

ISOLATION AND UTILIZATION OF LEMONGRASS OIL (*Cymbopogon nardus* L.) FROM NORTH CENTRAL TIMOR AS BASIC INGREDIENTS FOR FLAVOR

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ABSTRACT

Citronella (*Cymbopogon nardus* L.) is a grass plant with narrow leaf size. Citronella in NTT is relatively abundant but its utilization is not optimal and the price is relatively cheap. People only utilize citronella as animal feed, traditional drinks, and mosquito repellent additives. The purpose of this research is to isolate and make basic ingredients of fragrance from citronella oil from TTU district. The method for citronella oil isolation is water vapor distillation. The method of making fragrance is basic notes, middle notes and top notes with observation parameters used for testing fragrance is organoleptic test, stain test, durability test. The results of the fragrance of basic notes fragrance if applied to clothing then the fragrance that smells is lemongrass fragrance, while middle notes if applied to clothing then the fragrance is like a rose, top notes fragrance that smells is orange. The stain test results on basic notes for tissue paper and HVS paper showed very slight stains, while the middle notes showed very slight stains on tissue paper and HVS paper, and the top notes showed no stains on any of the three test papers. The durability test results showed that all three fragrances lasted up to 8 hours.

Keywords: Lemongrass, Fragrance, Organoleptic Test, Stain Test, Durability Test.

INTRODUCTION

Indonesia is a tropical country rich in natural resources. This wealth has been known internationally since ancient times. For many years, spices have attracted foreign attention. Today, Indonesia still plays a significant role in the spice trade, including the essential oils and their derivatives. Lemongrass oil (*Cymbopogon nardus* L.) is a grass plant with narrow leaves. Lemongrass oil is relatively abundant in NTT, but its utilization is not yet optimal and its price is relatively cheap. The community only uses lemongrass as animal feed, traditional drinks, and mosquito repellent. Currently, lemongrass essential oil is used as a base material for perfumes, cosmetics, food additives, and medicines. Lemongrass essential oil is liquid at room temperature, easily evaporates, and has a distinctive aroma.

The essential oil industry of lemongrass (*Cymbopogon nardus* L.) has various benefits, including job creation, increased farmer income, increased state revenue, and industrial growth in the agricultural sector. Essential oils are soluble in organic solvents but insoluble in water, consisting of various chemical compounds formed from the elements Carbon (C), Hydrogen (H), Oxygen (O), as well as some chemical compounds containing Nitrogen (N) and Sulfur (S) (Baba, 2018). Some types of essential oils produced in Indonesia include clove oil, ylang-ylang oil, patchouli oil, nutmeg oil, sandalwood oil, sweet wood oil, fragrant root oil, white wood oil, and fragrant lemongrass.

Lemongrass (*Cymbopogon nardus* L.) is a plant with a soft, non-woody stem that lives for several years continuously. Lemongrass is a type of plant from the Poaceae family, often referred to as the grass family (Kolo et al., 2018). Essential oils can be obtained from various parts of the lemongrass plant, such as the roots, stems, and leaves. The cultivation process for

lemongrass is not difficult, as the plant can grow in marginal lands, including former mining sites. The essential oil of *Cymbopogon nardus* L. from Oenenu Village, Bikomi Tengah Subdistrict, has been characterized using GC-MS. A total of 27 components representing 92.5% of the detected compounds were identified, with geraniol as the main component (18.82%), followed by citronellol (5.27%) and citronellal (1.28%). These three compounds are the main compounds contained in *Cymbopogon nardus* L. (Obenu et al., 2021).

Fragrances are products that are no longer unfamiliar in everyday life. Currently, the range of fragrances available is increasingly diverse, including those specifically designed for men, women, or both. A fragrance is a mixture of odoriferous substances dissolved in a suitable solvent (Ginting, 2021). These fragrant substances are derived from essential oils or produced synthetically. Perfumes play a significant role in human life as they can enhance the joys of life, influence mental and nervous systems, and impart fragrance to odorless materials (Hardiyati, 2019). Based on the above description, the author is interested in researching lemongrass plants from TTU Regency as a base material for fragrance production and to change the public's perception that lemongrass plants are not only used as spices and medicines but can also be used as fragrances.

RESEARCH METHODS

Time and Place of Research

This research was conducted from February 2023 to May 2023. The research stages included sampling, sample preparation, distillation, and fragrance production. Samples were collected in Oenenu Village. Preparation, distillation, and fragrance production were carried out in the Chemistry Laboratory of the Faculty of Agriculture, Science, and Health, University of Timor.

Research Tools and Materials

1. Research Tools

The tools used in this study included a steam distillation apparatus, a stand, a 250 mL Erlenmeyer flask, a dropping pipette, a glass funnel, a 500 mL separating funnel, a 1000 mL beaker, scissors, a knife, an analytical balance, three test tubes, a 50 mL graduated cylinder, a 20 mL fragrance bottle, and a test tube rack.

2. Research Materials

The materials used in this study included 30 kg of citronella plants obtained from Oenenu, ethanol, distilled water, fragrance seeds (exabs), aluminum foil, filter paper, label paper, tissue paper, and HVS paper.

Research Procedure

1. Collection of Materials and Preparation of Lemongrass Plants

Samples of lemongrass (*Cymbopogon nardus* L.) were taken from clumps, including stems and leaves. The samples were then cleaned of soil and dry leaves, washed thoroughly, cut into small pieces, and air-dried for 2x24 hours, avoiding direct sunlight. The air-dried samples were then weighed to a total of 30 kg (Obenu et al., 2021).

2. Distillation Using Steam Distillation

Thirty kilograms of lemongrass plants were placed in a pot containing water and equipped with a condenser, then heated on a stove over low heat. During heating, condensation occurred inside the condenser, and the distillate that emerged was collected in an Erlenmeyer flask (collection bottle). The resulting distillate is then placed in a separatory funnel and separated

from the water (Obenu et al., 2021). The oil obtained is then measured using a measuring cylinder.

- 1) Production of Lemongrass Oil and Ethanol (Basic Notes)
 1. Take 3 mL of lemongrass oil and place it in a 50 mL beaker
 2. Add 10 mL of ethanol solvent to the beaker
 3. Pour the solution into a 20 mL perfume bottle
 4. Shake the solution until homogeneous and let it sit for a few minutes (Baba, 2018).
- 2) Lemongrass Oil and Exab Fragrance Seeds (Middle Notes)
 1. Take 3 mL of lemongrass oil and put it in a 50 mL beaker.
 2. Add 10 mL of exabs fragrance solvent to the beaker.
 3. Put the solution into a 20 mL fragrance bottle.
 4. Shake the solution until homogeneous and let it sit for a few minutes (Baba, 2018).
- 3) Lemongrass Oil, Exab, and Ethanol (Top Notes)
 1. Take 3 mL of lemongrass oil and put it in a 50 mL beaker
 2. Add 10 mL of exabs fragrance solvent and 5 mL of ethanol to the beaker
 3. Transfer the three solutions into a 20 mL fragrance bottle
 4. Shake the solution until homogeneous and let it sit for a few minutes (Baba, 2018).

Observation Parameters

1. Organoleptic Test
 - 1) The fragrance was presented to 30 panelists to provide feedback on their liking or disliking of the fragrance.
 - 2) The fragrance was sprayed onto the 30 panelists.
 - 3) The evaluations from the 30 panelists were recorded as very like, like, somewhat like, dislike, and very dislike (Baba, 2018).
2. Stain Test

The stain test is conducted to determine whether any stains are caused when the fragrance is used. This test uses three parameters, examining the absorbency of an object, namely: 1. filter paper, 2. tissue paper, 3. HVS paper, by spraying the fragrance onto each test paper (Baba, 2018).
3. Durability Test
 - 1) Prepare a test cloth or paper.
 - 2) Spray the fragrance onto the test cloth or paper.
 - 3) Leave the test cloth or paper for 30 minutes.
 - 4) Then smell the test cloth or paper to see if the fragrance still persists (Ginting, 2021).

RESULTS AND DISCUSSION

Distillation

The distillation performed in this study was steam distillation. The steam distillation apparatus is shown in **Figure 1**, where the mixture does not mix, and the distillate that emerges forms two condensed layers: oil and water (hydrosol) (Sefriyanti et al., 2020). According to the research by Sulaswatty et al. (2019), steam distillation is the simplest and easiest method for producing or obtaining lemongrass oil. A sample of 30 kg of lemongrass was distilled in eight stages because the size of the distillation pot used could only accommodate 4 kg of lemongrass sample per distillation. The resulting distillate was then collected in a container.

The distillation process took 4 hours. The resulting lemongrass essential oil appears to float or remain at the top, while water remains at the bottom. According to Sefriyanti et al. (2020), essential oils are found in the upper layer because they have a lower density than water. The lemongrass essential oil obtained is characterized by a light yellow color, clarity, and a distinctive, sharp aroma. According to the research by Azriyenni et al. (2022), the acceptable analysis results for lemongrass oil are yellow in color with a very sharp lemongrass aroma. The oil obtained from the distillation process is then separated using a separator funnel to obtain lemongrass oil without water. The distilled lemongrass oil appears as shown in **Figure 2** below.



Figure 1. Distillation Equipment Set-up



Figure 2. Distilled Oil

Fragrance Production

In the production of perfumes, fragrance classification is required, where this classification is a grouping of several main components of the perfume, as it will facilitate the formulation of the perfume by considering the following components: base notes, middle notes, and top notes. The following is the fragrance classification as shown in **Figure 3**.

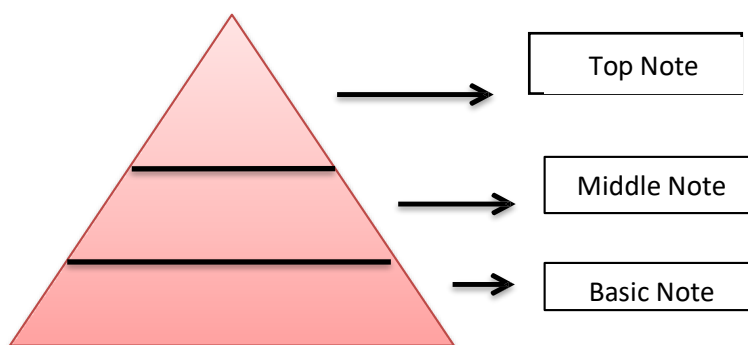


Figure 3. Classification of fragrances

1. Basic Notes

Basic notes are aromas with high molecular weight and form the core of a fragrance. Additionally, basic notes are the most long-lasting essential oils, with their fragrance lasting up to one week (Elwina et al., 2006). The results of fragrance production categorized as basic notes are shown in the figure below.



Figure 4. Basic Notes Fragrance

2. Middle Notes

Middle notes are the middle or core aromas that evaporate slowly after the top notes evaporate. The results of making fragrances with middle notes are shown in the image below.



Figure 5. Middle Note Fragrance

3. Top Notes

Top notes are the topmost aromas that have high vapor pressure, such as citrus or spices. The results of making fragrances with top notes are shown in the image below.

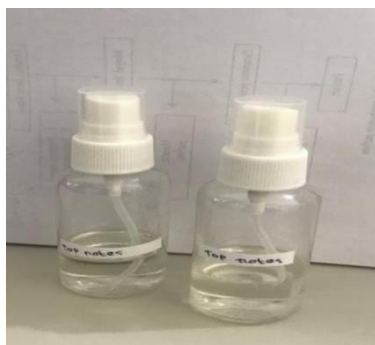


Figure 6. Top Notes Fragrance

Observation Parameters

1. Organoleptic Test

Based on the results of testing several parameters such as color, aroma, freshness, and aroma intensity, all parameters received good scores with 30 panelists. However, in addition to having a long-lasting aroma, which is always a requirement of the panelists, The aroma intensity parameter plays a very important role in perfecting a fragrance aroma. This is because it relates to the durability of the fragrance produced. Meanwhile, color, aroma, and freshness are used to further enrich and add value to a fragrance product.

a. Color

Color preference testing for fragrances is conducted by asking panelists to view the color of the product. Color testing in fragrances is often used in the fragrance industry to assist in the creation, description, and marketing of fragrances. For example, color can be used to describe whether a fragrance is fresher, sweeter, floral, or woody, and color can also help communicate other characteristics such as warmth, freshness, or even softness. This test was conducted by 30 panelists divided into two groups: students and the general public, who provided ratings ranging from 1 (very much liked), 2 (liked), 3 (somewhat liked), 4 (did not like), and 5 (very much disliked). The results of the panelists' organoleptic test on the color of lemongrass fragrance can be seen in **Figure 7**.

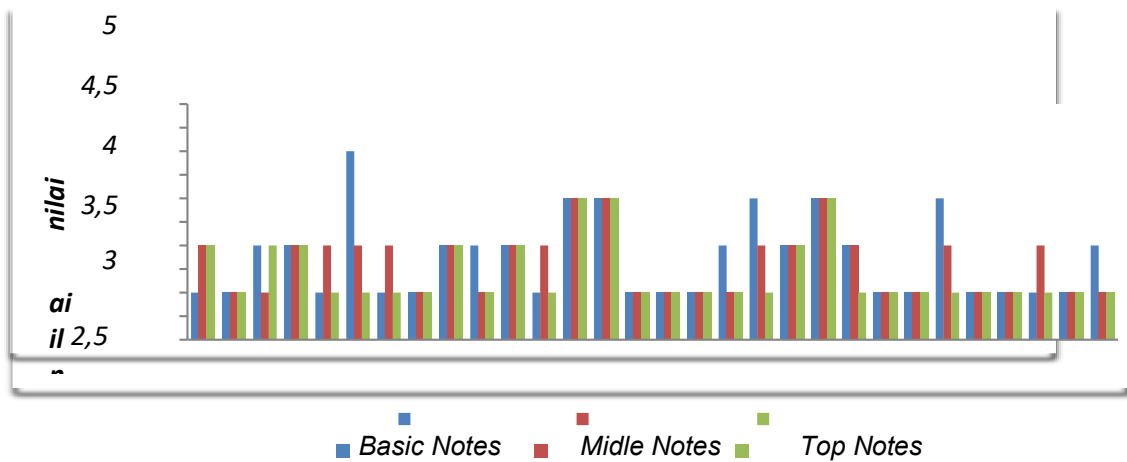


Figure 7. Grafic Organoleptic Test Graph for Lemongrass Fragrance

b. Aroma

This test was conducted by 30 panelists who gave ratings ranging from 1 (like very much), 2 (like), 3 (like somewhat), 4 (do not like) and 5 (dislike very much). The following graph shows the results of the panelists' organoleptic test of the aroma of lemongrass fragrance, as shown in **Figure 8**.

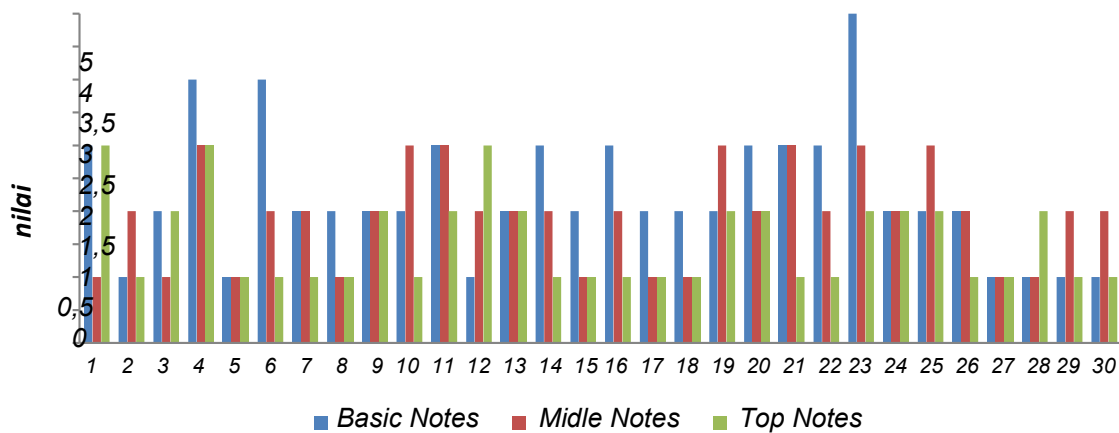


Figure 8. Organoleptic Test Graph for Lemongrass Fragrance

c. Freshness

The freshness of a fragrance is an aromatic quality that gives a fresh, revitalizing, and refreshing impression when worn. Fragrances with good freshness usually have fresh, bright, and energetic aromatic characteristics. Several elements that can give freshness to a fragrance are: 1. citrus aromas, used in top notes to provide freshness and an immediate sensation 2. mint aromas, which are often used in fragrance production to provide a refreshing effect on the skin 3. herbal aromas, which are often used in fragrances to provide.

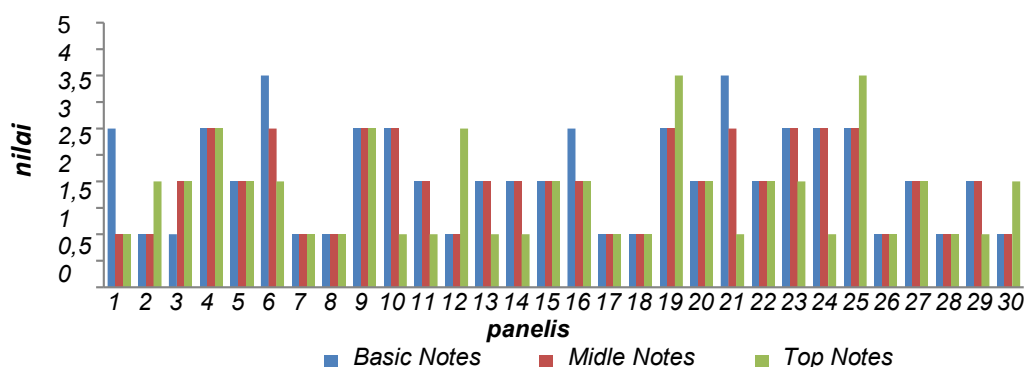


Figure 9. Organoleptic Test Graph for the Freshness of Lemongrass Fragrance

d. Aroma Intensity

Aroma intensity is the persistence of a product's fragrance or aroma. The aroma intensity of a fragrance can vary depending on several factors, including: 1. fragrance concentration, where higher concentrations result in stronger aroma intensity 2. composition and density of aromatic ingredients, which affect how strong and long-lasting a fragrance's aroma is 3. Skin type and pH, where the characteristics of a person's skin and pH can affect how the fragrance interacts with the body. For example, drier skin tends to retain fragrance better than oily skin 4. Application method, where applying the fragrance directly to the skin results in higher intensity than applying it to fabric 5.

Environment and temperature, where higher temperatures tend to increase fragrance volatility, making the fragrance feel stronger compared to colder, enclosed environments where the fragrance intensity is weaker. This test was conducted by 30 panelists who provided ratings ranging from 1 (very much like), 2 (like), 3 (somewhat like), 4 (do not like), and 5 (very much dislike). The following is a graph of the panelists' organoleptic test results on the intensity (persistence) of lemongrass fragrance, as shown in **Figure 10**.

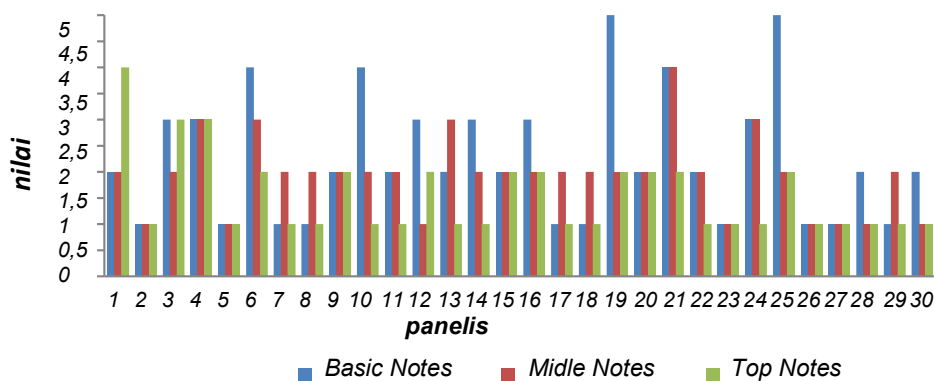


Figure 10. Organoleptic Test Graph of the Intensity of Lemongrass Fragrance

2. Stain Test

Stain testing on a fragrance is usually conducted to evaluate whether the fragrance leaves stains on the skin or clothing. This test serves to ensure that the fragrance is safe to use without causing stains that are difficult to remove. The test method used in this study was a stain test on fabric. The stain test parameters used were filter paper, tissue paper, and HVS paper, each with their respective absorption capacities (Baba, 2018). Tissue paper has excellent absorbency properties, so its use helps test the stain potential or the fragrance's ability to leave stains on surfaces such as clothing or fabric. HVS paper is often used in fragrance stain testing to evaluate the fragrance's resistance to stains or color changes, while filter paper has a smoother

texture and is made from tightly woven fibers. The absorbency of each stain-testing paper is compared to that of fabric or clothing. The results of the stain tests on the three papers are shown in the table below.

Table 1. Results of the Stain Test

Test paper Formulation	Test paper Formulation		
	Base notes	Middle notes	Top notes
Tissue paper	3	3	2
Filter paper	2	1	2
HVS paper	3	3	2

Description:

1. There are stains
2. No stains
3. Thin
4. Thick
5. Very thick

3. Durability Test

The durability test of a fragrance is a method used to evaluate how long the fragrance lasts after being applied to the skin or clothing. This is important because good fragrance durability is one of the factors that makes users feel satisfied with the product. There are several common methods used in testing the durability of a fragrance, including: skin tests, fabric tests, and absorbent paper tests (filter paper). This test is carried out at room temperature 28-29°C using filter paper and a durability test on the skin which is sprayed every 30 minutes the aroma is observed. This fragrance durability test is carried out for 8 hours. In accordance with the durability of citronella fragrances, in general, they have a minimum fragrance durability of 3 hours, so testing is carried out on citronella-based fragrances for a minimum of 3 hours and a maximum of 8 hours starting at 09:00 (hours/minutes). The following is a table of the results of the panelists' organoleptic tests on the durability of the fragrance aroma, which can be seen in Table 2.

Table 2. Durability Test Results

Time Observation	Formulation		
	Bassic notes	Middle notes	Top notes
09.00-09.30	*****	***	****
09.30-10.00	*****	***	****
10.00-10.30	*****	***	****
10.30-11.00	*****	***	****
11.00-11.30	***	***	****
11.30-12.00	***	**	***
12.00-12.30	**	**	***
12.30-13.00	**	**	***
13.00-13.30	**	**	***
13.30-14.00	**	**	***
14.00-14.30	**	**	***
14.30-15.00	**	**	***
15.00-15.30	**	**	***
15.30-16.00	**	**	***

Description:

Very strong	: *****
Strong	: ****
Somewhat strong	: ***
Weak	: **
Very weak	: *

Based on the table above **Table 2**, the three tested formulation samples show that the basic notes formulation maintains very strong aroma retention from 9:00 AM to 11:00 AM (hours/minutes), but aroma retention begins to decline (weak) from 11:00 AM to 4:00 PM (hours/minutes). For the middle notes, the aroma produced is moderately strong from 9:00 AM to 11:30 AM, but its aroma retention has already begun to fade or the aroma has become very weak from 11:30 AM to 4:00 PM (hours/minutes). Meanwhile, for the top notes formulation from 9:00 AM to 11:30 (hours/minutes), the fragrance's longevity is strong and begins to decrease (remaining moderately strong) from 11:30 AM to 4:00 PM.

It is concluded that based on the table, the fragrance with stronger fragrance longevity is obtained in formulation 3 (top notes) with a 3-star rating, meaning the fragrance is moderately strong. This indicates that all the fragrances produced have strong fragrance longevity and can even last up to 8 hours. According to Ubaidillah (2017) in his book, a good fragrance should last 3 to 8 hours. A fragrance with good quality and longer fragrance retention is more likely to be preferred by panelists compared to a fragrance with a short-lived aroma.

CONCLUSION

Based on the research and discussion, the following conclusions are drawn: The organoleptic test results for the most popular fragrances were the top notes, with 21 panelists liking color, 16 panelists liking aroma, 14 panelists liking freshness, and 18 panelists liking aroma intensity. Stain testing for the bass notes and middle notes revealed staining on tissue paper and HVS paper, but very light, while the top notes showed no staining on the three test papers. Durability testing for the bass notes, middle notes, and top notes showed up to 8 hours.

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