Bionatura
Latin American Journal of Biotechnology and Life Sciences

Article

Effect of drying methods and soaking of Ascorbic acid on the chemical content and specific qualities of oil in lemongrass leaves *Cymbopogon citratus* L.

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Available from. http://dx.doi.org/10.21931/RB/2023.08.03.122

ABSTRACT

Lemongrass (Cymbopogon citratus) is an herb that belongs to the genus Cymbopogon of aromatic grasses and contains volatile oil with fine lemon flavor; there is the dearth of information on how drying affects the chemical content and specific qualities promoting properties of the leaves. Hence, this study sought to investigate the effect of different drying methods and soaking with ascorbic acid on the chemical content and specific qualities of oil in the leaves of the lemongrass plant. An experiment was applied according to the CRD design. The experiment included two factors: Soaking with ascorbic acid at a concentration of (0.5) g / L for 15 minutes. In addition to a non-soaking treatment and the second factor, the drying methods (solar drying, shadow drying, electric oven drying at a temperature of 40 °C for 8 hours) and the comparison by soft weight. The following characteristics were measured (percentage of nitrogen, Phosphorus, potassium, volatile oil, oil density and oil refractive index), and the results were statistically analyzed using the SAS statistical analysis program. The mean of the coefficients was compared according to the Duncan polynomial test. The results showed significantly superior drying in the oven over other treatments, as well as superior soaking of ascorbic over non-soaking treatment and gave the interference (drying in the oven + soaking with ascorbic) the highest averages of the studied traits amounted to (2.3806)% for nitrogen and (2.691)% for potassium and (1.092)% for volatile oil and (0.879) mg/microliter of volatile oil density. The differences between these drying methods of selection were significant variations in the oil content of lemongrass leaves and selection in obtaining products with high yields. Essential oil compositions have also been observed to depend on the drying conditions. However, the order of preference of the drying methods that ensures adequate retention of the chemical content and volatile oil of the leaves, as observed in this study, is oven drying > shadow drying > sun drying >, in the order of decreasing magnitude.

Keywords: lemongrass, drying methods, ascorbic, chemical composition.

INTRODUCTION

Drying is an indispensable food processing method in many food industries due to its advantages such as increased product shelf life and reduced packaging costs in addition to some side effects in food quality [1]. The main purpose of drying is to minimize its moisture content, it is allowed to prolong its storage period and preserve it from biological deterioration operations, as well as reduce shipping and packaging costs due to its low weight and ensure its availability outside the production season [2]. Cymbopogon citratus L. is an herbaceous plant belonging to the Pocaceae family, known in many countries worldwide as lemongrass. It is one of the fast-growing perennial plants that are widely cultivated in the tropical regions of Asia and America. Its leaves are a source of essential oil widely used in the fields Medical [3]. This plant is used to prepare medicines, cosmetics, perfumes, cooking, etc. [4]. Among its important medical uses are treating cold, cough, rheumatism, back pain, gastrointestinal problems, bladder diseases, cholera, fever treatment, and diuretic [5]. Mentioned that the dried lemongrass leaves are rich in carbohydrates and volatile oils, especially piperitone, elemol,α–eudesmol, limonene [6]. Vitamin C is an important antioxidant that protects biological systems from the risk of oxidative [7], since immersion with an ascorbic acid solution before drying affects the stability of the nutrient during drying. The chemical content of medicinal and aromatic plants is associated with a group of internal and external factors, including the drying agent, which is considered a key factor to maintain the quality of medicinal and aromatic plants[8] .Also, the drying methods have an effect on the chemical content of the leaves and qualities of the flying oil. Method selection is also important for specific component extraction. Thus far, different extraction methods or techniques have been investigated and compared to achieve better essential oil yield [9] . [10] found that the different drying methods had a significant effect on the specific oil characteristics of the lemongrass, as the oven drying method recorded the highest averages compared to other drying methods. [11] also found significant differences in the ratio of oil between the different drying methods of lemongrass, as the oven drying method was superior to other methods, while solar drying gave the lowest averages of the percentage of volatile oil. This study aimed to determine the effect of different drying methods and soaking with ascorbic acid on the chemical content and specific qualities of oil in the lemongrass leaves.

MATERIALS AND METHODS

Fresh leaves of lemongrass were collected from a home garden in Babel governorate in the early morning and cut at a height of 10 cm from the soil surface during the agricultural season 2018, to study the effect of drying and soaking methods with ascorbic acid on some chemical properties and volatile oil in the lemongrass leaves. The experiment included two factors: the first soaking with ascorbic acid at a concentration of (0.5) g / l for 15 minutes and the treatment of not soaking. Second: Methods of drying (solar drying, shadow drying, electric oven drying at a temperature of 40 °C for 8 hours) in addition to the comparison by wet weight. The experiment included 8 treatments and the following symbols were given:

- T0 = Control (fresh leaves)
- T1= fresh leaves + (0.5) ascorbic
- T2 = solar drying + (0) ascorbic
- T3 = solar drying + (0.5) ascorbic
- T4 = shadow drying + (0) ascorbic
- T5 = shadow drying + (0.5) ascorbic
- T6 = oven drying + (0) ascorbic
- T7 = oven drying + (0.5) ascorbic

70 g of fresh leaves were weighed for each treatment, removing dirt and dust, some transactions were soaked with ascorbic acid for 15 minutes, placed in plates, dried in several ways, and solar drying took 24 hours and drying in the shade 40 hours. Moisture and weight ratio was calculated every 60 minutes, recording time and temperature every hour for the above methods with continuous stirring of samples. As for drying in the oven took 8 hours at a temperature of 40 ° C, humidity and weight was recorded every 15 minutes until the weight was established and the samples reached the appropriate humidity.Then it was ground with an electric mill and (0.2) gm of dry leaf powder was taken and digested using the digestive system manufactured by Siemens German. After the digestion process was completed, the solution was cooled by adding distilled water and then filtered on the filter paper. Then complete the leachate volume to 50 ml and save in Plastic packages bearing the name of the transaction until the other items are estimated [12] . The elements were estimated in the laboratory as follows:

1. Determination of nitrogen (%): Determine nitrogen concentration using the Microkjedhal system.
2. Determination of Phosphorus (%): Determine Phosphorus using soft digestion using ammonium molybdate and ascorbic acid in a chromatic manner using the Spectrophotometer [13]
3. Determination of potassium (%): The potassium concentration was estimated using the Flame-Photometer according to the method used in [14]

The characteristics of the volatile oil were estimated:

- The percentage of volatile oil: The percentage of volatile oil was estimated using a Clevenger device according to the method
- The essential oils' compositions were assessed through solid-phase microextraction in combination with gas chromatography (GC)/mass spectrometry. This method obtained the essential oil components from rehydrated plants and absorbed on 100 m Polydimethylsiloxane-coated fiber. Then, 0.1 g drug with 0.4 mL NaCl (10%) were added.
- Density of the volatile oil (mg / micro liters): The density of the volatile oil was estimated at a weight of 100 micro liters of oil at a temperature of 20 percent divided by its volume at the same temperature.
- Refractive index of volatile oil: Determine the refractive index of volatile oil at a temperature of 20 °C using the Abbe Refractometer.

An experiment was conducted according to the CRD design, and the results were statistically analyzed using the Statistical Analysis Program (SAS). The arithmetic mean of the coefficients was compared according to the Dunkin Polynomial test.

RESULTS AND DISCUSSION

There were significant differences in the chemical content of the major elements in the leaves of lemongrass, treatment (drying in the oven) significantly outperformed the rest of the other treatments in the percentage of nitrogen in the leaves, and gave the highest average of (2.299) %, while the method of sun drying gave the lowest average of (1.310) %. Fig.1. The soaking treatment in ascorbic exceeded the highest percentage of nitrogen (1.714) % compared to the non-soaking treatment that gave the lowest average of 1.563%.

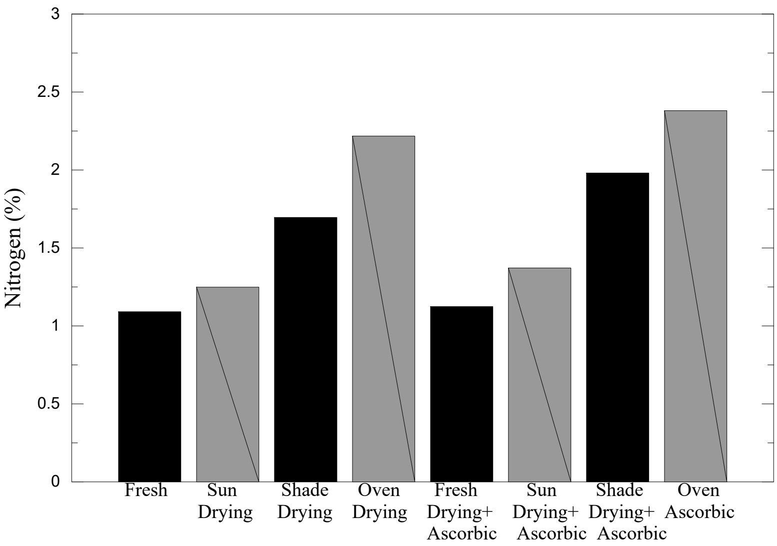


Figure 1. Effect of different drying methods and soaking with ascorbic acid on the content of lemongrass leaves from nitrogen (%)

The interaction between the factors of the study showed a significant effect, as the treatment (drying in the oven + soaking with ascorbic) was superior to the highest average of (2.3806)%, while the (solar drying + no soaking) treatment gave the lowest average (1.091)%. In fig. 2. Shows the presence of significant effects in the leaf content of Phosphorus, with the superiority of (solar drying) treatment significantly compared to other drying methods in the percentage of Phosphorus in the leaves. It gave the highest average of (0.372)%, while the drying method in the oven gave the lowest average of (0.337)%.

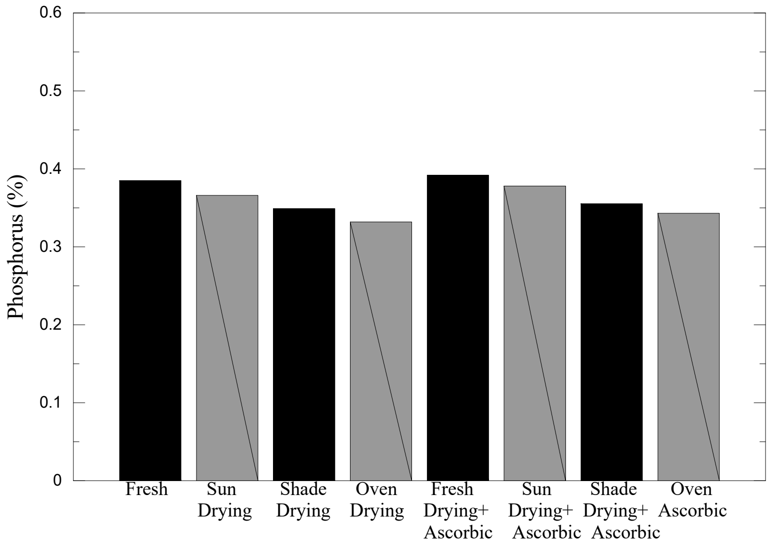


Figure 2. Effect of different drying methods and soaking with ascorbic acid on the content of lemongrass leaves from Phosphorus (%)

The soaking treatment in ascorbic was superior and gave the highest percentage of Phosphorus (0.367) % compared to the non-soaking treatment, that gave the lowest average of (0.358) %. Bi-interaction showed a significant effect, as the treatment (no drying + soaking with ascorbic) was superior to the highest average (0.392) %, while the (oven drying + soaking) treatment gave the lowest average (0.332) %.

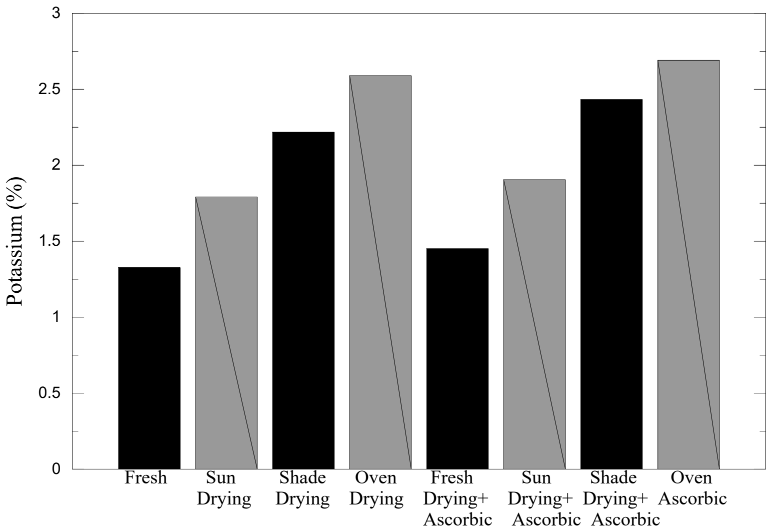


Figure 3. Effect of different drying methods and soaking with ascorbic acid on the content of lemongrass leaves from potassium (%)

Figure (3) shows the presence of significant differences in the chemical content in the leaves of lemongrass in potassium, as treatment (drying in the oven) was significantly superior to other treatments in the percentage of potassium in the leaves, It gave the highest average of (2.640) %, while the method of solar drying gave the lowest average of (1.848) %. The soaking treatment in ascorbic exceeded the highest percentage of nitrogen (2.120) % compared to the non-soaking treatment that gave the lowest average of (1.981) %. While the interaction between the factors of the study had a significant effect, as the treatment (drying in the oven + soaking with ascorbic) exceeded the highest average of (2.691) %, while the treatment (solar drying + not soaking) gave the lowest average (1.327) %. In the fig. 4 showed significant differences in the content of lemongrass leaves from the volatile oil, as the treatment (oven drying) was significantly superior to the rest of the drying treatment in the percentage of the volatile oil in the leaves. It gave the highest average of (0.983) % compared to the solar drying method which gave the lowest average of (0.367) %.

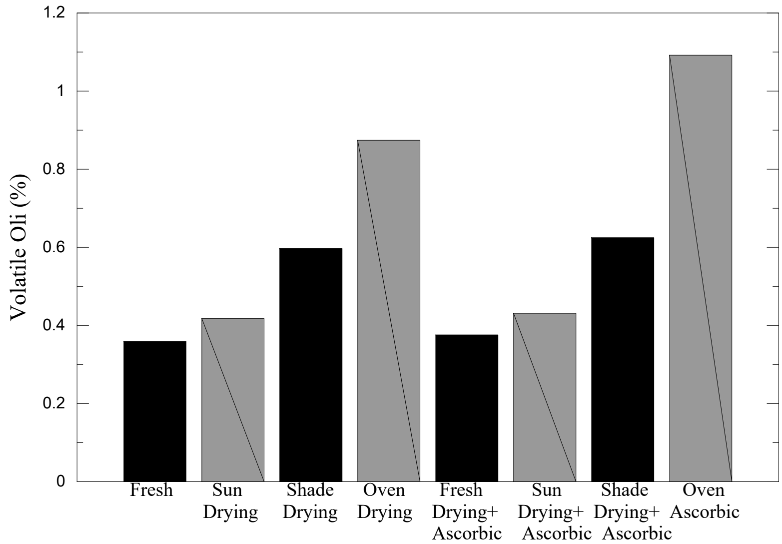


Figure 4. Effect of different drying methods and soaking with ascorbic acid on the content of lemongrass leaves from the volatile oil %

The figure 4. shows the superiority of soaking treatment with ascorbic by giving it the highest percentage of volatile oil that reached (0.631)% compared to the non-soaking treatment that gave the lowest average of (0.562)%. The interaction between the factors of the study had a significant effect, as the treatment (drying in the oven + soaking with ascorbic) was superior to the highest average (1.092)%, while the (solar drying + non-soaking) treatment gave the lowest average (0.359)%.In the fig. 5 shows the presence of significant differences in the density of volatile oil in the leaves of lemongrass, as the treatment (drying in the oven) was significantly superior to other treatments, it gave the highest average of (0.867) mg /micro liter, while the method of solar drying gave the lowest average of (0.732) mg /micro liter.

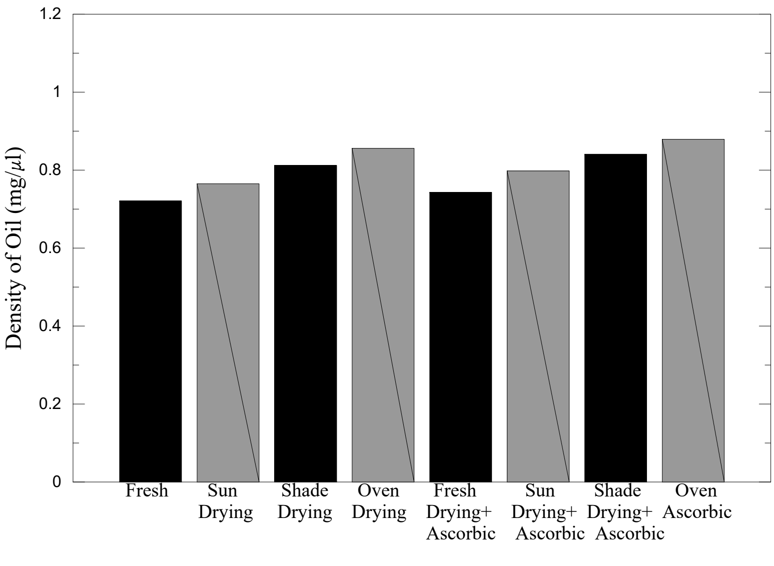


Figure 5. Effect of different drying methods and soaking with ascorbic acid on the density of volatile oil (mg/microliter).

Lemongrass from samples dried by oven at 40°C was the most preferred in overall acceptability. Oven drying at 40°C was found to be most suitable for drying lemongrass leaves for production to retain appreciable sensory attributes 16 .The soaking treatment in ascorbic excelled and gave the highest average volatile oil density of (0.815) mg / micro liter compared to the non-soaking treatment that gave the lowest average of (0.788) mg /micro liter.The interaction between the study factors had a significant effect, as the treatment (drying in the oven + soaking with ascorbic) was superior to the highest average (0.879) mg / micro liter, while the treatment (solar drying + not soaking) gave the lowest average (0.721) mg / micro liter.

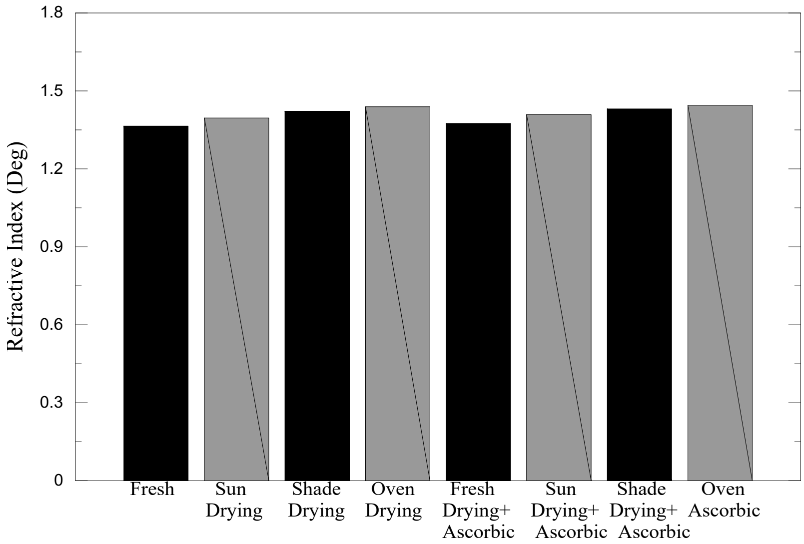
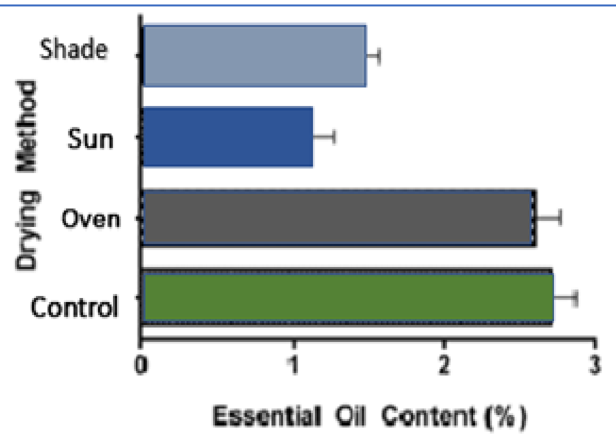


Figure 6. Effect of different drying methods and soaking with ascorbic acid on the refractive index of the volatile oil

In the figure (6) shows the existence of significant differences in the refractive index of the volatile oil, as the (oven drying) treatment significantly outperformed the other drying factors and gave the highest average of (0.956), while the method of solar drying gave the lowest average of (0.840). The soaking treatment in ascorbic was superior and gave a score of (0.934) compared to a non-soaking treatment that gave the lowest average of (0.875). The interaction showed the superiority of the treatment (oven drying + soaking with ascorbic) the highest average of (0.698), while the (solar drying + no soaking) treatment gave the lowest average of (0.891).



Method

Shade	Sun	Oven	Control	LSD,5%
1.44	1.20	2.70	2.80	0.18

Figure 7. Essential Oil Contents (%) of lemongrass leaves

The total oil contents and active ingredient levels differed depending on the drying method and plant species. In figure (7) the oven drying method produced the highest complete oil contents from lemongrass leaves at 2.70 % and 2.80% (of the total oil weight), respectively. Shade and sun drying significantly differed from both artificial methods and each other at 1.44% and 1.20%, respectively.GC analysis in tables 2 evaluated essential oil's main active components.

Componet	Oven (%)	Shade (%)	Sun (%)
α-Terpinene	1.77	1.11	2.90
α –Thujene	1.18	1.12	2.66
γ-Terpinene	8.44	9.60	20.60
p-Cymene	52.22	55.20	41.10
Linalool	22.30	15.54	14.91
Linalyl acetate	25.81	23.44	21.11

Table 2. Essential Oil Components of lemongrass leaves after Shade, Sun, and Oven drying

The basis essential oil components were identified using GC analysis and the effects of different drying methods on active component content were evaluated [17] . Moreover, shade and sun drying significantly differed from artificial methods as mentioned by [18]. In order to obtain drying of medicinal and aromatic plants, temperatures should be maintained within the range of 30-40°C to obtain the best results[15].The α-Terpinene compounds can be converted into p-cymene by solar radiation, and these types of alteration may result in different active ingredient ratios among different groups and thymol content has been higher after oven drying than after sun drying. Also, the ratio of Terpinene derivatives has been higher in sun-dried samples than in oven-dried samples. The reason for that direct sunlight may affect some active compounds in the plant [19]. Beside some active components could be affected by the temperature changes, whereas other active components could be more resistant to changing temperatures. This finding can be attributed to temperature changes during the sun, and shade drying operations. Meanwhile, oven drying applies constant temperature during the dehumidification process.

CONCLUSIONS

In light of the results obtained, wex can conclude that the drying methods in particular oven drying and maceration with ascorbic acid positively affect the content of lemongrass leaves of major elements and volatile oil. The compositions of the final essential oils were also investigated, and the dehydration methods have been observed to affect the active component ratios. Changing or constant temperatures, solar radiation, and environmental factors may underlie these differences and method selection has a considerable influence on the quality and production efficiency of the desired active component.

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Received: 25 June 2023/ Accepted: 26 August 2023 / Published:15 September 2023

Citation: Dizayee A.AS. Yield and Competitive Interaction between Black Seed (Nigella sativa L.) and Chickpea (Cicer arietinum L.) as Influenced by Inter and Intra-Specific Competition. Revis Bionatura 2023;8 (3) 122 http://dx.doi.org/10.21931/RB/2023.08.03.122

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