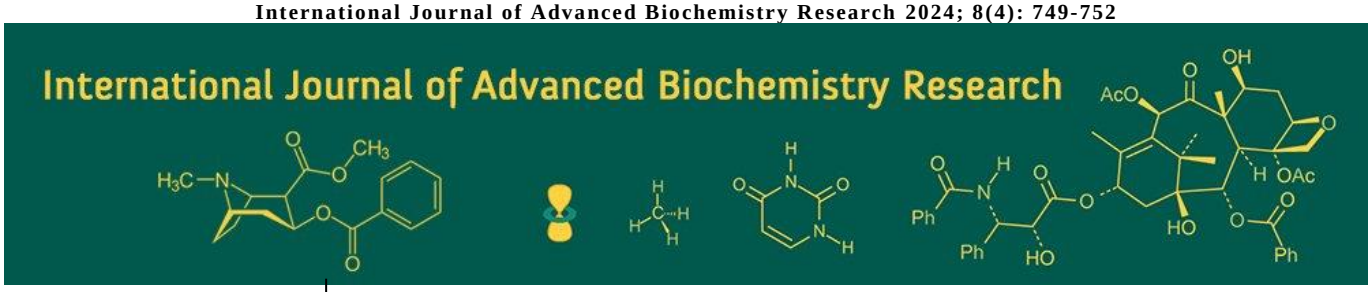


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# Studies on the effect of different shade drying periods of lemongrass (*Cymbopogon flexuosus* Steud.) on recovery of essential oil

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**Abstract**
Lemongrass (*Cymbopogon flexuosus*) is a perennial aromatic grass. The essential oil of lemongrass used in pharmaceutical and perfumery industries mostly. It is the most widely grown essential oil plants in tropics and subtropics of India. An experiment was conducted to investigate the effect of different shade drying periods; five different samples of lemongrass (fresh, 6 h shade dried, 12 h shade dried, 18 h shade dried and 24 h shade dried) were analyzed. And to obtain the essential oil of lemongrass, hydro-distillation method by Clevenger apparatus were used. All the experimental data were analyzed statically using Completely Randomized Design (CRD). The effect different shade drying periods on oil recovery of lemongrass of was found to be significant at the level of significant (0.05) with CD 0.094.The oil recovery of lemongrass essential oil found increased with increases of shade drying period and maximum oil recovery (1.294%) obtained after 24 h shade drying period at 4 h of distillation period.

**Keywords:** Shade drying, lemongrass, essential oil

## Introduction
Lemongrass (*Cymbopogon flexuosus*) is indigenous to India and used in Indian traditional healthcare system for more than 2000 years. It is distributed in Australia, Europe, South America, Africa and Indian subcontinent. It is commercially cultivated in Assam, Maharashtra and Uttar Pradesh. Essential oil are concentrated essences extracted from different plant of plants, containing hundred of substances, but typically with the prevalence of one, two or three of them that really characterized the fragrance. Essential oil is distilled from and flowering top of lemongrass. Lemongrass oil has a lemony, sweet smell and it is dark yellow to amber and its uses in scenting of soaps, detergents, insect repellent preparations. However, the major use of oil is as source of citral, which goes in perfumery, cosmetics, beverages and is a starting material for manufacture of lonones, which produces vitamin-A. There are mainly three types of lemongrass, the East Indian Lemongrass (*Cymbopogon flexuosus*), West Indian Lemongrass (*Cymbopogon citratus*), North Indian Lemongrass (*Cymbopogon pendulus*). *Cymbopogon flexuosus* is indigenous to India. *Cymbopogon flexuosus* is also called Malabaror Cochin grass which produces the genuine oil of commercial importance (Hussain *et al.*, 1988) [3]. Two types of East Indian Lemongrass are known: the "redgrass" and "white grass". The former is true *Cymbopogon flexuosus* and is locally known as 'Chomanna polu'; the colour of stem is reddish, the oil contains 75% or more of aldehydes, chiefly citral, exhibits good solubility in alcohol and hence is superior in quality. The bulk of Indian lemongrass is produced from this grass. The white grass is locally known as 'Wella polu'. The colour of stem is white, the oil contains less than (65–70%) citral content (Sakaria *et al.*, 2007) [5], exhibits poor alcohol solubility and hence considered inferior in quality. The percentage oil content on fresh weight basis varies between 0.20 to 0.80%. Interest in essential oil has increased over the year with the improvement in aromatherapy- a branch of alternative medicine which uses the essential oils of aromatic plants. The use and application is gaining popularity in most industries and amongst individuals. (Iyanu, 2010) [4]. To avoid the post harvest loss and to improve the oil recovery percentage in lemongrass we need to know improved post harvest management practices.

The recovery of oil percentage can be increased with the introduction of better post harvest practices.

## Materials and Methods

### Shade Drying

In shade drying method harvested material is spread out under shade in thin layers and to avoid mould growth, uniform drying it turned periodically. For obtaining highest yield and better quality oil, proper drying must required. In this experiment the fresh lemongrass was spread out in thin layers over cemented surface for drying in room temperature. It was done for different interval of time viz. fresh lemongrass, 6 h shade drying, 12 h shade drying, 18 h shade drying and 24 h shade drying. The thickness of the herb was around 2 inches maintained and for different interval of time 500g of fresh lemongrass for each treatment with three replications were taken and moisture content of the dried sample of each treatment were calculate.

### Moisture content

The moisture content of lemongrass was determined from 2g sample which was dried at 105 °C in oven for four hour till the sample becomes gray in color. Then it was cooled in dessicator and measured in digital balance Abera Atitegeb (2005). The percentage moisture content was estimated by the following expression

$$\text{Percentage moisture content} = \frac{W-w}{W} \times 100$$

Where,
W = Initial weight of sample, g
w = Final weight of sample after drying, g

### Oil Extraction

Extraction of lemongrass essential oil was done using Clevenger apparatus. Three sets of Clevenger apparatus was connected to each other in a series for continuous water supply to the condensers. The process of distillation consists of loading the dried lemongrass into the round bottom flask, adding sufficient amount of water, connecting the flask with condenser, maintaining temperature by heater, condensing the vapour in the condenser and collecting the oil in the receiver. Firstly the fresh lemongrass was subjected for oil extraction. Recovery of oil was recorded at constant temperature (100 °C) and time (4 h). Quantity of fresh Lemongrass and water used was 500 g and 1000 ml respectively. Fresh sample (500 g) was filled in round bottom flask of 2,000 ml capacity and 1000 ml of water adding on it. After that the flask was connected with condenser and the heater switch was turned on which was pre-set at 100 °C. On that temperature boiling of water starts, vapour comes to the condenser where condensations occur. Cold water inlet was connected at first apparatus, outlet of first was connected to second and the second connected to the third, the water outlet finally to drain from the third apparatus. Formula for calculating the oil recovery % was given by Guenther (1950) [2].

$$\text{Oil Content (\%)} = \frac{\text{Oil Weight (g)}}{\text{Sample Weight (g)}} \times 100$$

### Separation and dehydration

Oil separation and dehydration was done using chloroform, separating funnel and anhydrous sodium sulfate. To separate the essential oil from the water, we will take advantage of the fact that the oil is insoluble in water and is soluble in non-polar solvents like chloroform. Chloroform is added to the oil-water mixture in a separating funnel. This funnel allows the two solvents to layer and subsequently we can drain one solvent layer away from the other. After a few moments of shaking, the oil will Partition into the chloroform layer. Draining the water layer from the chloroform removes the oil from the water. The partitioning is almost never complete, so an extraction is usually carried-out multiple times.

After that, for dehydration very small quantity of anhydrous sodium sulfate was mixed in the separated oil and kept it overnight. Sodium sulfate absorbs the moisture present in oil and pure Lemongrass essential oil was obtained. Oil was collected in test tubes and stored in cool place.


**Fig 1:** Sample preparation for shade drying


**Fig 2:** Shade drying

**Fig 3:** Distillation of lemongrass oil by Clevenger apparatus

## Result and Discussion

### Effect of Different shade drying periods on Oil Recovery

Lemongrass essential oil were extracted from the samples, dried for various intervals of time after harvesting such as fresh lemongrass, 6 h shade drying, 12 h shade drying, 18 h

shade drying and 24 h shade drying as mentioned in the material and method section. The effect of different shade drying periods on oil recovery of lemongrass were recorded and depicted in table 1 and 2. It was observed that, the different moisture content obtained by different shade drying period causes significant changes in oil recovery of lemongrass. However the highest oil recovery (1.294%) of lemongrass was recorded in T5 which was statistically followed by T4 (1.058%) and lowest oil recovery (0.896%) of lemongrass was recorded in T1. The effect different moisture content on oil recovery of lemongrass of was found to be significant at the level of significant (0.05) with CD 0.094.

**Table 1:** ANOVA for oil recovery at different shade drying periods

| Source of variation | Degrees of freedom | Sum of squares | Mean sum of squares | F-calculated | F-Tabulated |
|---|---|---|---|---|---|
| Treatments | 4 | 0.317 | 0.079 | 30.193** | 3.112 |
| Error | 10 | 0.026 | 0.003 | | |
| Total | 14 | 0.343 | | | |

(**significant at level of 5%)

The graphical representation of the effect of different moisture content obtained by different shade drying on oil recovery of the lemongrass is shown in fig. 4.9. The oil recovery determined were 0.896 to 1.294% (w/w). Fresh lemongrass with 69.8% wb moisture content gives least oil recovery (0.896%) whereas lemongrass sample after 24 h shade drying with 39.76% wb moisture content gives maximum oil recovery (1.294%) of lemongrass.

**Table 2:** Effect of different shade drying periods on oil recovery

| Shade Drying periods | Oil Recovery,% (Dry weight basis) | |
|---|---|---|
| | Mean | S.E. |
| T1-Fresh Lemongrass | 0.896 | 0.02 |
| T2-6 h Shade drying | 0.914 | 0.031 |
| T3-12 h Shade drying | 0.968 | 0.01 |
| T4-18 h Shade drying | 1.058 | 0.054 |
| T5-24 h Shade drying | 1.294 | 0.006 |
| C.D. | 0.094 | |
| SE(m) | 0.03 | |
| SE(d) | 0.042 | |
| C.V. | 4.991 | |

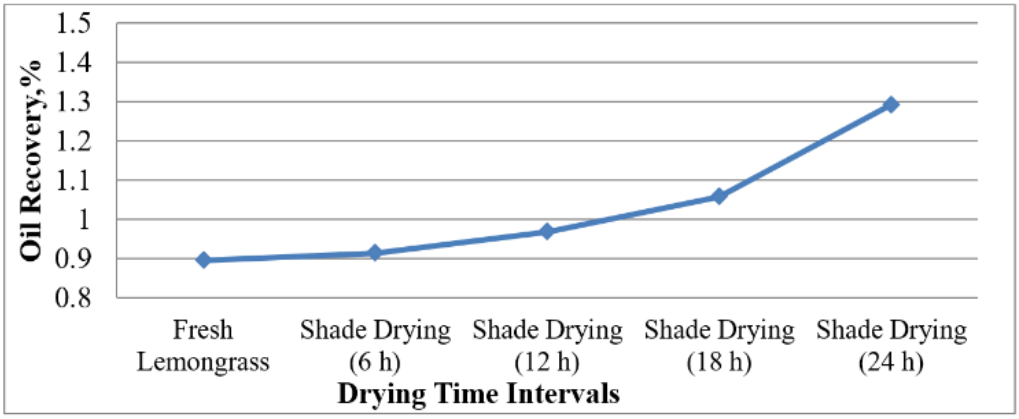


**Fig 4:** Effect of different Shade drying on oil recovery

It was observed that the oil recovery (%) increases proportionally as interval of shade drying hour increases up to 24 h. The Fig. 4 shows the lemongrass oil recovery (%) at different interval of shade drying hour after harvesting. Figure indicates the gradual increase in recovery of oil as number of shade drying time increases. The similar result in the studies of effect of different shade drying on oil recovery for palmarosa grass found by Soni, Khemlata and Kalbanle, Surendra (2023) [6] indicated the similar findings for the lemongrass essential oil recovery.

## Conclusion

The experiment was conducted to study the effect of different shade drying periods of lemongrass on essential oil recovery. The results obtained for the experiment was summarized. Based on the results obtained, it can be concluded that the different shade drying periods of lemongrass influenced the essential oil recovery of lemongrass. The oil recovery percentage increased with increases the shade drying period and maximum oil recovery was obtained at 24 h of shade drying period after harvesting of lemongrass.

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