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THE EFFECT OF *EMULSIFIER* SPAN 60 (*Sorbitan Monostearate*) ON THE HOMOGENEITY PROPERTIES OF *LOTION GEL* MADE *Virgin Coconut Oil* (VCO) AND ALOE VERA

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ABSTRACT

Making lotion from Virgin Coconut Oil (VCO) and Aloe Vera to which an emulsifier has been added requires antimicrobial ingredients, because the water phase facilitates the growth of microorganisms. The presence of methyl paraben preservative is very important in oil-in-water emulsions, because the shelf life of the product will last longer. This research aims to determine the effect of span 60 on homogeneity properties. The physical properties of the lotion include homogeneity test, pH test, viscosity test and specific gravity test based on SNI-16-3499-1996. The experimental process was carried out with varying weights of span 60 (sorbitan monostearate) 1 mg, 3 mg, 5 mg, 7 mg, methyl paraben with varying weights of 1.5 mg, 2 mg, 2.5 mg, 3 mg and a stirring time of 21 minutes. With the liquid phase and the heated oil phase.0.95- 1.05 g/ml.

Keywords: *Virgin Coconut Oil (VCO), Aloe Vera, Emulsifier, Span 60 (Sorbitan Monostearate), Methyl Paraben, Homogeneity.*

1. INTRODUCTION

1.1 Background

Many people today understand the importance of skin health care. This is one of the driving factors for increasing demand for cosmetic products for skin care. Cosmetics are products that are used repeatedly every day. One form of cosmetic preparation is lotion. Lotion is one of the emollient (softener) cosmetic preparations that contains more water. The function of lotion is to maintain skin moisture, clean, prevent, water loss or maintain active ingredients. The components that make up lotion are moisturizers, emulsifiers, fillers, cleaners, active ingredients, solvents, fragrances and preservatives (Mohiudin, AK. 2019).

*Emulsifier*is a food additive to help form a homogeneous mixture from two or more immiscible phases such as oil and water, in the process of making cosmetics the material that acts as a uniter of polar and non-polar compounds is an emulsifier (Agnes, 2019). Emulsifiers can stabilize an emulsion because they can reduce surface tension gradually. Surface tension decreases due to adsorption by the emulsifier on the surface of the liquid at the polar end as a hydrophilic group in the water phase and the hydrocarbon end which is lipophilic in the oil phase (Wulandari et al., 2019). Emulsifiers that are often used together are tween 80 and span 60 because they are nonionic emulsifiers which have a balance of lipophilic and hydrophilic properties, are non-toxic, non-irritating, has a low potential to cause hypersensitivity reactions, and is stable against weak acids and weak bases. The combination of emulsifiers span 60 and tween 80 is capable of forming water-in-oil (o/m) emulsions with concentrations of 1-10% (Rowe el al., 2009).

A preservative is a substance or chemical added to a cosmetic product that can extend the shelf life and protect the product against adverse effects, especially microbial damage. Methyl paraben is used as a preservative in cosmetics, food products, and other pharmaceutical formulations. Can be used in combination with other paraben compounds or with

other antimicrobial substances (Hanifah, 2013).

Virgin Coconut Oil(VCO) is coconut oil that is processed without using high temperatures and without the addition of chemicals, extracts from ripe and fresh coconuts which go through a special process that does not damage its natural contents. VCO is used as an active ingredient in skin moisturizers because it contains high levels of fatty acids, especially lauric acid and phenolic compounds. (Nuzantry, 2015).

Aloe vera is a medicinal plant that has been used since 1500 BC in many countries as a local medicine which has thick leaf flesh from the Liliaceae family. Compounds contained in aloe vera such as lignin contained in aloe vera gel are able to penetrate and absorb into the skin and prevent fluid loss from the skin surface (Ambarwati et al., 2020).

1.2 Supporting Theories

1.2.1 Methyl Paraben

Parabens are esters of para-hydroxybenzoic acid as antibacterial ingredients added to many consumer products to reduce bacterial contamination. This can be found in body care products such as soap, toothpaste and deodorant (Bledzka et al., 2014).

Commercially available parabens include methyl paraben, ethylparaben, propylparaben, butylparaben and benzylparaben. Among these types of parabens, methyl paraben and propyl paraben are the most frequently present in body care products (Núñez et al., 2008).

All emulsions require antimicrobial agents because the water phase facilitates the growth of microorganisms. The presence of preservatives is very important in oil-in-water emulsions because external phase contamination easily occurs. Because fungi and yeast are more common than bacteria, fungistatic and bacteriostatic agents are more necessary. It turns out that bacteria can break down nonionic and anionic emulsifiers, glycerin and a number of natural stabilizers such as tragacanth and guar gum. Preservatives commonly used in emulsions are methyl paraben, propyl paraben and phenoxyethanol (Hanifah, 2013).

Methyl paraben is widely used as a preservative in cosmetics, food products, and other pharmaceutical formulations. Can be used in combination with other paraben compounds or with other antimicrobial substances (Hanifah, 2013).

Methyl Paraben Structure

Chemical Formula: C8H8O3

Molar Mass: 152.15 g/mol

Boiling point : 125-128 ºC

Description : Powder, colorless, white, odorless, burning taste.

Solubility: Likes to dissolve in water, easily dissolves in ethanol and ether (Ministry of Health RI, 1995).

1.2.2 *Virgin Coconut Oil*(VCO)

Pure coconut oil or scientifically speaking virgin coconut oil (VCO) is oil derived from coconut starch, which is processed hygienically without direct contact with fire and without additional chemicals so that the important contents of the oil can still be maintained.

The main components of VCO are around 90% saturated fatty acids and around 10% unsaturated fatty acids. VCO's saturated fatty acids are dominated by lauric acid which has a C12 chain. VCO contains ± 53% lauric acid and around 7% capric acid. Both are medium chain saturated fatty acids which are usually called Medium Chain Fatty Acid (MCFA). VCO contains 92% saturated fat, 6% mono-unsaturated fat and 2% poly-unsaturated fat (Budiman et al., 2015).

Figure 1.1 *Virgin Coconut Oil*(VCO)

1.2.3 *Aloe Vera*

The Aloe Vera plant (Aloe vera) is a type of plant that has been known for thousands of years and is used as a hair fertilizer, wound healer, and is also used as a raw material for skin care. Aloe vera plants can be found easily in home gardens and can also be found in dry areas in Africa. Along with advances in science and technology, the use of Aloe vera has developed as a raw material for the pharmaceutical and cosmetics industry, as well as as an ingredient in food and health drinks.

The characteristics of the aloe vera plant are that its leaves are thick, long, narrow at the tips, green and slimy. The raw aqueous mass contains around 98.5% water with 1.5% containing a composition of vitamins, minerals, enzymes, polysaccharides, polysaccharide compounds and organic acids that are water-soluble and fat-soluble (Hamman J. 2008).

Figure 1.2 *Aloe Vera*

1.2.4 Definition of Exploration

Emulsifiers are materials that can reduce the surface tension and tension between two phases that do not dissolve each other so that they can mix and then form an emulsion. Emulsion is a heterogeneous system that has a dispersed part consisting of fat or oil droplets, a dispersing part consisting of water and an emulsifier part which functions to keep the oil granules suspended in water (Setiawan et al., 2015).

There are several types of emulsification commonly based on the concept of Hydrophilic Lipophilic Balance (HLB). HLB is a character that defines the relative affinity for oil and water. The hydrophilic-lipophilic balance is located in the middle, namely at number 10 on the HLB scale. Emulgators with low HLB values (2-6) stabilize water-in-oil emulsions, while emulsifiers with high HLB values (8-18) stabilize oil-in-water emulsions. One example of an emulsifier that is suitable for making oil-in-water emulsions is Tween 80 which has an HLB of between 8-16. (Mandei, 2019).

1.2.5 Tween 80

Tween (Polysorbate) 80 has the molecular formula C64H124O26 with a molecular weight of 1310 gr/mol. Tween 80 is a non-ionic surfactant which is classified as a non-toxic compound. Tween 80 functions as an emulsifying agent, nonionic surfactant, dispersing agent, solubilizing agent, suspending agent, and wetting agent.

Tween 80 has the characteristics of being a yellow liquid, soluble in water and ethanol, and insoluble in mineral oil or vegetable oil. This surfactant has an HLB of 15.0 for oil-in-water emulsion formulations (Rowe et al., 2009).

Tween 80 is a non-ionic surfactant and emulsifier that is often used in food and cosmetics. Tween 80 is a non-ionic emulsifier that has a balance of lipophilic and hydrophilic properties, is non-toxic, non-irritating, has a low potential to cause hypersensitivity reactions, and is stable against weak acids and weak bases. (Wedana et al., 2009).

1.2.6 Span 60 (*Sorbitan monostearate*)

Span 60 (*Sorbitan monostearate*) is a class of non-ionic surfactants used as an emulsifying agent in the preparation of oil-in-water emulsions. Span 60 is a yellow liquid with an HLB value of 4.7, has the molecular formula C24H46O6. Span 60 is generally soluble or dispersed in oil, can also be dissolved in organic solvents, is insoluble in water. Span 60 is lipophilic and

capable of forming oil-in-water emulsions when combined with a hydrophilic emulsifier at a concentration range of 1-10% in the formula (Rowe et al., 2009).

Span 60 functions as an emulgator, nonionic surfactant, solubilizer, wetting agent, dispersing agent or suspending agent in cosmetics and is generally considered a non-toxic ingredient (Murtiningrum et al, 2013). Appearance is a waxy solid, pale yellow in color with weak oil. Practically insoluble in alcohol, soluble in liquid paraffin (DEPKES, 1979).

Tabel 1.1 Lotion Parameters according to Indonesian National Standards (SNI)

Description	Standard (SNI)
Apparition	Homogeneous
Viscosity	2,000- 50,000 cp
Specific Gravity	0.95- 1.05 g/ml
pH	4.5- 8

(Source: SNI 16-4399-1996)

2. RESEARCH METHODS

Research methodology

2.1 Research Place

This research was conducted at the Laboratory of the Chemical Engineering Department of the Lhokseumawe State Polytechnic.

2.1 Tools and Materials

2.2.1Tools used

The tools used in this research were a Brookfield viscometer, hot plate magnetic stirrer, pycnometer, pH meter, object glass, 250 ml beaker glass, 150 ml beaker glass, 10 ml chemical glass, measuring pipette, drop pipette, separating funnel, filter paper, blender, plastic gloves, spoons, knives, jars and plastic bottles.

2.2.2Materials used

The ingredients used in this research include aloe vera, oil (VCO), Tween 80 (emulsifier), Span 60 (emulsifier), Methyl Paraben.

2.3 Experimental Treatment Design

2.3.1Fixed/Controlled Variables

- aloe vera: 100 ml
- Oil (VCO): 50 ml
- Tween 80: 50 ml
- Mixing Speed: 500 (rpm)
- Mixing Time: 21 minutes
- Room temperature

2.3.2Independent Variables

- Methyl Paraben: 1.5, 2, 2.5, 3 (mg)
- Span 60 (Sorbitan Monostearate): 1, 3, 5, 7, (mg)

2.3.3 Dependent Variable

1. Homogeneity Test
2. pH Test (SNI-16-3499-1996)
3. Specific Gravity Test (SNI163499-1996)
4. Viscosity Test (SNI-16-3499-1996)

2.4 Experimental and Testing Procedures

2.4.1 How to Make Emulsification

1. Connect the hot plate stirrer to a power source then turn it on by pressing the ON button.
2. Place the beaker glass and add the oil phase ingredients (VCO: 50 ml, tween 80: 50 ml) dissolved at a temperature of 65℃- 75℃ until melted.
3. Then place the glass beaker and add the water phase ingredients (methyl paraben, span 60 (Sorbitan Monostearate), aloe vera 100 ml) dissolved separately at a temperature of 65℃- 75℃ until melted.
4. Insert the magnetic stirrer rod.
5. Set the stirring speed (500 rpm)
6. Once all the phases are dissolved, add in the water phase to the oil phase little by little.
7. Stir until an emulsion forms.
8. Stirring was carried out for 21 minutes.
9. Store samples at room temperature.

3. RESULTS AND DISCUSSION

3.1 Research Results

Table 3.1 Data from Testing and Analysis Observations

Sample	Methyl paraben (mg)	Span 60 (sorbitan monostearate) (mg)	Homogeneity Test	Test pH	Specific Gravity Test (gr/ml)	Viscosity Test (cP)
1	1.5	1	M.S	6.2	0.9982025	500
2		3	TMS	6.2	0.998602	500
3		5	M.S	6.1	0.9942081	555
4		7	M.S	6.1	0.9998003	445
5	2	1	M.S	6.0	0.9882165	445
6		3	M.S	6.2	0.998602	500
7		5	M.S	5,6	1.001398	445
8		7	TMS	5.5	0.9974036	555
9	2.5	1	M.S	5.5	0.995007	500
10		3	TMS	5.5	0.9994008	500
11		5	M.S	5,6	0.9978031	500
12		7	M.S	5,6	0.9990014	555
13	3	1	M.S	5.4	1.0005992	700
14		3	M.S	5.3	0.9966048	760
15		5	M.S	5.3	0.9982025	780
16		7	M.S	5.0	0.9974036	780

3.2 Discussion

From the results of the research data carried out, the results and description of the discussion were obtained as follows:

3.2.1 Effect of Weight Comparison of Span 60, Methyl Paraben on Viscosity Values

The purpose of measuring the viscosity value is to determine the viscosity of the sample formulation against two materials that cannot mix with each other. Viscosity is a property that determines its resistance to shear force (Shabrina et al., 2020). By using a Brookfield Viscometer on 16 samples with different treatments, the results of measuring these values can be seen in Figure 3.1. The range of viscosity values obtained is around 500 – 780 cP.

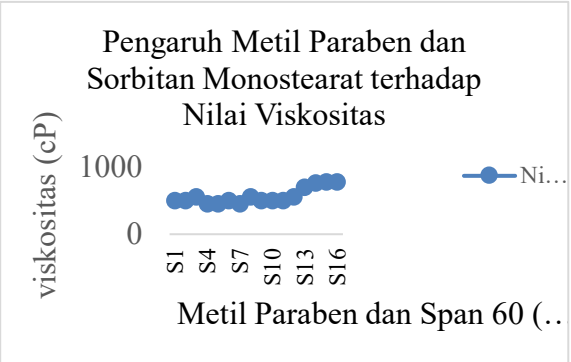

Figure 3.1 Effect of Weight Comparison of Methyl Paraben and Span 60 on Viscosity Values

The viscosity values of the 16 samples were different, in the sample parameters using a span weight of 60 (1, 3, 5, 7 mg) and a methyl paraben weight of 1.5, there was a not too big decrease in the resulting viscosity value, the results obtained ranges from 500 cP - 445cP where the results show that it does not meet the standards that have been set. In the sample parameters using a span weight of 60 (1, 3, 5, 7 mg) and a weight of methyl paraben of 2 mg, there was a not too big increase in the resulting viscosity value, the results obtained ranged from 445 cP- 555 cP. Then in the sample parameters using a span weight of 60 (1, 3, 5, 7 mg) and a methyl paraben weight of 2.5 mg, the resulting viscosity value was around 500 cP - 555 Cp. In the parameters using a weight of 60 span (1, 3, 5, 7 mg) and a weight of methyl paraben of 3 mg, there was a too large increase from the previous viscosity value of 700 cP - 780 cP, but this value did not meet the standards that had been set. . This happens because the resulting mixing time is too short, variations in the weight of methyl paraben and the weight of span 60 for the sample. This condition is not in accordance with the statement (Martin et al, 1993); in (physics et al., 2014), which states that the viscosity of the system can increase with increasing volume affecting the viscosity value obtained, the longer the stirring time,

the thicker the resulting sample.

The viscosity value decreases due to the length of storage. A decrease in viscosity can also be caused by storage environmental conditions such as light and air humidity. Packaging that is less tight can cause the gel to absorb water vapor from the outside, thereby increasing the volume of water in the gel, and the longer the storage period, the less trapped the number of air bubbles (Sihombing, et al., 2007). In oil with the addition of raw materials*aloe vera*which contains 98.5% water causes the viscosity to decrease because the oil will become thinner and the flow time will be faster.

3.2.2 Effect of Comparison of Span 60, Methyl Paraben and on Specific Gravity Values

Measurements carried outThe aim is to see the purity of the weight of 16 samples that were given different treatments. Specific gravity is the ratio between the weight of a substance compared to its volume at a certain temperature. When specific gravity measurements are carried out using a pycnometer, attention must always be paid to drying because this will affect the weight of the resulting pycnometer.

From the experimental results can be seen in Figure 3.2, the range of specific gravity values produced by the weight of span 60 and methyl paraben which were given different treatments, this affects the specific gravity value of 16 starting from0.9882165g/ml on sample parameters using a weight of span 60 1 mg and methyl paraben 2 mg and the highest on sample parameters using a weight of span 60 1 mg and methyl paraben 3 mg with a value1.0005992g/ml.

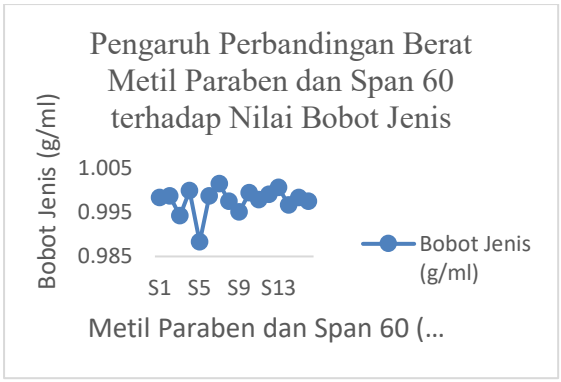

Figure 3.2 Effect of weight comparison of methyl paraben and Span 60 on specific gravity values

The results obtained from the 16 samples all met the established SNI standards (16-4399-1996).

3.2.3 Effect of weight ratio of Span 60, Methyl Paraben on pH Test

MeasurementThe pH was carried out to see how much influence the emulsifier Span 60 (Sorbitan Monostearate) had on the homogeneity of the lotion gel made from virgin coconut oil and aloe vera in the formulation of 16 samples with different treatments. According to Tranggono and Latifah (2007); in (Tinggi et al., 2014) which states that the physiological pH of the skin is 4.6-6.5, if a substance that comes into contact with the skin is more acidic or alkaline, it can irritate the skin. The pH analysis results obtained can be seen in figure 3.3.

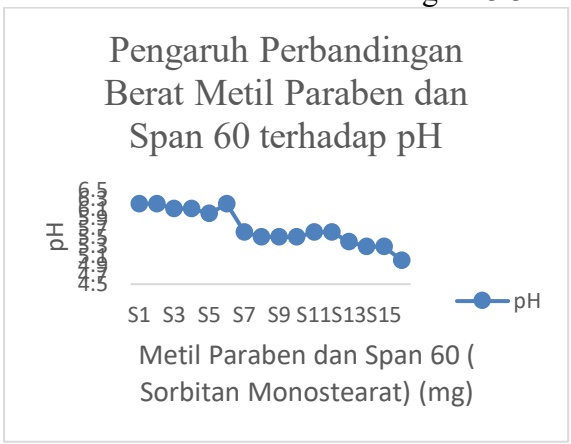

Figure 3.3 Effect of Weight Comparison of Methyl Paraben and Span 60 on pH

Based on figure 4.3 above, it can be seen that the comparison of the pH values of the emulsion samples obtained is around 5-6. According to (Tinggi et al., 2014) in the pH range, bacteria cannot grow well because it is too acidic. The optimal bacterial growth medium has a pH range of 7.05-8 or tends to be alkaline. This means that the 16 sample preparations are classified as neutral or tend to be weakly acidic and meet SNI standards (16-4399-1996) in the range of 4.5-8.

3.2.4 Effect of Weight Comparison of Span 60, Methyl Paraben on Homogeneity Test

The aim of observing homogeneity is to find out that all ingredients are mixed evenly and form an emulsion. Homogeneity is indicated by the absence of coarse grains or bubbles visible on the slide. Homogeneity test results can be done in 2 ways.

The first method is done on a watch glass by taking a small sample and then smearing it on the glass. The second method is carried out by visual observation by putting each sample into a bottle and observing it for 5 months and the results are obtained in table 3.2

Table 3.2 Data from Homogeneity Test Results

Sample	Homogeneity on the Moon					Information
	1	2	3	4	5	
1	H	H	H	H	H	**M.S**
2	H	H	H	TH	TH	**TMS**
3	H	H	H	H	H	**M.S**
4	H	H	H	H	H	**M.S**
5	H	H	H	H	H	**M.S**
6	H	H	H	H	H	**M.S**
7	H	H	H	H	H	**M.S**
8	H	H	H	TH	TH	**TMS**
9	H	H	H	H	H	**M.S**
10	H	H	H	TH	TH	**TMS**
11	H	H	H	H	H	**M.S**
12	H	H	H	H	H	**M.S**
13	H	H	H	H	H	**M.S**
14	H	H	H	H	H	**M.S**
15	H	H	H	H	H	**M.S**
16	H	H	H	H	H	**M.S**

Information :
H: Homogeneous
MS: Fulfills the requirements
TH : Not homogeneous
TMS: Not Eligible

From the results of the homogeneity test using the watch glass method, it can be seen that there are 16 samples, only 3 samples that do not meet the requirements are samples number 2, 8, and 10. BecauseHomogeneity is indicated by the absence of coarse grains or bubbles visible on the slide. This is due to variations in different mixing times, according to (McClements and Rao, 2011); in (Sari & Lestari, 2015)) the longer the stirring time and increasing the stirring speed can reduce the viscosity of the emulsion, but can also lengthen the separation time of the oil-in-water emulsion. In this study, the stirring speed was not varied, the results showed that there were no clumped particles.

4. CONCLUSION

4.1 Conclusion

Based on the observation data made and the discussion that has been described, it can be concluded as follows:

1. Based on the results of the analysis, the addition of span 60 as an emulsifier and methyl paraben as a preservative in the samples greatly affected the homogeneity and shelf life of the mixture of virgin coconut oil (VCO) and aloe vera because the emulsion used required antimicrobial ingredients because the water phase could facilitate the growth of microorganisms.
2. Based on the test results, it shows that span 60 and methyl paraben have an effect on the characteristics of the lotion as explained in the homogeneity, pH, viscosity and specific gravity tests.

4.2 Suggestions

In further research, it is hoped that this research can be continued to the manufacturing stagelotion products or their derivatives and carry out organoleptic tests. It is hoped that the results obtained will become a reference for students who continue this research.

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