Patchouli Oil Quality In Various Methods of Drying Plant Materials Nilam (*Pogostemon cablin* Benth)

Darmadi Erwin Harahap[1*], Eka Nurwani Ritonga [2], Qorry Hilmiyah Harahap[3], Msy.Nurhalimah[4], Muhammad Darwis[5], Dodi Syahrin[6]

[1,2,3,6]Program Study Agroteknologi, Fakultas Sains Dan Teknologi, Universitas Muhammadiyah Tapanuli Selatan, Sumatera Utara Indonesia
[4]Program Study Peternakan, Fakultas Sains Dan Teknologi, Universitas Muhammadiyah Tapanuli Selatan, Sumatera Utara Indonesia
[5]Program Study Pendidikan Biology, Fakultas Keguruan dan Ilmu Pendidikan, Universitas Muhammadiyah Tapanuli Selatan, Sumatera Utara Indonesia
[*] Corresponding author:
Email: darmadi@um-tapsel.ac.id

Abstract.
This study aims to determine the effect of various drying methods on patchouli oil yield and patchouli content. The study used a Completely Randomized Design (CRD) with four treatments, namely P_0 = without drying (control), P_1 = drying under direct sunlight, P_2 = drying using a paranet, and P_3 = drying using a tarpaulin. The parameters observed included patchouli oil yield and patchouli content. The results showed that the drying method significantly affected patchouli oil yield and patchouli content. The highest oil yield was obtained in the P_2 treatment (drying using a paranet) with an average of 2.61%, while the lowest yield was obtained in the P_0 treatment (without drying) at 1.82%. The highest patchouli content was also found in the P_2 and P_3 treatments at 30%, while the lowest was found in the P_0 treatment at 25%. Thus, the drying method using paranet is the best treatment in increasing patchouli oil yield and patchouli content.

Keywords: *Patchouli Oil, Drying Method, Yield and Patchouli Content.*

I. INTRODUCTION

Patchouli plant (Pogostemon cablin Benth)(1) is one of the essential oil producing plants which is very profitable and is one of Indonesia's main export commodities.(2)Patchouli oil is widely known in the perfume, cosmetics, aromatherapy, pharmaceutical, and personal care industries for its unique aroma and remarkable ability as a fragrance fixative.(3) (4)Indonesia contributes significantly to the international essential oil trade, even becoming one of the world's leading suppliers of patchouli oil. To meet the global demand for patchouli oil, improving oil quality is a crucial component in the development of the industry.(5).

Plant variety, harvest age, growing conditions, distillation techniques, and post-harvest handling are some of the factors that significantly influence the quality of patchouli oil. The drying process of the plant before distillation is a crucial post-harvest step. By reducing the moisture content of the plant material, the drying process helps the essential oil diffuse more efficiently during distillation. This can help increase oil yield while preserving the active compounds in patchouli oil.(6) (7).

Patchouli drying methods used by farmers in the field vary widely and are usually traditional. Some farmers dry directly in the sun, while others use shade such as shade nets and tarps to reduce the light and heat exposure to the plant material. In certain situations, patchouli can be distilled directly without the drying process. The quality of the resulting patchouli oil may vary in terms of yield, color, aroma, and key compound content due to these differences in methods.(8).

Due to the high heat intensity, direct sunlight exposure is known to accelerate the drying process. However, excessively high temperatures and continuous exposure to light can cause the loss of some volatile essential oil components.(9). Conversely, drying under shade netting or tarpaulin can reduce sun damage to aromatic compounds, although the drying process is slower. Undried plant material, on the other hand, has a higher water content, which can affect distillation efficiency and the quality of the resulting oil. Therefore, choosing the right drying method is crucial to maintaining the quality of patchouli oil.(9).

Physical and chemical parameters such as yield, color, specific gravity, refractive index, water content, solubility in alcohol, acid number, and patchouli alcohol content are usually used to determine the quality of patchouli oil.(10)The quality of patchouli oil on the international market is greatly influenced by the patchouli alcohol compound. Higher levels of patchouli alcohol are associated with higher quality and economic value.(11)According to the Indonesian National Standard (SNI 06-2385-2006), the patchouli alcohol content in good quality patchouli oil must be at least 30%.

Previous studies have shown that the drying process of essential plant materials affects the yield and amount of secondary metabolites produced. Studies on patchouli leaf drying methods have shown that different methods can result in different patchouli alcohol yields and levels.

However, there is still limited scientific information comparing the quality of patchouli oil using sun-drying, shade netting, tarpaulin, and no drying methods. Research is needed on the quality of patchouli oil produced by various drying methods, as these are widely used by patchouli farmers in their daily post-harvest activities. It is hoped that this research will yield scientific data on the most effective drying techniques for maintaining patchouli oil quality.

II. RESEARCH METHODS

This research was conducted in Kampung Baru, Sibabangun District, Central Tapanuli Regency. The tools used include digital scales, steam distillation apparatus, thermometers, measuring cups, glass bottles, digital cameras, and ovens. Patchouli content analysis was carried out using a Gas Chromatography Mass Spectrometry (GC-MS) instrument. Patchouli oil yield levels indicate the efficiency of oil extraction. The formula used is: Yield = Oil weight (g) / Dry material weight (g) × 100%. To see the effect of the drying method, a Completely Randomized Design test was carried out. The materials used include fresh patchouli plants, 70% alcohol, distilled water, and standard patchouli alcohol chemicals used as calibration standards in GC-MS analysis.

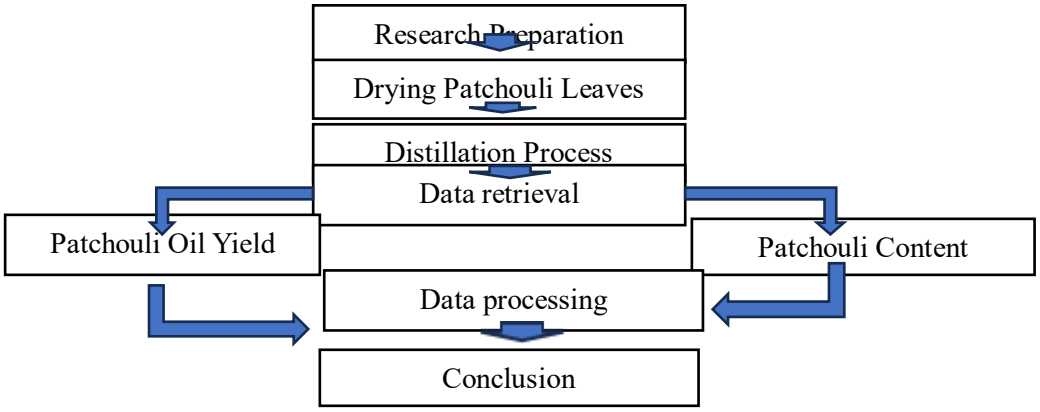

Fig.1. Research Flowchart

Data obtained in the field next testing was carried outaccording to the predetermined test model.

III. RESULTS AND DISCUSSION

Data from observations of the oil yield from patchouli leaves and the patcholi content for each drying method treatment can be seen in Table 1. The results of data processing show that the drying method has a significant effect on the patchouli oil yield and patcholi content.

Table 1. Observation Data on Patchouli Oil Yield and Patchouli Content

Treatment	Yield (%)	Patchouli Content (%)
P0	1.82 c	25 c
P1	2.38 b	27 b
P2	2.61 a	30 a
P3	2.15 b	30 a

Description: Numbers followed by the same letter in the same column showed no significant difference based on the DMRT test at 5% level.

a. Patchouli Oil Yield (%)

From Table 1 it can be seen that the highest patchouli oil yield due to the drying treatment was in treatment (P2)., drying using shade nets was 2.61%, and the lowest was in treatment (P0) without drying at 1.82%.

Volatile essential oils are found in patchouli leaves and stems. Compared to direct sunlight, drying under shade netting reduces the intensity of direct sunlight, resulting in a lower and more stable drying temperature.(12).

This occurs because the temperature of the material can rise significantly when dried directly, causing the volatile essential oil to be lost before the distillation process. On the other hand, drying using a shade net provides sufficient drying conditions to reduce the water content but is not too hot, thus minimizing oil loss due to evaporation.(13).

The gradual drying conditions, which allow the water content of the material to decrease without excessive loss of essential oil, result in a high yield of patchouli oil in the drying treatment under a shade net (P2). Dried material usually produces a higher yield than fresh material because drying removes some of the water from the plant tissue, so that water vapor during distillation can more easily penetrate the oil cells and remove essential oils from the material.(14).Fresh patchouli material has a high water content, so when the material is directly distilled without drying in the sun (P0), the water remains bound to the plant tissue, which inhibits the oil release process during distillation.(15).

Drying temperatures are lower in open-air drying because shade netting reduces direct solar radiation. In addition to allowing tissue breakdown and increasing the permeability of oil gland cell walls, these conditions maintain the stability of volatile compounds. Consequently, oil release during refining is more efficient and yields higher. This is consistent with research.(16), which states that desiccants facilitate the extraction of patchouli oil during distillation because they increase the permeability of the oil gland cells. In addition, research(17), shows that the use of proper drying techniques can produce higher patchouli oil yields and better oil quality.

b. Patchouli Content (%)

From Table 1 it can be seen that the highest patchouli content due to the sun-drying treatment was in treatments (P2) and (P3), sun-drying using shade netting, namely 30%, and the lowest was in treatment (P0) without sun-drying, 25%.

When dried at too high a temperature, the lighter components in patchouli oil can evaporate or break down, even though patchouli alcohol is a relatively stable sesquiterpene alcohol. Drying under shade netting produces a lower temperature than drying directly in the sun. As a result, the drying process is slower and more controlled.(15).

Under these conditions, the water content can be reduced without damaging the essential oil components. As a result, compared to undried or overheated material, there is more patchouli alcohol in the oil.(9), the quality of patchouli oil is greatly influenced by post-harvest treatment, especially drying; this process can change the relative composition of sesquiterpenes and increase the patchouli alcohol content under the right conditions.

The water content was very high in the treatment without sun drying (P0). Because much water is still stored in the leaf tissue, water vapor has difficulty penetrating the oil glands. As a result, the hydrodistillation process is less effective.(18) (19). In contrast, drying under shade netting reduces the water content to an ideal level, which makes cell walls and oil glands more susceptible to rupture during distillation. The release of heavy compounds such as patchouli, which are largely stored within the leaf tissue, is increased under these conditions.(20).

The essential oil, patchouli alcohol, is more easily released during the distillation process due to drying.(16). Rapid drying in direct sunlight can stop it instantly, while drying under shade netting takes

longer, allowing the process of transforming the precursor compounds into patchouli alcohol to proceed more smoothly.

Researchers from(21)found that a slower drying process improved the quality of patchouli oil and its patchouli alcohol content. Patchouli alcohol is a high-boiling compound, and the loss of other components can alter the stability of the oil. Therefore, the quality of oil from shade drying is often superior to that from open-air drying.(22). Study(23)shows that the drying method affects the yield and quality of patchouli oil, including the content of its main components.

IV. CONCLUSION

1. The drying method affects the yield and quality of patchouli oil.
2. The highest oil yield was obtained in the P_2 treatment (sun-drying using paranet) with an average of 2.61%, while the lowest yield was obtained in the P_0 treatment (without sun-drying) at 1.82%.
3. The highest patchouli content was found in the P_2 and P_3 treatments at 30%, while the lowest was found in the P_0 treatment at 25%.

V. SUGGESTION

In the patchouli distillation process, it is recommended to use a sun-drying method using shade nets to obtain patchouli oil with better quality and higher economic value. Furthermore, further research is needed on varying shade levels and drying times to determine the most optimal drying technique.

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