

Characteristics Of Hand Sanitizer With Additional Ingredients Of Red Ginger Essential Oil (*Zingiber Officinale* Var *Rubrum*) And Aloe Vera Gel (*Aloe Vera* L)

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Abstract – Use hand sanitizer more widespread during the current pandemic -19 Covid as an effort to break the chain of the virus and to meet health protocols set by the government. This study applied red ginger essential oil and aloe vera gel in the manufacture of a good and standardized hand sanitizer , obtaining the interaction effect of adding red ginger essential oil and aloe vera gel to hand sanitizer products. Characterization of physical preparation includes hand sanitizer test v iskositas, densitas ,homogeneity, dispersion, adhesion and chemical characterization, namely the pH test. The difference in the concentration of essential oil and aloe vera gel statistically did not significantly affect the viscosity, density, homogeneity of hand sanitizer preparations. The highest viscosity was found in formulations A₀ B₃, A₁ B₃, A₂ B₀, A₃ B₂ with a value of 0.014 Ns/m³. The highest density was found in formulation A₁ B₀ with a value of 0.923 g/ml. Based on the overall homogeneity test , 12 of the 16 formulations of hand sanitizer products have met SNI No. 06-2588 . Based on the analysis day a scatterplot, factor A (concentration of essential oils) provide a significantly different effect restricted a p of the scatter performed . All hand sanitizer formulations exhibit sufficient dispersive power lu as in the range of 8.0 to 9.5 cm for the consistency of the gel is low, just use aloe gel as a natural gel material. Based on the adhesion test, the difference in concentration of red ginger essential oil and aloe vera gel had a significant effect on adhesion. The sixteen formulations of hand sanitizer products have a stickiness of > 1 second. Based on the pH test, the different concentrations of red ginger essential oil and aloe vera gel significantly affected the pH for all formulations. The pH value of each sample is in the range of 5.7-6.6 so that it is still acceptable for human skin which is in the range of 4.5 -6.5

Keywords – Red Ginger Essential Oil, Aloe Vera Gel, Hand Sanitizer.

I. INTRODUCTION

The main health problem in developing countries like Indonesia is infection. This infection is caused by viruses, fungi, bacteria, and parasites. Infection has several levels, namely mild infection to severe infection. The infection is easy to spread if there is direct or indirect contact from someone who is infected with a healthy person (18). However, without realizing it, infection can also occur due to personal habits that do not maintain cleanliness after carrying out certain activities. Generally, the microbes that cause infection are *Escherichia coli* and *Staphylococcus aureus* (10).

Microbial contamination can be prevented by getting used to washing hands. *The World Health Organization* (WHO) has determined that hand washing is the most important and effective way to prevent the spread of infection (15). Furthermore, (25) explains the steps for good hand washing are as follows: 1. wet hands, 2. apply soap, 3. rub foam all over the hands and between the fingers, 4. minimal brushing, 20 seconds, 5. rinse under running water, and 6. dry hands.

The increasing mobility and busyness of people in the current era, especially in urban areas, the presence of soap and water is sometimes not as desired, such as the available water is not clean and smells, or soap that is used together raises concerns over the cleanliness and health of previous users. Therefore, there are many instant products that are fast and practical, including innovative waterless hand sanitizer products known as antiseptic *hand sanitizers* or *hand sanitizers*.

Hand sanitizer is the cleaning liquid alcohol-based hand used to kill microorganisms by means of use without rinsing with water. The liquid in question certainly contains substances that very quickly kill microorganisms on the skin of the hands (11). The use of hand sanitizers is increasingly widespread during the current Covid-19 pandemic as an effort to break the chain of virus spread and to comply with health protocols set by the government. Hand sanitizer is used when water and soap for hand washing is not available or because of the effectiveness and the ease of carrying the product.

Most hand antiseptic gel products use alcohol as an antibacterial. Dangerous side effects and skin irritation are consequences that can occur when using chemicals in topical preparations (24). The main composition of antiseptic hand sanitizer is alcohol 60-95% additional ingredients in the form of polymers, water, active ingredients, preservatives and fragrances. Many commercial hand sanitizer products use synthetic ingredients for both fragrance and antimicrobial properties. These natural ingredients for hand sanitizer product fragrances are expected to provide a preferred aroma compared to other products and have higher effectiveness in controlling microbes. Natural ingredients both as fragrances and moisturizers play an important role in determining consumer interest in a product. This is due to consumers having consideration for the purchase of a product attributes that we have seen from him such is the natural ingredients and aroma.

Essential oils are volatile compounds that are insoluble in water and can be separated from plant tissues through a distillation process. The use of essential oils in Indonesia is very diverse, including as aromatherapy to treat psychological problems and is calming, for health as an inflammatory, un-insect, inflammatory, un-phlogistic, aphrodisiac and decongestant, as a source of fragrance and also an odor binder. *fixative*), for food additives as a food additive and flavor enhancer, as well as a natural pesticide to eradicate insects and pests (18). Based on the data (10) can be seen also that the largest use is as an enabler of essential oil fragrance and flavor industry *flavor* and *fragrance*. Meanwhile, according to (27) ginger essential oil is widely used as a cosmetic ingredient, perfume and aromatherapy in the pharmaceutical industry and as a flavoring agent in the food industry.

Aloe vera plant gel formulated as a moisturizer and its effectiveness against microbial contamination. *Aloe vera* gel it contains saponins, flavonoids, tannins and polyphenols that get activities as an antiseptic (23). Furthermore, it was stated by (17) that *aloe vera* can be used as a natural moisturizing ingredient that can increase the moisturizing function of the skin. Skin moisture can be maintained by using *Aloe Vera* which controls water loss and exchange of water soluble components. According to (29) the results showed that the formulation with a combination of 0.1% glycerin moisturizer and 0.5% *aloe vera* gel was the best product because this formulation got the highest score from Bayes' calculations. While the *aloe vera* gel formulation at a concentration of 5% already has a wound healing effect (6). However, the formulation of the concentration of essential oil and the concentration of *aloe vera* gel has not been found that is right for hand sanitizer products.

This study aims to get interaction effect adding essential oil of red ginger and *Aloe vera* gel to the product of hand sanitizer (hand sanitizer), get cleaning products good hands and meet the standards that the customer wants and is effective against microbial contamination and get best characteristics of hand Sanitizer formulated according to standards.

II. METHODOLOGY

A . Materials and tools

The materials used in this study were ethanol, *aloe vera* leaf gel (*Aloe vera*), glycerin, aquades, and red ginger essential oil. *Aloe vera* gel and glycerin are used as moisturizers that will keep the skin moist on the hands. The tools used in the manufacture of hand sanitizer products include: digital balance, *stopwatch*, volumetric pipette, volumetric flask, stirrer, weighing paper, beaker, measuring cup, *magnetic* stirrer, and *homomixer*. While the tools used in testing the product characterization include: viscosity meter (Oswald Viscometer), pH-meter, pycnometer.

B. Research design

The design used in this study was a completely randomized design (CRD) in factorial form with 2 factors, namely the first red

ginger essential oil formulation consisting of no red ginger essential oil (A_0); and various concentrations of red ginger essential oil (A_1), (A_2); (A_3); The second factor is *Aloe vera* gel formulation consisting of 4 concentrations, namely without *Aloe vera* gel (B_0); (B_1); (B_2); (B_3) The experiment was repeated 2 times so that the number of experimental samples was 32 samples.

C . Research Stages

Stage 1. Red ginger essential oil formulation and Formulasi Aloe vera gel

a. Red Ginger Essential Oil Formulation According to Widyastuti (2013)

The essential oil formulation process begins with selecting red ginger essential oil according to the concentration in the treatment, which can be seen in the table. 3 then dissolved in ethanol. To make a solution with a concentration of 0.3%, 3 ml of essential oil was taken and dissolved in 1000 ml of ethanol. Furthermore, mixed right by means of manual shaking ± 5 minutes at room temperature until homogeneous.

b. Making and the formulation Gel Aloe Vera *Aloe vera* according to Zetiara (2014)

Aloe vera gel is taken by cutting an aloe vera leaf at the bottom which is white, then rinsed with distilled water and the surface is dried. The base of the aloe vera leaf is cut about one cm and the thorny part along the *Aloe vera* leaf is also cut. The leaves and strands of *Aloe vera* are peeled. The wide cross section is cut lengthwise into 2 parts with a knife. The part containing the fruit flesh is placed facing up and the gel is scraped from top to bottom, from the tip to the base of the *Aloe vera*. This step is repeated several times until all the gel is released from the *Aloe vera* skin. The *Aloe vera* gel is immediately blended and the result is a coarse, foamy extract immediately put in the refrigerator. The crude extract of *Aloe vera* gel is filtered so that only the liquid is obtained.

The formulation of *Aloe vera* gel was carried out by taking *Aloe vera* gel according to the concentration in the treatment (see Table 3), to make a concentration of 0.5%, 5 ml of *Aloe vera* gel was taken and then dissolved in distilled water. Then the mixture was shaken manually for ± 5 minutes at room temperature until homogeneous.

Stage 2. Manufacture of hand sanitizer with 65% alcohol

Stages of hand sanitizer gel formulation (*handsanitizer*) shall refer to a method of making bioethanol gel on (14) were modified. The method used is to dissolve *Aloe vera* gel in distilled water using a magnetic stirrer with a stirring speed of ± 1200 rpm for 30 minutes. After the *Aloe vera* gel was completely dispersed in water, NaOH base was added then the mixture was stirred manually for ± 5 minutes until a thick and clear gel was obtained.

Making hand sanitizer $A_1 B_1$, the method used is to dissolve *Aloe vera* gel in 313.9 ml of distilled water. After the *Aloe vera* gel is completely dispersed in water, NaOH base is added. Then the mixture was stirred manually for ± 5 minutes until a thick and clear gel was obtained. Add 677 ml ml of etanol and 1 ml of glycerin which has been prepared previously. After that, it was homogenized with a homomixer with a speed of 2000 rpm for one hour. And so on, the method of making hand sanitizer was in accordance with the combination treatment formulation .

III. RESULT

1. Viscosity

Viscosity testing to determine the texture of the sample preferred by the panelists. For hand sanitizer products, viscosity is an attribute related to the ease with which the product is removed from the packaging. Panelists prefer products with a rather high viscosity, this is because the product does not spill easily when used. Viscosity parameters can be measured with a viscometer.

Tabel 1. Viscosity

Combination	Aloe vera Gel Concentration				Average (N/m ²)
Concentration	B ₀	B ₁	B ₂	B ₃	
Red Ginggaer Essential Oil	No gel	0,50 %	5 %	10 %	
A ₀ (No Essential Oil)	0.010	0.014	0.009	0.014	0.012 A
A ₁ (0.3%)	0.013	0.009	0.012	0.014	0.012 A
A ₂ (0.5%)	0.014	0.012	0.011	0.011	0.012 A
A ₃ (0.8%)	0.012	0.013	0.014	0.009	0.012 A
Average	0.012 a	0.012 a	0.012 a	0.012 a	

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The analysis showed that the concentration of red ginger essential oil and aloe vera gel effect but no significant effect on the viscosity of each product. Based on the viscosity test using the Oswald viscometer, the formulations that obtained higher viscosity values were the formulations A₀B₁, A₀B₃, A₁B₃, A₂B₀, A₃B₂ with a value of 0.014. According to (24), panelists prefer a slightly thick *hand sanitizer* formulation so that the product does not spill easily when the product is used or poured into hands. One of the factors that affect the viscosity of a solution is the presence of other substances. The presence of additives such as suspensions increases the viscosity of the liquid (53). The presence of additional ingredients, namely glycerin as a moisturizer, which is added to each formulation, has a viscosity level that is preferred by the panelists. Likewise with the addition of *Aloe vera* gel and red ginger essential oil.

One of the differences in liquids is the difference in the viscosity of the liquid. Viscosity or viscosity is the size of the friction in the fluid. The greater the viscosity, the slower the fluid flow (9).

The difference in concentration of red ginger essential oil and *Aloe vera* gel had no significant effect on viscosity, but all samples showed a tendency to increase viscosity along with the increase in the concentration of red ginger essential oil and *Aloe vera* gel. It was deemed necessary to carry out further testing with the addition of aloe vera concentration.

The highest viscosity is the product A₀B₁, A₀B₃, A₁B₃, A₂B₀, A₃B₂ with a value of 0.014 Ns/m³. Viscosity values in the sixteen formulations slightly differed between samples. The five formulations with the highest viscosity measurement results were found in the formulation with the highest concentration of *Aloe vera* gel (10 ml) or with the highest concentration of red ginger essential oil (0.8 ml). In other words there is tendency of increasing concentrations proportional to the increase in viscosity.

2.Density

Character i stick products *handsanitizer* also performed density measurement. Density determination aims to determine or identify a substance, either in solid or liquid form. The *hand sanitizer* product is one of the products made from ethanol. Etanol has a lower density than water. The higher the density of the product, the lower the ethanol content (25).

Determination of specific gravity aims to determine or identify a substance, either in solid or liquid form. The density of a product is one of the characteristics used to determine the physical properties of the resulting product. This hand sanitizer product is one of the products made from ethanol. Ethanol has a lower density than water. The higher the density of ethanol, the lower the ethanol content.

The results of the Anova analysis and continued with the BNJ test at a level of 5% the difference in the concentration of essential oil and aloe vera gel on the density of the product can be seen in Table 2 .

Tabel 2. Density

Combination	Aloe vera Gel Concentration				Average (N/m ²)
Concentration	B ₀	B ₁	B ₂	B ₃	
Red Gingger Essential Oil	No gel	0,50 %	5 %	10 %	
A ₀ (No Essential Oil)	0.896	0.903	0.901	0.902	0.900 A
A ₁ (0.3%)	0.923	0.901	0.903	0.904	0.907 A
A ₂ (0.5%)	0.905	0.902	0.904	0.902	0.903 A
A ₃ (0.8%)	0.899	0.895	0.899	0.880	0.895 A
Average	0.905 a	0.900 a	0.901 a	0.899 a	

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The density value of the product formulation containing a certain concentration of red ginger essential oil and *Aloe vera* gel has a tendency to influence the increase in the density value. This means that the higher the density value, the lower the material content. This density value is related to the overall formulation material used. The sixteen formulations had densities in the range of 0.895 to 0.923 g/ml.

The results of sample and control tests were in the range of 0.895 -0.923 g/ml. When compared with hand sanitizer products that are already on the market with a density value of 0.882 g/ml, the sample still meets the criteria as a hand sanitizer product containing ethanol. These density values can also be interpreted as the percentage of ethanol were men enough i as an antiseptic. The highest density is found in hand sanitizer products A₁ B₀.

3. Homogeneity

Homogeneity test was carried out to observe the distribution of hand sanitizer evenly. Homogeneity characterization is to determine whether the preparation obtained is in a completely mixed condition from each of its constituent materials. A good gel preparation must meet the requirements of SNI No 06-2588, namely a gel preparation that does not have coarse grains or lumps in the preparation.

The results of the Anova analysis and continued with the BNJ test at a level of 5% the difference in the concentration of essential oil and *Aloe vera* gel on product homogeneity can be seen in Table 3.

Tabel 3. Homogeneity

Combination	Aloe vera Gel Concentration				Average (N/m ²)
Concentration	B ₀	B ₁	B ₂	B ₃	
Red Gingger Essential Oil	No gel	0,50 %	5 %	10 %	
A ₀ (No Essential Oil)	1,000	1,000	1,000	1,000	1,000 A
A ₁ (0.3%)	1,000	1,000	1,000	1,000	1,000 A
A ₂ (0.5%)	1,000	1,000	1,500	2,000	1,375 A
A ₃ (0.8%)	1,000	1,000	2,000	1,500	1,375 A

Average	1,000 a	1,000 a	1,375 a	0.899 a	
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According to the results of product homogeneity analysis, it shows that the concentration of red ginger essential oil and *Aloe vera* gel has no significant effect on the homogeneity of hand sanitizer products. Although statistically it has not shown a significant effect, individual observations have differences in homogeneity due to differences in the concentration of essential oils and *Aloe vera* gel.

Based on Table 3 . Only 4 products out of 16 products were judged to be inhomogeneous, namely $A_2 B_2$, $A_2 B_3$, $A_3 B_2$, and $A_3 B_3$. The results of the homogeneity test showed that 12 samples of hand sanitizer products had met SNI. However, the sixteen product samples were hedonic favored by the panelists in terms of clarity.

Overall, as many as 12 of the 16 formulations of hand sanitizer products that have been made have met SNI No. 06-2588 means that there are no coarse/fine grains in the preparation.

3. Spreadability

The spreadability test was carried out to determine the ability to spread hand sanitizer on a surface. In this case, the dispersion test is to see the ability to spread on the skin surface in the hope that it can spread easily when applied to the hands.

The results of the Anova analysis and continued with the BNJ test at a level of 5% showed the effect of differences in the concentration of essential oils and *Aloe vera* gel on product homogeneity can be seen in table 4

Tabel 4. Spreadeability

Combination	Aloe vera Gel Concentration				Average (N/m ²)
Concntration	B ₀	B ₁	B ₂	B ₃	
Red Ginggaer Essential Oil	No gel	0,50 %	5 %	10 %	
A ₀ (No Essential Oil)	9,500	8,250	9,250	8,750	8,938 A
A ₁ (0.3%)	8,750	8,500	8,750	8,500	8,625 A
A ₂ (0.5%)	8,250	8,000	8,000	8,000	8,063 B
A ₃ (0.8%)	8,500	8,250	8,250	8,500	8,375 B
Average	8,750 a	8,250 a	8,563a	8,438a	

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Based on Table 4 . The hand sanitizer products with the highest spreadability are $A_0 B_0$ and $A_0 B_2$ with an average value of 9.5 and 9.25 cm. Overall samples of hand sanitizer products have a dispersion in the range of 8.0-9.5 cm. This is because the product sample has a tendency to be slightly liquid, the consistency of the gel is low

Based on the results of the analysis of the dispersion, treatment $A_0 B_0$, $A_0 B_1$, $A_0 B_2$, $A_0 B_3$ and $A_1 B_0$, $A_1 B_1$, $A_1 B_2$, $A_1 B_3$ significantly different from the treatment $A_2 B_0$, $A_2 B_1$, $A_2 B_2$, $A_2 B_3$, $A_3 B_0$, $A_3 B_1$, $A_3 B_2$, $A_3 B_3$ and not significantly different from each other. Factors A_0 (without red ginger essential oil) and A_1 (0.3% red ginger essential oil) gave a significantly different effect with factors A_2 (0.5% red ginger essential oil) and A_3 (0.8% red ginger essential oil) on dispersion parameters.

The increase or decrease in spreadability is strongly influenced by the gel consistency. The higher the viscosity, the lower the dispersion. This is because the high viscosity makes it difficult for the gel to flow so that the spread area obtained is small (3). In addition, dispersion is also related to the ability to spread the active compounds contained in the gel/material on the skin. Red ginger essential oil contains active compounds of flavonoids, alkaloids, steroids, polyphenols, tannins and saponins (15). The distribution of the active compound needs to be considered because it is related to its effectiveness and function

Some chemicals in red ginger diantaranya yes *gingerol* , fly oils, *limonene* , α - *linolenic acid* , *aspartic acid* , β - *sitosterol* , starch, *caprylic acid* , *capsaicin* , *chlorogenic acid* , and *farnesol* . Ginger also contains gingerols and shogaols which give it a spicy taste. Ginger rhizome generally contains 0.25-3.3% essential oil. This essential oil gives rise to the distinctive aroma of ginger and consists of some of the most important oils, zingiberene, curcumen, phillandrene, and so on (13).

The dispersion test value that meets the SNI standard No. 06-2588 is 5-7 cm. According to Gark et al (2002) good dispersion in the range of 5-7 cm with the consistency of hand sanitizer that is comfortable to use. All hand sanitizer formulations show a fairly wide spreadability with a range of 8.0 – 9.5 cm. This is because the gel consistency is low, there is no use of gelling agent to increase the consistency of the gel, only aloe vera gel is used as a natural gel material.

5. Adhesion

Adhesiveness test is intended to determine how long the time of attachment of hand sanitizer on the surface of the skin to the active ingredient contained in the dosage he bsorpsi. The results of the Anova analysis and continued with the BNJ test at the level of 5% showed the effect of differences in the concentration of essential oils and *Aloe vera* gel on adhesion.

The hand sanitizer product that has the highest adhesion is $A_0 B_3$ with a value of 12 and the lowest is $A_3 B_2$ with a stickiness of 1 second. When compared with control $A_0 B_0$ which has a stickiness of 2 seconds, 10 product formulations have adhesion < 5 seconds, 15 formulations have a stickiness greater than 1 and 1 product formulation has adhesion for 1 second.

Tabel 5. Adhesion

Combination	Aloe vera Gel Concentration				Average (N/m ²)
Concentration	B ₀	B ₁	B ₂	B ₃	
Red Gingger Essential Oil	No gel	0,50 %	5 %	10 %	
A ₀ (No Essential Oil)	2,000	8,000	7,500	12,500	7,500 A
A ₁ (0.3%)	8,500	4,000	5,000	3,500	5,250 B
A ₂ (0.5%)	2,500	5,000	3,500	2,500	3,375 BC
A ₃ (0.8%)	2,000	4,000	1,000	1,500	2,125 BCD
Average	3,750a	5,250 a	4,250 a	5,000a	

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The results of the analysis of variance and followed by the 5% BNJ test showed that $A_0 B_0$ (without treatment), $A_0 B_1$, $A_0 B_2$, $A_0 B_3$ was significantly different from all other samples (15 samples), namely $A_1 B_0$, $A_1 B_1$, $A_1 B_2$, $A_1 B_3$, $A_2 B_0$, $A_2 B_1$, $A_2 B_2$, $A_2 B_3$, $A_3 B_0$, $A_3 B_1$, $A_3 B_2$ and $A_3 B_3$.

Treatments $A_1 B_0$, $A_1 B_1$, $A_1 B_2$, $A_1 B_3$ significantly different stickiness with $A_0 B_0$, $A_0 B_1$, $A_0 B_2$, $A_0 B_3$ but not significantly different from $A_2 B_0$, $A_2 B_1$, $A_2 B_2$, $A_2 B_3$, $A_3 B_0$, $A_3 B_1$, $A_3 B_2$ and $A_3 B_3$. Treatment $A_2 B_0$, $A_2 B_1$, $A_2 B_2$, $A_2 B_3$ has no significant difference in the adhesive power with $A_3 B_0$, $A_3 B_1$, $A_3 B_2$ and $A_3 B_3$. Treatment $A_1 B_0$, $A_1 B_1$, $A_1 B_2$, $A_1 B_3$ is significantly different from $A_3 B_0$, $A_3 B_1$, $A_3 B_2$ and $A_3 B_3$.

This proves that the difference in the concentration of red ginger essential oil and aloe vera gel has a significant effect on adhesion. According to (2) the longer the gel is attached to the skin, the greater its effect will spread on the surface of the skin. Preferably the adhesion of semi-solid is more than 1 second (28). The sixteen formulations are $A_0 B_0$, $A_0 B_1$, $A_0 B_2$, $A_0 B_3$, $A_1 B_0$, $A_1 B_1$, $A_1 B_2$, $A_1 B_3$, $A_2 B_0$, $A_2 B_1$, $A_2 B_2$, $A_2 B_3$, $A_3 B_0$, $A_3 B_1$, $A_3 B_2$ and $A_3 B_3$ hand sanitizer products have a stickiness of > 1 second.

6. pH value

The pH value is a characteristic that needs to be considered in a topical formulation. pH test to determine the sensitivity or ability of the skin to accept a pH value. This means to find out whether the pH value of a preparation is acceptable to the skin. The pH value requirement according to SNI No.06-2588 is 4.5 -6.5. The condition of the preparation with a very low pH causes the skin to become irritated while at a very high pH causes the skin of the hands to become scaly (21). The results of the pH test for the -16 formulations can be seen in table 6

The results of the Anova analysis and continued with the BNJ test at a level of 5% showed the effect of differences in the concentration of essential oils and aloe vera gel on the pH of hand sanitizer products as shown in Table 6

Tabel 6. pH

Combination	Aloe vera Gel Concentration			
Concntration	B ₀	B ₁	B ₂	B ₃
Red Gingger Essential Oil	No gel	0,50 %	5 %	10 %
A ₀ (No Essential Oil)	6,650 AA	6,000 Ba	5,800 Ca	5,700 Da
A ₁ (0.3%)	6,500 Ab	6,200 BB	6,100 Cb	6,000 Db
A ₂ (0.5%)	6,200 Ad	6,100 Bc	6,400 cc	6,200 DC
A ₃ (0.8%)	6,550 ABC	6,450 Bd	5,750 CD	5,900 dd

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5% Uppercase letters are read horizontally , lowercase letters are read vertically

Based on the analysis, it can be seen that all treatments showed an interaction effect of different concentrations of red ginger essential oil and aloe vera gel on each product $A_0 B_0$, $A_0 B_1$, $A_0 B_2$, $A_0 B_3$, $A_1 B_0$, $A_1 B_1$, $A_1 B_2$, $A_1 B_3$, $A_2 B_0$, $A_2 B_1$, $A_2 B_2$, $A_2 B_3$, $A_3 B_0$, $A_3 B_1$, $A_3 B_2$ and $A_3 B_3$ with respect to pH. All products (16 formulations) were not significantly different from each other. The difference in concentration of red ginger essential oil and *Aloe vera* gel significantly affected the pH for all formulations.

Potential of Hydrogen (pH) is a measure that describes the degree of acidity or alkalinity of a solution, pH is measured on a scale of 0-14 . According to (22) for hand sanitizer products, a pH that is suitable for the skin of human hands is needed. The expected pH value or degree of acidity of hand sanitizer products is in the range of 4.5 - 6.5 so that it is in accordance with the pH value of human skin. Based on the pH value data in the table, the pH value of each sample is in the range of 5.7-6.6. Thus, this indicates that the pH value of the hand sanitizer product is still acceptable to the skin because it is still within the expected limits.

The pH value of less according to the pH value of the skin such as too acidic or too alkaline will be able to accelerate the destruction of skin tissue se Perti occur allergies, irritation and can lead to skin diseases and other ailments. This happens because the damage to skin tissue will make it easier for bacteria or other microbes to grow and multiply and infect parts that are vital to the body.

This pH test is to determine the pH stability of each formulation made whether it is in accordance with the pH of the skin. This is because if it is too acidic it will cause skin irritation while if it is too alkaline it will result in scaly skin (1) .

The 16 hand sanitizer formulations have pH values in the range of 5.7 – 6.6. According to Emma, et al (2014), the pH of the preparation that can be accepted by the skin is between 6-8. Thus, the pH 16 of the hand sanitizer formulation is still safe to use.

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