Formulation and Evaluation of Herbal Hand Sanitizer Based on Stevia (*Stevia rebaudiana*)

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Abstract. The purpose of this study was to analyze the quality of herbal hand sanitizer based on stevia in the addition of trembesi (*Albizia saman* (Jacq.) Merr) leaf extract. Experimental research in the laboratory, the study used two factorial Completely Randomized Design, namely stevia extract (1.0; 0.75; 0.50; 0.25; 0.0%) and trembesi extract (0; 0.25; 0.5; 0.75; 1.0%) with two repetitions. Each formulation was tested according to SNI-06-2588-1992. The results showed that all formulation comply with SNI-06-2588-1992 standards.

1. Introduction

Due to in situations the pandemic of the corona virus disease 2019 (COVID-19), World Health Organization (WHO) has addressed the importance of hand hygiene in avoiding the spread of the COVID-19 virus. Normally hand hygiene facilities is included alcohol-based hand sanitizer. Nevertheless, high dose of alcohol or high frequency of alcohol-based hand sanitizer application increase skin dryness causing skin burning exacerbates high risk of skin infection. Therefore, natural bioactive compound derived from the available agricultural crop was chosen to be developed into the safe and efficient alcohol-based hand sanitizer accordingly.

The plant of trembesi (*Samanea saman* Jacq. (Merr)) was selected due to the presence of unsung biological potentials. Trembesi is a large umbraculiform tree growing over 20 meters height with a stout trunk about 1.5 m in diameter and huge spreading canopy providing shade. The trembesi also named as rain tree because of the leaves fold together on the approach of rain. The taxonomy of trembesi belongs to the family Mimosaceae which is the subfamily Leguminosae are rich in alkaloids, and their extracts have been reported to possess various bioactivities [1,2].

Traditional knowledge in Venezuela, rain tree is a traditional remedy for colds, diarrhea, pain, and intestinal ailments. A root and leaves decoction are used in hot baths for dermatitis, eczema, and also stomach cancer. Saponin-like alkaloid pithecolobine has been isolated from the bark and the seed. Alkaloids are said to be abundant in the bark, stems, leaves, and seeds. Leaves and stems have saponin and tannin; gum is present in the trunk [1].

Gonzales et. al. has extracted and isolated of the alkaloids from the Samanea saman (Acacia) Bark and revealed that its potential of antiseptic. The alkaloid compound contained is pithecolobine that has evaluated as antimicrobial and antioxidant properties [2–4].
Stevia (Stevia rebaudiana Bertoni) is a lasting hedge beginning in Paraguay, generally utilized as sweetener or as pharmaceutical. Stevia contains important natural antioxidants as a cancer prevention agent, for example, flavonoids and different phenolics, tannins, essential oils and other substances. Their extracts also have been revealed potential as antioxidant, antimicrobial and anti-inflammatory [5, 6].

2. Method
Extraction of trembesi leave and stevia leave are used maceration method with ethanol 70% and macerated for 24 hours. The hand sanitizer gel formulations with the active ingredient trembesi and stevia leaf extract can be seen in Table 1.

| Table 1: Formulation of hand sanitizer gel |
|-------------------------------|   |   |   |   |   |
| Ingredient                  | F0 | F1 | F2 | F3 | F4 |
| Aquadest ad. (mL)           | 100| 100| 100| 100| 100|
| CMC-Na (g)                  | 1.3| 1.3| 1.3| 1.3| 1.3|
| Stevia leaf extract (g)     |   | 1.0| 0.75| 0.5| 0.25|
| Trembesi leaf extract (g)   |   |   | 0.25| 0.5| 0.75|
| Gliserine (g)               | 2.6| 2.6| 2.6| 2.6| 2.6|
| Propylene glycol (g)        | 1.3| 1.3| 1.3| 1.3| 1.3|

3. Evaluation
The hand sanitizer gels were evaluated for organoleptic properties, density, dispersive power, and homogeneity. The trembesi- stevia hand sanitizers were thereafter sensorial assessed in 20 volunteers by the interview questionnaires. Homogenity test aims to look at the stability of the gel during storage. Homogenity of handsanitizer gel dosage was investigated by placing it on two objective glasses and the result showed the homogeneous form of a transparent gel.

| Formulation | Form     | Color          | Odor             |
|-------------|----------|----------------|------------------|
| F0          | Very Viscous | Colorless     | No odor          |
| F1          | Viscous   | Brownish green | Stevia           |
| F2          | Viscous   | Brownish green | Stevia           |
| F3          | Viscous   | Dark green     | Stevia and trembesi |
| F4          | Viscous   | Dark green     | Stevia and trembesi |
| F5          | Viscous   | Light green    | Stevia and trembesi |

4. Result and Discussion
Result of the organoleptic test on the sixth hand sanitizer formulations have the same form that is viscous. Nevertheless the colors on each formulation is different. Hand sanitizer without addition stevia leaf extract and trembesi leaf extracts (F0) is colorless.
Meanwhile the hand sanitizer formulation with extracts of stevia leaf extract is Brownish green, and color density increases with addition of extract. In observation of the smell of formulation, F0, F1, F2, F3, F4, F5, and F6 was odor depend on adding of extract.
Table 3: Density of hand sanitizer gel

| Formula | Density (g/cm³) |
|---------|----------------|
| F0      | 1.0165         |
| F1      | 1.0217         |
| F2      | 1.0249         |
| F3      | 1.0268         |
| F4      | 1.0233         |
| F5      | 1.0188         |

Homogeneity test aims to look at the stability of the gel during storage. Homogeneity test of handsanitizer gel was investigated by smearing the gel sample on a piece of glass or other suitable transparent material, gel dosage should indicate the homogeneous composition and coarse grains are not observed [7]. The result showed the homogeneous form of a transparent gel and coarse grains are not observed (Table 4). The determinations of dispersive power purposes to get the capabilities of gel dosage to spread on the surface of the skin to facilitate it can determines the spread of active substances that contained in the gel on the skin. This relates to the distribution of the active substances that contained in the dosage. The results of dispersive power can be shown in Figure 1.

Table 4: Homogenity of hand sanitizer gel

| Formula | Homogenity |
|---------|------------|
| F0      | Homogen    |
| F1      | Homogen    |
| F2      | Homogen    |
| F3      | Homogen    |
| F4      | Homogen    |
| F5      | Homogen    |

Figure 1: The dispersive power of hand sanitizer gel
The test resulted that the dispersive power of hand sanitizer gel dosage corresponds with Indonesian National Standards (SNI). The dispersive power was conducted to find out ability to spread hand sanitizer gel on a surface. The dispersive power test also looks at ability spreads the gel on the surface of the skin where the gel is expected to be able to spread easily at the moment applied to the skin of the hands. Result of dispersive power value according to Figure 1 that meets SNI No. 06-2588-1992 standard, which is 5-7cm [8].

![Chemical structure](image1.png)

(a) Structure of pithecolboline (b) Structure of steviol

In addition pithecolboline also exhibits as alternative agents of antibacterial and antifungal potentials to control the fungal and mycotoxin contaminations in food grains. The structure of of pithecolboline showed in Figure 2 (a) [2]. Meanwhile stevia leaf contain of steviol (Figure 2 (b)) [8] that interactions of steviol with each of monoamine oxidase A and B (MAO-A and MAO-B) enzymes were investigated by the in silico approach [9].

A lot of sanitizers including this hand sanitizer also include humectant, for instance, glycerine, in the formulation to reduce the incidence of dry skin associated with the use of alcohol-based products as the alcohol can strip away sebum that helps to keep the skin moist [10].

5. Conclusion
Herbal hand sanitizer based on stevia in the addition of trembesi leaf extract that evaluated for organoleptic properties, density, dispersive power, and homogeneity. The organoleptic test resulted that the dosage are viscous, odor depending on the extract leaf and gel. Homogeneity test resulted that all gel dosage concentrations are homogenous. The dispersive power test resulted for 6.05 to 6.35 cm.

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