.95 and 2.42 log (CFU/G) recorded by sunlight, oven at 35c° and 60c°, respectively. Similar trend, traditional drying under shade nets presented the highest total fungal count (9.350 log ((CFU/g)) compared to the other traditional method of direct sunlight drying, which recorded a trace total fungal count of 0.220 log (CFU/g). It is of interest to mention that heat treatment using electric oven-drying method at the two tested temperature, was inhibited the fungal growth and activity. Those stated by Sellami *et al;* 2012 who pointed out that increasing temperature during oven drying, had negative influence, Dabaneh,2013 and Pachura *et al* ., 2022.

Data in (Table 4) reflected the influence of drying method on the essential oil content (%), which significantly affected by a technique of drying. In sequence, essential oil percentage that outcome of shading process (3.60%) was higher than those of sunlight (3.08%), followed by those of oven drying at both of 45c°(2.86%), and at 60c° (2.57%), respectively.

These results are in fully agreement of those results obtained by Venskutonis, 1997 on sage and thyme as well as Yusif *et al* 2000; on oregano. These results suggested that, increasing drying temperature was decreased the essential oil content of sage, which indicated that the biological structure of the oil glands was strongly affected at the high temperatures. In this regard, Diaz-Maroto *et a*l; 2003 reported that epithelial cells in the dried samples have been observed to have collapsed and split open. Similar results have been also demonstrated by Khangholi and Rezaeinodehi, 2008 on *Artemisia annuea* plants as affected by the method of drying. Moreover, Sellami *et al.,* 2012 reported such as this significant decrease in the sages`(*Salvia officinalis* L.) essential oil content as a result to increasing the drying temperature from 45c° to 65c°.

Chemical composition of the extracted essential oil constituents have been illustrated in Table (5), given by GC-MS analysis of the sage ex-plants, that have been dried using different methods of sun, shade, and oven drying (45c° & 60c°). Hereafter, varied ranges of different components (%) have been recorded concerning each method: 1,8-cineole ranged 37.18% to 46.25% recorded by oven-drying at 60c°and sunlight drying, respectively. (-)- Bornyl acetate ranged between 1.92% by shading and 2.79% by oven (60c°), (t)-Camphor varied from 13.28 % to 19.50% due to sun and shade drying, respectively. B-Caryophyllene recorded a range of (9.46% - 12.36%) lowest value related to sunlight, and the highest to oven at 60c°, otherwise, camphene recorded a range of 4.15% - 8.03%. Similarly, α-Terpinyl acetate recorded a highest percentage of 8.16 and the lowest under 3.04.

Table 4. Effect of sage drying method on some dried leaves properties and oil % at the first cut on spring 2022 under Al-Arish conditions

		Drying method				
		Direct sunlight	**Shading**	**Oven 45c°**	**Oven 60c°**	**LSD**
1	Moisture%	$8.55^{b} \pm 0.26$	$9.00^{a} \pm 0.08$	$8.11^{c} \pm 0.13$	$7.89^{d} \pm 0.14$	0.19
2	Ash%	$8.94^{c} \pm 0.08$	$9.93^{c} \pm 0.10$	$9.11^{b} \pm 0.11$	$8.56^{d} \pm 0.04$	0.13
3	Fiber%	32.76 ± 0.41	$32.21^{b} \pm 0.37$	33.50 ± 0.41	$32.61^{b} \pm 0.51$	0.63
4	Fat%	$8.21^{bc} \pm 0.07$	$8.09^{c} \pm 0.06$	$8.35^{c} \pm 0.15$	$8.79^{a} \pm 0.10$	0.15
5	Protien%	$4.10^{d} \pm 0.02$	$4.50^{b} \pm 0.06$	$4.76^{a} \pm 0.09$	$4.32^{c} \pm 0.08$	0.10
6	Carbohydrates%	$56.22^{c} \pm 0.22$	$60.78^{ab} \pm 0.44$	$60.09^{b} \pm 0.08$	$62.11^{a} \pm 2.50$	1.69
7	Chlorophyl%	$0.745^{c} \pm 0.007$	$0.728^{d} \pm 0.005$	$0.768^{b} \pm 0.01$	$0.799^{a} \pm 0.009$	0.013
8	Carotenoids%	$0.266^{bc} \pm 0.005$	$0.258^{c} \pm 0.005$	$0.275^{ab} \pm 0.005$	$0.284^{a} \pm 0.003$	0.013
9	Total phenolic content(TCP)	$1.951^{c} \pm 0.005$	$1.929^{a} \pm 0.005$	$1.964^{b} \pm 0.002$	$1.983^{a} \pm 0.005$	0.013
10	Total flavonoids content(TFC)	$0.202^{a} \pm 0.005$	$1.929^{d} \pm 0.005$	$1.964^{b} \pm 0.002$	$1.983^{a} \pm 0.005$	0.013
11	Antioxidant activity (%)	$89.02^{b} \pm 1.15$	$88.43^{b} \pm 0.14$	$88.62^{b} \pm 0.49$	$90.44^{a} \pm 1.62$	1.41
12	Bacterial count	$4.07^{b} \pm 0.07$	$4.88^{a} \pm 0.07$	$2.95^{c} \pm 0.12$	$2.42^{d} \pm 0.19$	0.18
13	Fungal count	$0.220^{b} \pm 0.09$	$9.350^{a} \pm 0.10$	$0.000^{c} \pm 0.000$	$0.000^{c} \pm 0.000$	0.094
14	Oil%	$3.08^{b} \pm 0.11$	$3.60^{a} \pm 0.03$	$2.86^{c} \pm 0.04$	$2.57^{d} \pm 0.08$	0.09

Table 5. Effect of sage drying method on chemical composition of the extracted essential oil at the first cut on Spring 2022 under Al-Arish conditions

Component	Direct sunlight	Shading	45c°	60c°
1.8-Cineole	46.25	39.88	41.42	37.18
(-)-Bornyl acetate	2.14	1.92	2.56	2.79
(+)-Camphore	13.28	19.50	14.33	14.62
B-Caryophyllene	9.46	11.84	11.00	12.36
Camphene	8.03	7.56	6.36	4.15
α-Thujene	0.02	-	0.25	-
β-Thujene	1.12	1.00	0.77	0.71
α-Terpinyl acetate	3.04	4.52	6.30	6.16
β-Pinene	6.00	6.44	7.12	6.84
α-Pinene	6.15	6.86	6.02	6.00
β-Phellandrene	-	-	-	0.03
β-Myrcene	1.88	1.96	2.04	2.00
α-Terpinene	0.71	-	-	-
D-Limonene	2.81	3.26	2.06	1.77
Y-Terpinene	0.67	0.86	0.67	0.51
Thujene	2.19	2.33	0.95	0.66
Trans-3-Pinanone	0.62	0.58	0.41	o.44
Camphol	1.28	2.16	1.31	1.00
α-Terpineol	2.44	2.00	2.08	1.54
α-Humulene	0.30	-	-	-

Thujone, α-thuone and β-thujene, recorded ranges of o.66% - 2.33%, 0.02%- 0.25%, and 0.71%-1.12%, lowest percentages have been recorded at oven (60c°), while, highest values have been observed at sun, oven (45c°), and sun drying method, respectively. Some other components (up to 20) have been found as presented in Table (5), some of them have been found under one or more technique, while absented regarding another methods. Xing *et al*; 2017 attributed this results to the effect of high temperatures and the oxidation reactions, hydrolysis of glycosylated forms, or some release of substances. These results are in harmony with the findings of Sellami *et al*; 2012 and Sadowska *et al* ., 2017 on sage (*salvia officinalis* L.) plant. This observed variation in sage essential oil compounds due to method impact of variation, reflected the possibility of choosing which more suitable drying technique for each specific purpose of oil sage, such as anti-inflammatory, antimicrobial (Ghorbani and Esmaeilizadeh, 2017). These results agree with those results reported by Pachura *et al*., 2022 and Imam *et al*., 2023.

CONCLUSION

Post-harvest treatment of sage in order to preservation have been evaluated via three main topics of drying method: sun, shade, and oven drying, outcomes reflected the necessary to define a purpose of preservation, then the decision making. Results have been varied significantly among methods, leading to the fact that drying method is depending on the goal of drying. Thus essential oil content as a main target, have been found at highest value by using shading technique. At the same conditions, highest value of ash content have been found. On the other hand, microbial activity recorded high counts at shading. Highest values of protein and fiber contents have been obtained by oven drying at 45c°, while, sun drying recorded highest TFC. Oven-drying at 60c°improved the antioxidant activity and enriched content of both of pigments, fat, carbohydrates and TPC, as well as inhibited the microbial activity.

Obviously, This variation led to possibility of choosing concerning essential oil components, since, highest content of both of 1,8-cineole , camphore , and β- thuijene have been found by sun drying method, which only give α-terpinene. Meanwhile, highest values of both of camphore, α-pinene, limonene, and thujone have been observed in shading. α- Thujene have been obtained only in sun and oven (45c°) drying in traces. By oven -drying method, highest contents of both of β-pinene, β-Myrcene, and α-thujene have been obtained at 45c°, while at 60c°, highest contents of both of (-)-Bornyl acetate, β- caryophllene, and α-terpinyl acetate have been obtained, as well as only at this method, β-phellandrene have been found.

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الملخص العربي

الطريقة المختارة لتجفيف المرمرية تحت ظروف العريش المناخية

دينا عبد العاطى سليمان أحمد

أجريت هذه الدراسة بالمزرعة البحثية لقسم الإنتاج النباتى – كلية العلوم الزراعية البيئية – جامعة العريش خلال فبراير – مايو لعام ٢٠٢٢ بهدف تقييم ثلاثة طرق رئيسية لتجفيف المرمرية تحت ظروف شمال سيناء الطرقتين التقليديتين هما التجفيف الشمسى و التجفيف باستخدام شباك التظليل و التجفيف باستخدام الفرن الكهربي تحت درجتين مختلفتين من درجات الحرارة ٤٥ – ٦٠ درجة مئوية تمت معاملة ما بعد الحصاد على الحشة الأولى لاختيار أنسب طريقة للتجفيف ، حيث تمت التحاليل الفيزيائية و الكيميائية و الحيوية على المنفصلات النباتية وزيت المرمرية. أظهرت النتائج فروقا معنوية بين طرق التجفيف و أوضحت النتائج أن اختيار الطريقة المناسبة يعتمد على الهدف من عملية التجفيف ، حيث تم الحصول بالظل بينما حسن التجفيف بالفرن الكهربى عند درجة حرارة ٦٠ درجة مئوية من نشاط مضادات الاكسدة و مثبط النشاط الميكروبى و أعطى قيم عالية من الكربوهيدرات و الدهون و الصبغات النباتية يتراوح مدى كل من الرطوبة ،الرماد ، الالياف ، الدهون ،البروتين ، الكربوهيدرات و كمية الزيت: (٧,٨٩ – ٩,٠٠)، (٨,٥٦ – ٩,٩٣) ،(٣٢,٢١ – ٣٣,٥٠)، (٨,٠٩– ٨,٧٩)، (٤,٠١ – ٤,٧٦)، (٥٦,٢٢ – ٦٢,١١)، (٢,٥٧– ٣,٦٠) %. سجلت طريقة التجفيف الشمسى أعلى قيمة من ١,٨ سينول (٤٦,٢٥)، طريقة التظليل أعطت أعلى قيمة من الكامفور (١٩,٥٠)، بيمنا سجلت طريقة بالفرن الكهربى اعلى قيمة من بيتا بيناين (٠٧,١٢)عند ٤٥م°, اسيتات البورنيول (٢,٧٩)عند ٦٠م°

الكلمات المفتاحية:– مريمية، التجفيف، الزيوت الطيارة، معاملات ما بعد الحصاد، فرن كهربائي.