

## Antimicrobial Activity of Liquid Soap Containing Turmeric (*Curcuma domestica* Val.) and Lemongrass (*Cymbopogon nardus* L.) Leaf Juice

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**Abstract.** The purpose of this study was to formulate an antimicrobial liquid soap containing 25% turmeric and lemongrass leaf juice. Lemongrass leaf juice and turmeric juice 25% were formulated into a liquid soap. Stability, pH and viscosity of the liquid soap were evaluated. For stability tests, the preparation was stored for 3 months at room temperature. The pH test was measured by Hanna pH meter. The viscosity test, was measured by Brookfield viscometer. The antimicrobial activity of the liquid soap was measured by disc diffusion method using bacteria such as *Staphylococcus epidermis*, *Eschericia coli*, *Microsporium gypseum* and *Candida albicans*. Physical properties of the formulated liquid soap including pH, viscosity, and stability showed that it was stable for 3 months. The results of antimicrobial test of the liquid soap containing turmeric and lemongrass leaf juice showed that the inhibition diameter against *Staphylococcus epidermis*, *Eschecheria coli*, *Microsporium gypseum* and *Candida albicans* were 22.89, 27.05, 24.30, and 33.05 mm, respectively, while the liquid soap without the juice were 20.76, 19.50, 20.50 and 21.46 mm, respectively. The soap was effective in inhibiting the growth of microbes. Combination of turmeric and lemongrass leaf juice increased the inhibitory zone diameter of the liquid soap for microbe.

**Keywords:** Antimicrobial Agent, Lemongrass Leaf, Liquid Soap, Turmeric Leaf.

**Abstrak.** Penelitian ini bertujuan untuk memformulasi sabun cair antibakteri yang mengandung 25% air perasan daun kunyit dan daun sereh. Pengujian sifat fisika kimia sabun dilakukan terhadap stabilitas, pH, dan viskositas. Untuk pengujian stabilitas, sediaan disimpan selama 3 bulan pada suhu ruang. Pengujian pH dilakukan dengan menggunakan pH meter Hanna. Viskositas diukur menggunakan viskometer Brookfield. Pengujian aktivitas antimikroba terhadap *Staphylococcus epidermidis*, *Eschericia coli*, *Microsporium gypseum* dan *Candida albicans* dilakukan dengan metode difusi agar menggunakan pencadang kertas. Sifat fisika kimia sabun yang dihasilkan stabil selama 3 bulan. Hasil pengujian antimikroba dari sabun cair yang mengandung air perasan daun kunyit dan daun sereh stabil menunjukkan diameter hambatan terhadap *Staphylococcus epidermis*, *Eschericia coli*, *Microsporium gypseum* dan *Candida albicans* adalah 22,89, 27,05, 24,30, dan 33,05 mm secara berurutan, sedangkan yang tidak mengandung air perasan daun kunyit dan daun sereh menunjukkan diameter hambat sebesar 20,76, 19,50, 20,50 dan 21,46 mm secara berurutan. Sabun cair yang dihasilkan efektif dalam

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*menghambat pertumbuhan mikroba. Kombinasi air perasan daun kunyit dan daun sereh meningkatkan diameter zona hambat dari sabun cair yang dihasilkan.*

**Kata kunci:** *Candida albicans, daun kunyit, daun sereh, Eschericia coli, Microsporium gypseum, Sabun cair, Staphylococcus epidermidis.*

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## 1. Introduction

Turmeric (*Curcuma domestica* val.) is one of rhizomatous plants included into Zingiberaceae family. It has a pseudo stems formed from the leaf sheaths. The height of the plant can reach up to 1.0 to 1.5 meters. It forms clumps like shrubs and clustered. The leaves are single, wide lanceolate in shape, flat brimmed, tapered tip base, pinnate, flaccid and light green in color. The main compounds found in turmeric are curcuminoids (3.0-5.0%) and essential oil (2.5-6.0%) [1]. The plant has been used as traditional medicine in many countries because of the antibiotic and antiseptic effects of curcumin contained in the plant, an important constituent of turmeric. A yellow-pigmented fraction isolated from the rhizomes of *Curcuma* contains curcuminoids belonging to the dicinnamoyl methane group. Curcuminoids are present to the extent of 3-5 %. It is an important active ingredient responsible for the biological activity of *Curcuma*. Though the major activity is anti inflammatory, it has also been reported to possess antioxidant, anti allergic, wound healing, anti bacterial, anti fungal and anti tumor activity [2].

Lemongrass (*Cymbopogon nardus* L.), Poaceae family, is herbaceous, has pseudo stems consisting of flat leaf sheaths with 20-60 cm long, parallel, ribbon shape, thin and smooth hairy, has an aromatic smell because of its essential oil consisting of geraniol and sineol which are antiseptic. It is widely used for seasoning and cold medicine [3]. Lemongrass extracts showed important therapeutic potentials such as anti-cancer, antihypertensive and anti-mutagenicity. Others include non-toxic properties, anti-diabetic, anti-oxidant, anxiolytic, anti-nociceptive and anti-fung [4].

Previous research has been conducted to examine the phenol coefficient of plants containing essential oils [5]. These compounds can kill bacteria and fungi thus are antiseptic or antibacterial<sup>6</sup>. The utilization of juices of kaffir lime, lemongrass and basil leaves have been also investigated for antibacterial activity against *Salmonellathypi* and *Staphylococcus aureus* [6].

Based on these traditional used and previous researches above, we conducted this study of juices of leaves containing essential oils which are turmeric (Labiateae) and lemongrass leaves (Poaceae) formulated into liquid soap with concentration of each juice was 25%. Microbial test were *Staphylococcus epidermis*, *Eschericia coli*, *Microsporium gypseum*, and *Candida albicans*.

## 2. Materials And Methods

### 2.1. Materials

The materials used in this study were Nutrient Broth (Oxoid), Nutrient Agar (Oxoid), Potato Dextrose Agar (Oxoid), sterile distilled water, sterile NaCl 0.9%, turmeric leaves juice 25% and lemongrass leaves juice 25%, and liquid soap. The samples (turmeric and lemongrass) were taken from sub-district of Padang Bulan Selayang II Medan.

### 2.2. Preparation of Juices from Turmeric and Lemongrass Leaves at Concentration of 25%

Turmeric leaves were sliced or cut thinly, and then crushed in a mortar until smooth. Twenty five grams of the leaves were weighed using an electric scales, put in to 100 ml volumetric flask. Sterile distilled water was added up to the mark line. Then, the volumetric flask was closed and stored in a refrigerator for 24 hours. The next step was to filter it using a filter paper so that the juice with concentration of 25% was obtained. The same procedure was carried out for lemongrass leaves.

### 2.3. Preparation of Liquid Soap

The liquid soap formula used in this study was modified based on a formula used in a previous study [8].

R/ Olive oil	15
Potassium hydroxide	8
Carboxy methyl cellulose	0.5
Sodium lauryl sulfat	0.5
Stearic acid	0.25
Butyl hydroxy anisole (BHA)	0.5
Parfume	1
Disstiled water	up to 50 ml

#### A. Modified formula

R/ Sodium lauryl sulfat	20
Hydroxy propyl methyl cellulose (HPMC)	5
Glycerin	5
Tween 80	9
Turmeric juice	25
Lemongrass juice	25
Disstiled water	up to 100 ml

Twenty grams of sodium lauryl sulfate was dissolved in 25 ml of turmeric leaf juice (mixture A). As much as 2.5 grams of HPMC was weighed and then poured in to 25 ml of lemongrass leaves juice and allowed to expand for about 15 minutes. Glycerin was gradually added into expanded HPMC while stirred until homogen. Later, Tween 80 was added and stirred to obtain a homogeneous mixture (mixture B). Mixture A was poured slowly into mixture B, and stirred until the mixture was homogen. If necessary, it could be heated in a water bath, then added with distilled water.

## 2.4. Physical Properties of the Preparations

### A. Physical Stability

Physical stability of the preparation examined including consistency, color, and odor. Preparation was stable if its color, odor and consistency were not changed visually during storage, and also not over grown by fungus.

### B. Determination of pH

Determination of pH of preparation was done by using Hanna pH meter. The instrument was first calibrated using standard neutral pH buffer solution (pH 7.01) and acidic pH buffer solution (pH 4.01) until showed pH values. Then the electrode was washed with distilled water, and dried using tissue paper. Samples were made at concentration 1% (1 gram preparation was weighed and dissolved in 100 ml distilled water). Then the electrode was dipped into the sample solution until the instrument showed a constant pH value. The number appeared in pH meter was the pH value of preparations.

### C. Determination of Viscosity

Viscosity of the preparation was examined by using the Brookfield viscometer. Procedure: Spindle 63 was attached to viscometer and put into the preparation to the limit line. The motor was switched on at speed 3 so spindle was rotated. The measurement was considered finished if the needle indicated a constant number. The viscosity was obtained by multiplying the readable numbers with a factor of 100.

## 2.5. Preparation of Inoculum

### A. Preparation of Culture Stocks

The bacterial colonies were taken with sterile loop, and then inoculated in slanting NA medium by scratching the loop gently up the surface of NA. Then it was incubated in the incubator at 37°C for 24 hours. The same procedure was applied for *Staphylococcus epidermis* and *Eschericia coli*. The fungal colonies were taken using a sterile loop, and then inoculated in slanting PDA medium by scratching the loop gently up the surface of PDA. Then it was incubated in the incubator at 25°C for 48 hours. This applied to *Microsporium gypseum* and *Candida albicans*.

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### B. Preparation of Inoculum

The bacterial colonies were taken from culture stocks with a sterile loop and suspended in a test tube containing 10 ml NB. Then the turbidity of the solution was measured at wavelength 560 nm until obtained 25% transmittance. This applied to *Staphylococcus epidermis* and *Eschericia coli*. The fungal colonies were taken from culture stocks with a sterile loop and suspended in a test tube containing 10 ml NaCl 0.9%. Then the turbidity of the solution was measured at wavelength 580 nm until obtained 25% transmittance. This applied to *Microsporium gypseum* and *Candida albicans*.

### C. Antimicrobial Activity of the Liquid Soap Containing Juices of Turmeric and Lemongrass Leaves

Antimicrobial activity of the liquid soap containing juices of turmeric and lemongrass leaves was evaluated by agar diffusion method using a paper petri dish. As much as 0.1 ml of bacterial inoculums was mixed homogeneously with 15 ml of NA in the petri dish, then the medium was allowed to be solid. A paper disk was dipped into the sample for 15 minutes, and attached to the solid agar medium. Then it was incubated at 37°C for 24 hours. Next, the clear zone diameter around disk was measured using calipers. The test was performed 3 times. This procedure was also applied to *Staphylococcus epidermis* and *Eschericia coli*.

As much as 0.1 ml of bacterial inoculums was mixed homogeneously with 15 ml of NA in the petri dish, then allowed the medium to be solid. Paper disk was dipped into the sample for 15 minutes, and attached to the solid agar medium. Then it was incubated at 25°C for 48 hours. Next, the diameters of the clear zones around the petri disks were measured using calipers. The test for each disk was performed 3 times. This procedure applied to *Microsporium gypseum* and *Candida albicans*.

## 3. Results

### 3.1. Physical Properties of the Preparations

Results of the physical properties of the liquid soap containing juices of turmeric and lemongrass leaves are demonstrated in Table 1. The present study indicated that physical properties of preparations were stability, pH and viscosity. During 3 months of storage, the liquid soaps were stable; no change was obtained in terms of consistency, color and odor, pH, and viscosity as shown in Table 1.

### 3.2. Antimicrobial Activity of the Liquid Soap Containing Juices of Turmeric and Lemongrass Leaves

The results of the antimicrobial activity test showed that the liquid soap containing turmeric and lemongrass leaves juices can inhibit the growth of *Staphylococcus epidermis*, *Eschericia coli*, *Microsporium gypseum* and *Candida albicans*.

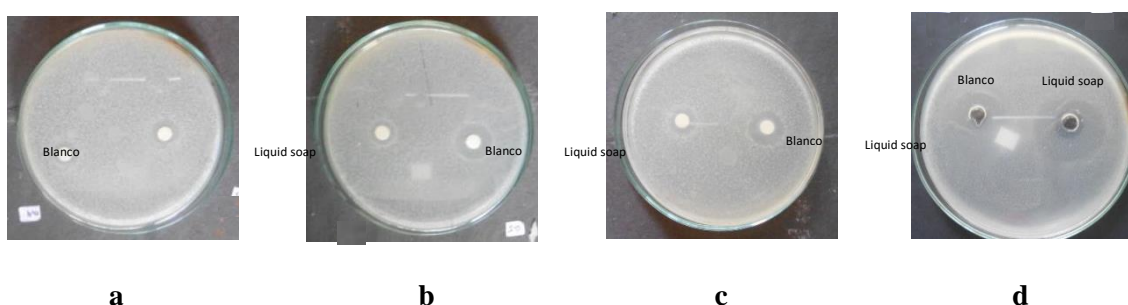
**Table 1.** Physical Properties of the Liquid Soap Containing Juices of Turmeric and Lemongrass Leaves

	Liquid soap	Liquid soap without extract
Shape	liquid	liquid
Color	greenish brown	clear
Odor	aroma of turmeric and lemongrass	-
pH	6.9	8.7
Viscosity	500 cp	2000 cp

**Table 2.** Antimicrobial Activity of Liquid Soap Containing Turmeric and Lemongrass Leaves Juices

	Inhibitory Zone Diameter (mm)*	
	Liquid soap	Liquid soap without extract
<i>S. epidermis</i>	22.87	20.76
<i>E. coli</i>	27.05	19.5
<i>M. gypseum</i>	24.3	20.5
<i>C. albicans</i>	33.05	21.46

\* = average of three times measurements



**Figure 1.** Inhibitory Zone Diameter of the Liquid Soap Containing Juices of Turmeric And Lemongrass Leaves Against (a) *Staphylococcus epidermis*, (b) *Escherichia coli*, (c) *Microsporium gypseum* and (d) *Candida albicans*

#### 4. Discussion

Based on Table 1, the viscosity of liquid soap without extract was more viscous than the liquid soap containing juices of turmeric and lemongrass leaves. The viscosity decreased due to the addition of the extract into the liquid soap formula.

Based on the Table 2, it could be seen that liquid soap containing turmeric and lemongrass leaves juices had a great inhibition against all microbes. According to Indonesian Pharmacopeia Fourth edition, effective inhibition as an antimicrobial is 14-16 mm. This liquid soap was more effective to inhibit microbial test growth of *Candida albicans* with inhibitory zone diameter 33.05 mm than *Staphylococcus epidermis*, *Escherichia coli*, and *Microsporium gypseum*.

A previous study Research done by Nurbaya (2014) showed that mixture of the juices of turmeric and lemongrass leaves with each concentration of 25% provided synergistic effect in inhibiting *Salmonella thypi* and *Staphylococcus aureus*.

## 5. Conclusion

Liquid soap containing juices of turmeric and lemongrass leaves with concentrations of 25% demonstrated antibacterial activity indicated from the presence of inhibitory zone of more than 14 mm. The most effective inhibition of the liquid soap was on *Candida albicans* with inhibitory zone diameter of 33.05 mm compared to other microbes tested.

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## REFERENCES

- [1] S.Y.Hartati, Balitro, "The use of turmeric as traditional medicine and other benefits. *Research and development of industrial plants*", vol. 19, no.2, pp. 5-9. 2013
- [2] A.D. Pandey, S.K. Katiyar, "Determination and comparison of the curcuminoid pigments in turmeric genotypes (*Curcuma domestica* Val) by high-performance liquid chromatography", *International Journal of Pharmacy and Pharmaceutical Sciences*, vol. 2, pp. 125-127. 2010.
- [3] Department of Health Republic of Indonesia, *The use of medicinal plants*, Third ed. Directorate Jeneral of Drug and Food Surveillance, Jakarta, 1983.
- [4] S.K. Olorunnisola, A.M. Hammed, S. Simsek. Biological properties of lemongrass: Anoverview. *International Food Research Journal*, vol. 121, no.2. 2014
- [5] Department of Health Republic of Indonesia, *Materia Medika Indonesia*, Sixth ed. Directorate Jeneral of Drug and Food Surveillance, Jakarta, 1989
- [6] S.Nurbaya, E. Sitompul, and Suryanto, "Test of phenol coefficient from plants' leaves containing volatile oils". *National Seminar in Biology*. 2013.
- [7] Behura S, Srivastava VK. "Essential oils of leaves of *Curcuma* species". *Journal of Essential Oil Research*. Vol.1, no.16(2), pp.109-10. Mar 2004
- [8] J.C. Kasenda, P. Yamlean, and W.A. Lolo, "Formulation and test of antibacterial activity of liquid soap containing ethanolic extract of *Acalypha hispida* Burm.F leaf toward the growth of *Staphylococcus aureus*". *Jurnal Ilmiah Farmasi UNSRAT*. Vol. 5(3), pp. 40-47. 2016
- [9] S.Nurbaya, E. Sitompul, and Suryanto, Test of antibacterial activities of juices of lemongrass, citrus, and basil leaves, and their combinations. *National Seminar in Biology*. 2014.