

LITERATUR REVIEW : VARIATIONS IN CONCENTRATION OF CITRONELLA OIL AND QUALITY TEST IN MANUFACTURING HAND AND BODY LOTION

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Abstract

Lemongrass (*Cymbopogon nardus* L.) has become a leading essential oil-producing plantation commodity in Indonesia, with the largest lemongrass plantation area located in the Aceh Province. Despite Indonesia being the world's second largest producer of lemongrass oil or commonly known as citronella oil, a majority of the oil is exported in crude form, while a small portion is utilized domestically or imported as pure oil at a higher price. Enhancing the value of citronella oil can be achieved through the isolation of its active compounds, such as citronellal, geraniol, and citronellol, which possess bioactive properties as mosquito repellents and are capable of inhibiting specific bacterial activities. Direct application of lemongrass essential oil on the skin is less effective due to its volatile nature, hence it can be formulated into hand and body lotions as a skin moisturizer and to enhance its disinfective aroma. This research aims to determine the effect of citronella oil in hand and body lotion production, focusing on concentration variations in the formulation. The study utilizes a systematic literature review method to evaluate the concentration variations of citronella oil in hand and body lotions. Various studies present differing outcomes regarding the optimal concentration of citronella oil in hand and body lotions. Research findings indicated that varying concentrations of citronella oil affect the lotion's quality, including pH levels, viscosity, and their impact on the skin. Although different concentrations yield varying characteristics, most studies suggest that the highest concentration, ranging from 6% to 15%, tends to produce desired results such as high spreadability, normal pH, and the distinctive aroma of lemongrass. Based on these research findings, it is concluded that the concentration of lemongrass oil in hand and body lotion formulations significantly impacts product quality. Recommendations from this study advocate for the application of the highest concentration of citronella oil in lotion formulations to achieve the desired characteristics.

Keywords : essential oil, lemongrass, hand body lotion.

I. INTRODUCTION

Lemongrass (*Cymbopogon nardus* L.) is a significant plantation commodity in Indonesia known for its production of essential oils. The lemongrass cultivation area in smallholder plantations increased to 25.891 hectares, while the area in large private plantations decreased to 156 hectares from 373 hectares in 2020 (1). Aceh province stands as Indonesia's largest lemongrass producer, cultivating 20.625 hectares and yielding 3.414 tons of lemongrass.

The lemongrass plants hold significant potential as a dual-value commodity on low-fertility lands. Indonesia stands as the world's second-largest producer of citronella oil after

China (2). However, nearly 75% of citronella oil is exported in crude form, while the remaining 25% is utilized for domestic purposes (3). Indonesia also imports citronella oil in the form of 'pure oil' at a higher price compared to the crude oil it exports (4). Increasing the value-added of citronella oil can be achieved by isolating active components through multi-stage distillation. Processed lemongrass transformed into essential oil holds high market value, reaching up to Rp250.000 per 100 ml (5). The global export value of essential oils amounted to 215,81 million US dollars with a volume of 7,54 million tons during 2020 (6). Global interest in citronella oil shows a considerable increase, particularly in European countries such as France, Poland, Ireland, Belgium, Spain, and the Netherlands. Such interest will continue to rise in tandem with the advancement of modern industries like the perfume industry, beauty or cosmetic ingredients, food, pharmaceuticals, aromatherapy, and the pharmaceutical sector (7).

Distillation of lemongrass leaves and stems produces an essential oil known as citronella oil. The dominant active components in citronella oil are citronellal, geraniol, citronellol. These components are bioactive and act as mosquito repellents (8), while also exhibiting the ability to inhibit the activity of bacteria such as *Staphylococcus aureus* and *Escherichia coli* (9). Direct use of essential oil is less effective due its volatile nature, hence the need to formulate it into lotions for easier application to the skin by consumers and to maintain the stability of the essential oil during storage (10).

Hand body lotion is an emulsion product for external (skin) topical use. Lotion aids in reducing skin dehydration caused by water evaporation, softening, cleansing, and preserving active ingredients (11). The fundamental components of lotion preparations consist of an internal phase, an external phase, and an emulsifier (12). Emulsifiers function as emulsifying agents to stabilize the emulsion substances (13). The physical properties of hand and body lotion that comply with national standards will affect its pharmacological effects. Lotion formulations should have a suitable pH to prevent skin irritation, possess good spreadability, and long-lasting adhesion to ensure the optimal activity of active ingredients (14). Based on this background, a systematic literature review is conducted to evaluate and identify relevant research in this field, aiming to support further research development.

II. METHODOLOGY

This research was conducted using the systematic literature review method. Systematic Literature Review (SLR) is a research and development method used to evaluate previously gathered research related to a specific topic focus (15). This study discusses the variations in concentrations of citronella oil in hand and body lotion formulations that have been previously undertaken by researchers and are scientifically justifiable. The literature sought and utilized in this writing includes publications from various sources such as journals, books, scholarly works, and theses, ranging from 2013 to 2023.

III. RESULTS AND DISCUSSION

Hand body lotion is composed of several components, including stearic acid, triethanolamine, water, glycerine, methylparaben, liquid paraffin, propylparaben, cetyl alcohol, and essential oils. The production of hand body lotion with the addition of lemongrass essential oils as an aromatherapy scent has various concentration variations. Differences in

concentration within the formulation of the hand body lotion will result in products with different qualities. In its manufacturing process, the lotion ingredients consist of two unmixed phases stabilized using an emulsion system. The oil-in water emulsion system aims for quick absorption and even distribution on a wide skin surface, providing a soft and cool effect due to the evaporation of the external water phase, and the preparation doesn't feel oily upon application (16).

In the study that discusses about the optimal effect of citronella oil concentration in hand body lotion, it was identified that the optimal concentration was 6% (17). The produced product exhibited high spreadability, homogeneity, and the distinctive strong aroma of citronella oil, which was preferred by the panelists. Additionally, it proved effective as a mosquito-repellent lotion. However, an increase in the concentration of the active ingredient, citronella oil, showed a significant rise in pH values, reaching 7,2 in the second week, while its viscosity decreased. This raised concern about potential skin irritation due to the increased pH and decreased viscosity.

In the study that discusses about formulation of fragrant lemongrass oil skin lotion with varying concentrations of triethanolamine, there wasn't a significant difference observed among lotion formulations with varying concentrations of citronella oil at 0%, 0,5%, 1%, and 1,5%. The researchers stated that all four concentrations met the quality test requirements specified in SNI 16-4399-1996. However, the concentration of triethanolamine significantly influenced the viscosity of the lotion, wherein higher concentrations of citronella oil and triethanolamine resulted in increased viscosity (18).

In the study that discusses about analysis of the concentration of essential oil from citronella as an additive in making anti-mosquito lotion, it was found that the optimal concentration of citronella oil in the hand body lotion samples was 2%. The produced product exhibited skin-safe characteristics, no irritation, had a pH of 7.2, and emitted the distinctive citronella scent (19).

In another study, the best concentration identified in the lemongrass scented lotion samples was 15%. This product displayed high spreadability, homogeneity, and a normal pH level (between 4.5 – 6.5). The difference from the previous study lies in the 15% concentration having a normal pH, potentially due to its mixture with 15% basil oil, altering the total amount of essential oils added (20).

Differences in the concentration of citronella oil added to the formulation of hand body lotion and the duration of stirring can effect the resulting lotion (8). The higher the concentration of citronella oil used, the higher the pH value and the lower the viscosity due to a higher water content. The pH value will decrease over time during storage, and the viscosity will increase with longer storage durations due to evaporation.

IV. CONCLUSIONS AND NEWNESS

Basen on the results of the reviewed research, it can be concluded that there is a correlation between the concentration of citronella oil and the quality of hand body lotion as indicated by test for homogeneity, yield, viscosity, pH, and microbial contamination. Recommendations from various literature sources suggest that the optimal concentration of citronella oil lies in formulations with the highest concentration, yielding results that are safe

for the skin (non-irritating when used), exhibit high spreadability, have a normal pH (4.5 – 6.5), and possess the distinctive citronella scent (lemongrass oil) that can enhance its appeal to the public and be effective in protecting the skin from mosquitoes. However, it should be noted that increasing the concentration of the active substance citronella oil can increase the pH value significantly, while the viscosity decreases. This has the potential to cause skin irritation. Therefore, further research needs to be carried out to influence other factors that can reduce this deficiency.

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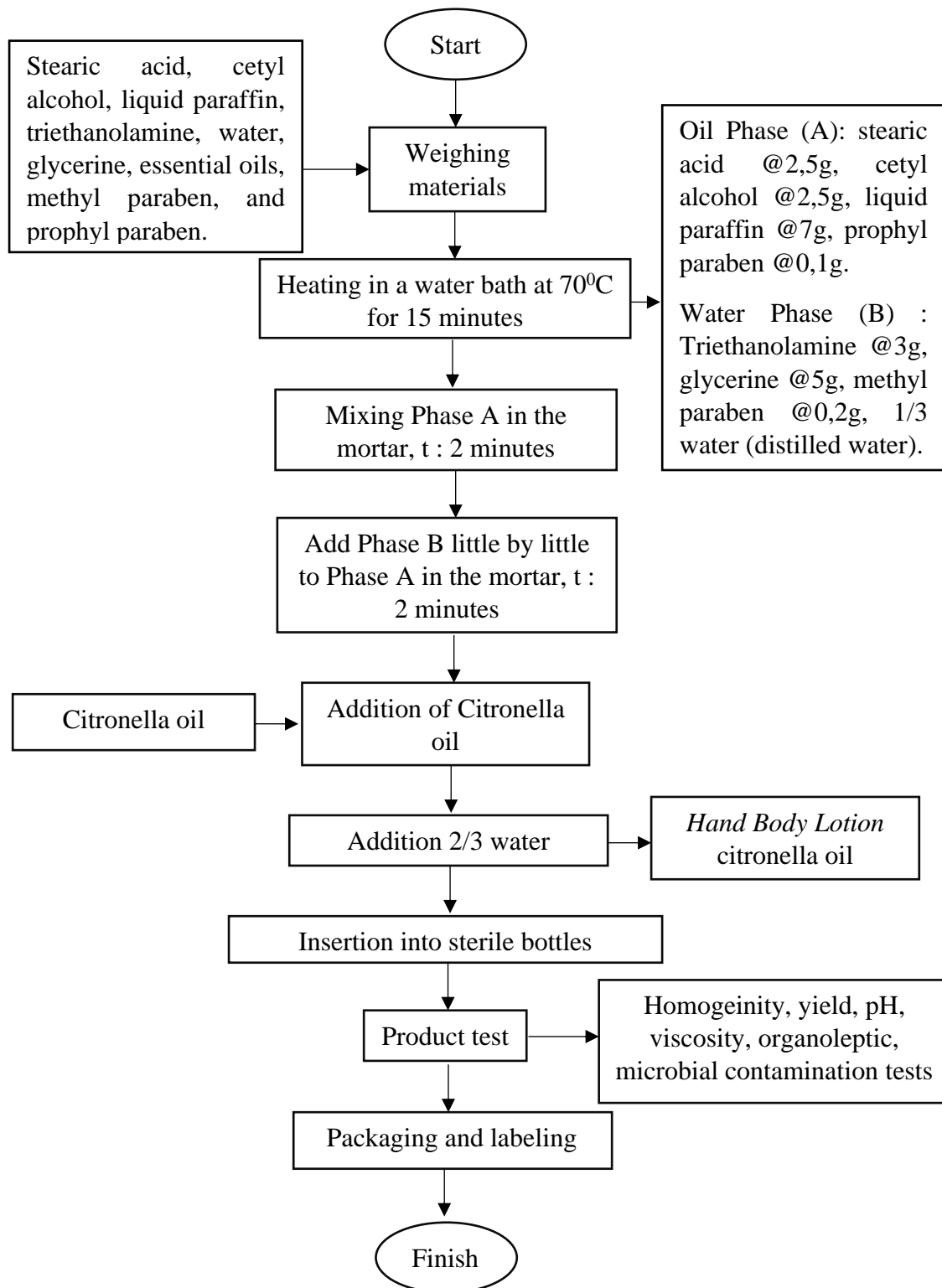
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TABLES AND FIGURES

Table 1. Prior research

No.	Author	Year	Title	Formulation	Results
1.	Yuliansi	2020	Formulation and Effectiveness Test of Citronella Oil Anti-Mosquito Lotion Preparation.	Addition of citronella oil with varying concentrations of 0%, 2%, 4%, and 6%.	Optimal concentrations of citronella oil is 6% with homogeneity, high spreadability, and the distinctive strong aroma of citronella oil,

				which was preferred by the panelists.	
2.	Wati <i>et.al</i>	2020	Formulation of Fragrant Lemongrass Oil Skin Lotion With Varying Concentrations of Triethanolamine.	Addition of citronella oil with varying concentrations of 0,5%, 1%, and 1,5%.	The researchers stated that all four concentrations met the quality test requirements specified in SNI 16-4399-1996.
3.	Siskayanti <i>et.al</i>	2021	Analysis of The Concentration of Essential Oil from Citronella As An Additive in Making Anti-Mosquito Lotion	Addition of citronella oil with varying concentrations of 0%, 0,5%, 1%, 1,5%, and 2%.	Optimal concentrations of citronella oil is 2% with skin-safe characteristics, no irritation, had a pH of 7.2, and emitted the distinctive citronella scent.
4.	Kristianingsih & Febriana	2022	Analysis of The Concentration of Essential Oil from Citronella As An Additive in Making Anti-Mosquito Lotion.	Addition of citronella oil with varying concentrations of 0%, 10%, and 15%.	Optimal concentrations of citronella oil is 15% High spreadability, homogeneity, and a normal pH level (between 4.5 – 6.5).



Source : Modification from Hidayati *et.al* (2021)

Figure 1. Hand body lotion formulation