CHAPTER IV

RESULTS AND DISCUSSION

4.1. Formulation Results of Lotion of Ethanol Extract of Potato Peels

Lotion is a liquid emulsion consisted of an oil phase and a water phase stabilized by the emulgator. The basic components of the lotion form were included of protective material, softener, moisturizer, thickener, film layer forming and emulgator (Lachman, 1994). In lotion formulation of this study using 70% ethanol extract of potato (*Solanum tuberosum* L.) peels. The antibacterial lotion formulated contains active ingredients of potato peels extract having concentrations of 0.8%, 0.9%, and 1%.

In this study, the formulations used were as follows:

Table 4. 1 Formulation of Lotion Preparation of Potato Peels Extract

Material	Concentration			
	Base (F0)	**F1**	**F2**	**F3**
Potato peels extract		0.8%	0.9%	1%
Stearic acid	2.5%	2.5%	2.5%	2.5%
Cetyl alcohol	0.5%	0.5%	0.5%	0.5%
Liquid paraffin	7%	7%	7%	7%
Glycerin	5%	5%	5%	5%
Triethanolamin	1%	1%	1%	1%
Methyl paraben	0.1%	0.1%	0.1%	0.1%
Perfume	0.1%	0.1%	0.1%	0.1%
Aquadest	add 50 mL	add 50 mL	add 50 mL	add 50 mL

Information:

F0: Lotion without potato peels extract

F1: Lotion of potato peels extract 0,8 %

F2: Lotion of potato peels extract 0,9 %

F3: Lotion of potato peels extract 1%

The formulation as in (Table 4.1) did not experience any changes in terms of material components or concentrations. The following the formulation in the experimental design because the formulation (Table 4.1) could form a good preparation of lotion.

The production of lotion consists of two phases, namely the water phase and the oil phase mixed into the preparation of lotion. The oil phase material used was stearic acid, a type of fatty acid with a long hydrocarbon chain; stearic acid is used as an emulsifier in topical formulations (Ahmadita, 2017). Stearic acid was intended as an emulsifier which dissolved in oil and binded the two mixed phases to be homogeneous (Rangotwat *et al*., 2016) and the mixing could increase the consistency of the preparation was so that the viscosity of the preparation would also increase (Ng, 2013). Liquid paraffin is a material that was intended as a moisturizer, lubricant and lotion formation (Rangotwat *et al*., 2016). Cetyl alcohol aims to stabilize the emulsion in the lotion preparation (Rangotwat *et al*., 2016).

The water phase material used humectants. They were glycerin as a controlling material for changes of moisture between products and air in which be both were in containers on the skin as well as prevented irritation to the skin (Rangotwat *et al*., 2016). Glycerin as a humectant that would resist water evaporation and binded water in the preparation so they did not evaporate in order to give a soft texture (Hendradi *et al*., 2013). Triethanolamine aimed as an emulsifier in the water phase and regulates pH which aims to maintain pH stability. The pH stability of the preparation was intended to keep the dosage in order to it was not damage and irritate the skin (Rangotwat *et al*., 2016). Triethanolamine also could form oil in stable water (Gondoska and Lee, 2005). Nipagin or methylparaben was used as a preservative to maintain the stability of the preparation in order to prevent contamination and could inhibit bacteria with a small inhibitory power (Farmakope Indonesia, 1997).

The results of the manufacture of the lotion from ethanol extract of potato peels were obtained oil emulsion form in water because it were

constituent components consisted of liquid paraffin which was supported by Sheng's statement (2009) which said that liquid paraffin was usually used in oil-in-water emulsions. The results of Saidar's research (2012) entitled "Physical Stability Formulation and Mosquito Repellent Effect Test of *Foeniculum vulgare* Mill", revealed that a form of oil-in-water emulsion lotion. This was because the amount of the dispersed phase (oil/fat) used in the lotion was smaller than the dispersing phase (water phase) so that the oil phase was dispersed evenly into the water phase and formed oil-in-water emulsion with the help of the emulgator. According to Megantara *et al*. (2017), the type of emulsion from the preparation was also caused by the use of emulgators which tended to be more soluble in water, called triethanolamine. Besides, it could also be caused by the solvent used in form of.

The oil-in-water emulsion system in potato peels extract formulations was expected to provide cool and fresh sensation because water proportion was more dominant in the formula used as stated by Mardikasari *el at*. (2017), O/W lotion was easier to be cleaned and washed because the outer phase characteristics were hydrophilic. It was in line with the statement of Tiran *et al*., (2014) that the selection of an oil-in-water emulsion system was adjusted to make preparations that were expected to treat infections caused by bacteria therefore the emulsion system could enhance the diffusion process of potato peels extracts through bacterial cell membranes.

Moreover, the oil emulsion system in water as an active ingredient was expected to increase the antibacterial activity of potato peels extract against the growth of *Staphylococcus aureus* as supported by Mitsui's (1997) statement that the oil-in-water emulsion system was the most widely used emulsion system in cosmetic products and many orthers because Voigt, (1994) stated that oil-in-water emulsions had the advantage of being easy to apply, having hight of dispersion and penetration, easily washed by water, did not give an oily taste when applied to the skin. In conclusion it could increase acceptance and comfortability in its use as well as the cost

required was relatively lower in relation to the water proportion content in the formula.

After obtaining the lotion base, potato peels extract was added as an active substance in various concentrations, for instance, F1 (0.8%), F2 (0.9%) and F3 (1%). Potato peels extract addition had been dissolved first using aquadest. The Lotion from potato peels extract showed that it could be mixed with the base of the lotion because it could form a lotion and there was no separation between the base and extract at all concentrations. The difference in concentration of added potato peels extract aimed to determine the most optimal concentration as an antibacterial. To determine the physical-chemical properties of the lotion preparation, an evaluation was carried out included organoleptic test and favorite, homogeneity test, pH test, dispersion test, and viscosity test.

4.2. Evaluation Test of Lotion from Ethanol Extract of Potato Peels by F1, F2, and F3

4.2.1. Organoleptic Test

Observation of the characteristics of forms, colors and odors of the lotion preparation from ethanol extract of potato peels was conducted in four formula that were observed visually by the researcher. The obtained data were presented in (Table 4.2) as follows:

Table 4. 2 Organoleptic Observation Results

Formula	Characteristics		
	Form	**Color**	**Smell**
F0	Runny	White	Rose is strong
F1	A little thick	Light brown	Rose is strong
F2	Thick	Light brown	Rose
F3	Very thick	Light brown	Weak Rose

Information:

F0: Formulation 0 (Basis)

F1: Formulation 1

F2: Formulation 2

F3: Formulation 3

Based on the results of organoleptic observations of antibacterial lotion, the ethanol extract from potato peels in various concentrations showed a thick and homogeneous dosage form. On the base of the lotion or F0 (0%) it produced a runny form, white color, and strong rose smell. At the concentration of F1 (0.8%), it produced a rather thick form, light brown color, and strong rose odor. At F2 (0.9%) it producesd a thick, light brown and rose odor. Meanwhile F3 (1%) produced a very thick form, light brown and the smell of rose is weak. The higher concentration of ethanol extract of potato peels contained in the preparation of antibacterial lotion, the thicker the dosage form produced. The smell of rose produced came from the addition of perfume in the preparation of the lotion which aimed to cover the smell of potato peels that was typical of the preparation so that it could increase consumer acceptability.

Based on the results of organoleptic tests, it met the expected criteria. It showed that the lotion could be used as a good basis for the formulation of ethanol extract from potato peels it was supported by Trimardani's statement (2015) that a good preparation could form a homogeneous visual preparation and soft texture.

The preference test of the preparation from ethanol extract of potato peels was carried out using the questionnaire method consisted of several questions about personal data and product data. Personal data contained questions such as name and study program of the panelist. While the product data included questions to analyse physical properties of the preparation such as the smell types and color of the preparation. The research questionnaire sheet were presented in

(Appendix 1). The preference test was conducted using 25 panelists. This test is subjective and used a panelist scale. This test was done to see how many people like this formulation of the lotion from ethanol extract of potato peels. Data on the observation of the results of the average score of the preference test questionnaire on the four formulas are presented in (Table 4.3) as follows:

Table 4. 3 Average Score of the Favorite Test Questionnaire

Formula	Panelist	Form	Color	Smell	Average
		Score			
F0	25	3.08	3.84	3.8	3.57
F1	25	3.12	3.2	3.2	3.17
F2	25	3.44	3.04	3.28	3.25
F3	25	3.36	2.88	3.08	3.11

Information:

F0: Formulation 0 (Basis)

F1: Formulation 1

F2: Formulation 2

F3: Formulation 3

Based on the preference test results of antibacterial lotion of potato peels extract in various concentrations in, the respondents liked the formula 2 which was thick. The results of the preference test on the color parameters showed that the respondents liked the color in formula 1 which was light brown obtained from the addition of potato peels extract. The results of the preference test dealing with on odor parameters showed that respondent liked the smell in formula 2 as rose. Based on the preference results test, it could be concluded that the preferred formulation was thick, light brown, and rose fragrant.

Based on the preference test results of antibacterial lotion from potato peels extract in various concentrations, it showed an average score of F0 (0.8%) of 3.57, F1 (0.9%) of 3.17, F2 (1%) of 3.25 and

F3 (1%) around to 3.11. Based on the preference results test, it could be concluded that the preferred formula was F2 (0.9%) because it was thick, light brown in color and rose aromatic.

4.2.2. Homogeneity Test

Data observations of homogeneity test results on the four formulas were presented in (Table 4.4) as follows:

Table 4. 4 Homogeneity Test Results

Formula	Results
F0	Homogeneous
F1	Homogeneous
F2	Homogeneous
F3	Homogeneous

Information:

F0: Formulation 0 (Basis)

F1: Formulation 1

F2: Formulation 2

F3: Formulation 3

The homogeneity test results showed that all formulas had homogeneous characteristics that did indicate the presence of coarse particles or lumps that exist, even, mixed, and seen colored equations when it was applied to transparent glass. According to Mardikasari *el. at*., (2017) that homogeneous preparations will be mixed when it was applied to transparent glass. It mean that the ingredients used in lotion production were perfectly mixed. According to Anggraini, (2017), the requirements for the lotion preparation were homogeneous, i.e. if it was applied to a piece of glass in which there was no separation between the constituent components of the emulsion.

4.2.3. pH test

pH testing was done to find out how much acidity of the preparation. Moreover, it was intended to know the safety of the lotion preparation at the time of use so it did not irritate the skin, the stability of the preparation, and its effectiveness (Fajriyah, 2009). If the lotion had exceeding or less pH than the skin pH it would irritate the skin (Karina, 2014). Preparations that were too acidic would cause skin irritation. Meanwhile pH that was too alkaline could cause dry effects on the skin (Trimardani, 2015). Observation data of pH test resulted on the four formulas which were presented in (Table 4.5) as follows:

Table 4. 5 pH Test Results

Formula	Deuteronomy	Average pH
F0	3	7
F1	3	7
F2	3	7
F3	3	7

Information:

F0: Formulation 0 (Basis)

F1: Formulation 1

F2: Formulation 2

F3: Formulation 3

pH testing of the lotion preparation from ethanol extract of potato peels having concentration 0.8%, 0.9%, 1% were measured with universal pH paper that showed a pH value of 7 for the base lotion, F1 (0.8%) showed a pH value of 7, F2 (0.9%) showed a pH value of 7 and F3 (1%) showed a pH value of 7. The pH value of the lotion supply had to meet the requirements set out in SNI No. 16-4399-1996, which ranged from 4.5 to 8.0 (Rahayu, 2016). The preparation formulations of antibacterial lotion from ethanol extract of potato peels met the SNI requirements because they were still in the pH range according to the requirements. Based on the pH value obtained, it could be stated that

the lotion from ethanol extract of potato peels in various concentrations was safe for topical use.

4.2.4. Dispersion Test

Dispersion is the ability of the base and active substances to disperse on the surface of the skin to provide therapeutic effects (Windriyati, 2007). The dispersion test was carried out to determine the extent of the dispersion of lotion when applying on the skin. It would affect the penetration of the drug and the release speed of active compounds at the location of usage. According to Wyatt *et al.*, (2008) a good preparation could disperse easily and comfortably. Data observations of the scatter in the test results were presented in the fourth formula (Table 4.6) as follows:

Table 4. 6 Dispersion Test Results

Formula	Deuteronomy	Average dispersion power (cm)
F0	3	6.7
F1	3	6.3
F2	3	6.2
F3	3	6

Information:

F0: Formulation 0 (Basis)

F1: Formulation 1

F2: Formulation 2

F3: Formulation 3

In the test of dispersion, the supply of the lotion from ethanol extract of potato peels at F0 showed a dispersion diameter of 6.7 cm, F1 (0.8%) indicated a dispersion diameter of 6.3 cm, F2 (0.9%) indicated the value of the dispersion diameter 6, 2 cm and the value of the power diameter dispersions lotion of F3 (1%) was 6 cm. The test results showed that F0 had the largest dispersion power of 6.7

cm, then decreased to F3 with a dispersion value of 6 cm. This was due to the increase concentration of ethanol extract of potato peels which decreases the power dispersion of lotion because it is thicker. The statement is supported by Shintaningsih, (2007) that the more dilute a lotion, the greater the dispersion of power. The requirements of scattering power testing which shows the consistency of semisolid in providing comfort during use are sample diameters between 5 cm-7 cm (Garg *et al*, 2002; Suryanto, 2012; Anggraini, 2017).

Dispersion power diameter on the basis and dosage formulation of extracts of potato peels extracts were followed the requirements of good dispersion power 5-7 cm. This test showed that the lotion can be dispersion even on the glass surface. The results of the scattering power were inversely proportional to the viscosity because the smaller the viscosity obtained, the wider the dispersion of the preparation.

4.2.5. Viscosity Test

Viscosity was an important characteristic in semisolid, liquid formulations that provided a resistance description of liquid to flow, when produced, put into packaging, and had important properties at the time of use, such as consistency, dispersion, and moisture (Anita, 2008).

The viscosity test aimed to ascertain the thickness level of the preparation according to the use of the topic to Trimardani (2015), the physical preparation had to have sufficient thickness in order to it was easy to be applied on the skin and the contact time of the preparation with the skin would be longer so that the active ingredient will be more optimal (Trimardani, 2015). The requirements for viscosity values based on SNI No. 16-4399-1996 was between 2000-50000 cp (Fuuta, 2016). Based on these results, it appeared that there was an increase in viscosity of potato peels extract concentrations. Data of observation results dealing with viscosity test were stated in the four formulas in (Table 4.7) as follows:

Table 4. 7 Viscosity Test Results

Formula	Results
F0	30000 cps
F1	31300 cps
F2	33500 cps
F3	34700 cps

Information:

F0: Formulation 0 (Basis)

F1: Formulation 1

F2: Formulation 2

F3: Formulation 3

Viscosity testing of the lotion preparation from ethanol extract of potato peels at F0 (0%) showed a viscosity value of 30000 cps, F1 (0.8%) around of 31300 cps, F2 (0.9%) around 33500 cps and F3 (1%) around 34700 cps. The test results showed F0 had the smallest viscosity value of 30000 cps, then increases to F3 with a value of 34700 cps. This is due to an increase concentration of potato peels extract it resulted on an increase of viscosity value because it became thicker. In contrast, the dispersion of the preparation decreased. This was due to an increase in viscosity. It was the effect of an increase of potato peels. Moreover, the addition of extract also affected organoleptics (form, color, and smell), dispersion, pH, and antibacterial inhibitory value.

4.3. Antibacterial Activity Testing of Lotion from Potato Peels Extract (*Solanum tuberosum* L.)

Antibacterial activity of lotion from Potato peels aimed to determine the ability of potato peels lotion to inhibit the growth of *Staphylococcus aureus* which was one of the bacteria resulted skin infections compared to base control and positive control. Antibacterial activity of lotion from Potato peels was done by well diffusion method. In this study, the control variables used were included basic control, active substance control, and

positive control. Base control was a preparation of lotions without potato peels extract in the formula. The diameter of the inhibitory zone against *Staphylococcus aureus* in this study was presented in (Table 4.8) as follows.

Table 4. 8 Antibacterial Test Results

Formula	Deuteronomy	The average diameter of the inhibition zone (mm)
F0	3	9,625
F1	3	12.500
F2	3	13,375
F3	3	13.500
C +	3	16.250

Information:

F0: Formulation 0 (Basis)

F1: Formulation 1

F2: Formulation 2

F3: Formulation 3

C+: Control positive (Clindamycin 1%)

The antibacterial lotion test of potato peels extract in F1 (0.8%) resulted inhibition of the average diameter *Staphylococcus aureus* bacteria which was 12.5 mm. It which showed that there was a bacterial inhibition. The testing results of antibacterial lotion from ethanol extract of potato peels F2 (0.9%) with an average diameter of 13.375 mm could inhibit the growth of *Staphylococcus aureus* bacteria. Antibacterial lotion test for ethanol extract of potato peels for F3 (1%) had higher bacterial inhibition with an average diameter of 13.5 mm. From the test results, they showed that the higher extraction concentration, the higher inhibition of bacteria. According to Pelczar and Chan (1998), an increase in the concentration of potato peels extract could develop the antibacterial activity of the lotion from ethanol extract of potato peels.

Base control was used to see whether or not there was an antibacterial power of the lotion base to the *Staphylococcus aureus* bacteria. The reason

for using the base lotion was as a comparison between the base of the lotion without extracts and lotion with potato peels extract. The measurement results of inhibitory zone was 9,625 mm in diameter. It was in line with, Rangotwat (2016), that inhibitory zones were formed because formulation of the lotion used water-soluble methylparaben as a preservative and could inhibit the *Staphylococcus aureus* bacteria in a small rent.

The results of antibacterial power test for positive control using the clindamycin gel 1% was obtained 16.25 mm in diameter of the inhibition zone. It meant that there was inhibitory power of the bacteria *Staphylococcus aureus*. Positive controls might inhibit the bacterium *Staphylococcus aureus* as clindamycin gel is an antibiotic that inhibits gram-positive bacteria by inhibiting protein synthesis by binding to the ribosomal subunits of organisms 50 s resulting in inhibition of peptide bond formation. According to Kresnawati, (2010) clindamycin is a semisynthetic antibiotic derivative of lincomycin. Clindamycin was effective against bacterial Gram-positive *cocc*i, such as *Streptococcus* and *Staphylococcus.* So clindamycin could be used to treat several types of infections on skin caused by bacteria.

Based on the antibacterial activity test results of lotion from Potato peels extract it Revealed that the average diameter of the inhibitory zone formed in the groups was quite active for lotion F1 (0.8%) F2 (0.9%), and F3 (1%). The results was in accordance with the previous studies conducted by Junior and Zanil (2000). According to Junior and Zanil (2000), the activity level of an antibacterial based on from the diameter of the inhibitory zone showed inactive group (diameter of the inhibition zone <9 mm); quite active (diameter of inhibition zone 9-12 mm); active (diameter of inhibition zone 13-18 mm); and very active (inhibition zone diameter> 18 mm). Lotion formulation of potato peels based on dosage provided strong antibacterial activity in inhibiting *Staphylococcus aureus,* based on David and Stout (1971). They stated that rate of growth of bacteria with inhibitory zones> 5 mm including the weak category, 5-10 mm including the moderate category,

10-19 mm including the strong category, and 20 mm or more categorized as very strong.

The results of data analysis used one-way variance (*One Way* ANOVA) with *Statistical Product Service Solution* (SPSS version 16) using confidence level of 95% or p = 0.05. It was found that the inhibitory zone diameter of the lotion from ethanol extract of potato peels showed the significant signs of 0,000 ($p < 0.05$) it indicated that the resulting inhibition zone was significant because it had a smaller value or less than 0.05 (Appendix 3.). Based on results of research, here was antibacterial activity from potato peels extract to inhibit the growth of *Staphylococcus aureus* bacteria.

Based on the results of F2 (0.9%) and F3 (1%) there was a significant effect on the growth of *Staphylococcus aureus* bacteria. However in F1 formulations (0.8%) had no significant effect on the growth of *Staphylococcus aureus* bacteria. Based on *the Post Hoc Test,* (Appendix 3), it could be concluded that the difference between the variables tested showed significant results ($p < 0.05$). On the other hand except between variables F0 with F1, then F1 with F0, F2, and F3, then F2 with F1, F3 and K +, then F3 with F1, F2, and K +, and on variable K + with F2 and F3 did not show significant differences.

The formation of a clear zone caused by the presence of active compounds produced by ethanol extract of potato peels in the form of alkaloids, flavonoids, and polyphenols (Depkes RI, 2001) which acted as antibacterial. According to Dwidjoseputro (1980), antibacterial was a substance that could disrupt the growth or even kill bacteria by disrupting harmful microbial metabolism. The action mechanism of antibacterial compounds was included inhibiting cell wall synthesis, inhibiting the integrity of the permeability of bacterial cell walls, inhibiting enzyme action, and inhibiting the synthesis of nucleic acids as well as proteins.

The effect of alkaloid compounds as antibacterial was disrupting the constituent components of peptidoglycan in bacterial cells so that the cell

wall layer was not formed in full and caused cell death (Darsana, 2012). Another mechanism for antibacterial alkaloids was the alkaloid component known as DNA intercellator and inhibits topoisomerase enzymes of bacterial cells (Karou *et al*., 2005; Ningsih, DR *et al*., 2016). Alkaloids have inhibitory mechanisms activatedh DNA (Cowan, 2009). Flavonoids that function as antibacterials by binding to bacterial proteins thus inhibiting enzyme activity which ultimately disrupts bacterial metabolic processes and the lipophilic properties of flavonoids which caused bacterial cell membranes to be damaged because cell membranes contained lipids which allowed them to pass through membranes (Robinson, 1995).

Flavonoids as antibacterial with the formation of complex compounds in the form of extracellular proteins were then dissolved so that they could damage bacterial cell membranes along with the release of intracellular compounds (IndoBIC, 2005 in Nuria *et al*., 2009). Flavonoids caused damage to the permeability of bacterial cell walls, microsomes, and lysosomes as a result of interactions between flavonoids and bacterial DNA (Cushnie, 2005). Other research stated that the mechanism of flavonoids inhibited cell membrane function by disrupting the permeability of cell membranes and inhibiting enzyme bonds such as ATPase and phospholipase (Li, 2003).

Polyphenol and saponin compounds had the same activity as flavonoids which were related to interactions on bacterial cell walls. Antibacterial compounds were bound to cell receptors some of which were transpeptidase enzymes, then transpeptidase reactions occured so that peptidoglycan synthesis was inhibited (Ajizah, *et al*., 2007). The antibacterial mechanism of phenol compounds in killed microorganisms by denaturing cell proteins. The hydrogen bond formed between phenol and protein caused the protein structure to be damaged. The hydrogen bond will affected the permeability of the cell wall and cytoplasmic membrane because both were composed from proteins. The permeability of cell walls and cytoplasmic membranes that were disrupted caused an imbalance of

macromolecules and ions in cells so that cells became lysis (Pelczar and Chan, 1988).

Polyphenols as antibacterial agents acted as toxins in the protoplasm, damaging and penetrating cell walls and depositing bacterial cell proteins. Large molecular phenolic compounds are capable of activating essential enzymes in bacterial cells even in very low concentrations (Heyne, 1987). Polyphenols can cause damage to bacterial cells, denatured proteins, activated enzymes, and resulted cell leakage (Heyne, 1987). The hydrogen bond formed between phenol and protein caused the protein structure damage (Pelczar and Chan, 1988). Phenol also worked through protein coagulation and cell membrane damage (Pelczar and Chan, 2008). Antibacterial compounds that played a role in the research from the results of ethanol extract of potato peels, which is the content of polyphenol compounds, based on previous research, according to Syafitri (2013) phenol compounds on potato peels have been tested for antibacterial activity against gram-positive *Bacillus subtillis*, and gram-negative bacteria *Escherichia coli*. According to Liewen 1992, besides being an antioxidant, phenolic compounds had function as antimicrobials because the concentration of phenolic compounds in potato peels was higher than in potato tubers (Dhianawaty, 2015). The inhibition of bacteria from potato peels extract in concentrations of 0.8%, 0.9%, and 1% showed that the preparation of the lotion from ethanol extract of potato peels had potency as a topical preparation that cured skin infections due to *Staphylococcus aureus* bacteria.

The performance mechanism of this lotion could be viewed from the content of the active ingredients in the form of; Potato peels extract which had an active compound in the form of alkaloids, flavonoids, and polyphenols (Depkes RI, 2001). They acted as an antibacterial thus the compound could disrupt growth or even kill bacteria by disrupting harmful microbial metabolism. According to Ganiswarna (1995), the action mechanism of antibacterial compounds was included inhibiting cell wall synthesis, disrupting cell membrane permeability, inhibiting cell protein

synthesis, and inhibiting nucleic acid synthesis of bacterial cells.

The effect of alkaloid compounds had the activity of disrupting with the constituent components of peptidoglycan so that the cell wall layer was not completely formed and then caused cell death. Flavonoid compounds had the activity of denaturing cell proteins so that the cessation of cell metabolic activity caused death. Polyphenol compounds had activities by interacting on the cell wall of bacteria. These antibacterial compounds were bound to cell receptors so that the synthesis of peptidoglycan was inhibited and then there is an imbalance of macromolecules and ions in cells that caused lysis (cell leakage).

4.4. Halal Product Analysis

Halal is of the rules of Islam religi principle, which is used to declare that something is permitted or prohibited to be consumed by Muslims on the basis of Al-Quran, hadist, or ijtihad (ulama agreement) (Salahudin, 2010). Halal in Islam is *Halalan thoyyiban* which provides halal, hygienic, clean, pure, nutritious, high-quality, and healthy literary, technical and practical means (Husain *et al*., 2012; Halal Industry Development Corporation (HDC), 2014).

This means that the materials used must be made from halal and appropriate materials and is produced free from contamination of unclean and haram ingredients. According to Haidayatullah, (2018), the raw materials allowed were those from plants which were used additives materials made from unclean and haram ingredients. In general, prohibited materials are from human body parts, such as the placenta and keratin from human hair and equipment whose ingredients come from pig body parts (Haidayatullah, 2018).

According to Ranasasmita (2014), there were at least three critical points that determined the halal nature of the drug. they are the processes and materials of insulation through extraction, fermentation processes and materials as well as the use of supporting materials (excipients) In relation

to this study, the critical point in making formulations of potato peels extract preparations were in the manufacturing process and the use of additional ingredients (excipients) so that more detailed information was needed on the manufacturing process, tools used, and sources of additional ingredients (excipients) which raised doubts about the halal product formulations available dealing with antibacterial lotion of potato peels extract. Results data of halal product analysis were listed in (Table 4.9) as follows:

Table 4. 9 Results of Halal Analysis Product Lotion Potato Peels Extract

No.	Criteria	Halal	Haram	Information
	Materials			
1.	Potato peels	✓		Potato peel could be said halal because it did not contain toxic material/compound
2.	Ethanol 70%	✓		Ethanol is haram if the concentration level is more than 1%, but it can be said halal because ethanol in this study the result of extraction process which had undergone evaporation by Rotary Evaporator so that in the final product the extract did not contain ethanol residue
3.	Aquadest	✓		It can be said halal because it was pure solvent obtained from PT. Brataco

No	Criteria	Halal	Haram	Information

4.	Stearate Acid	✓	
5.	Methyl Paraben	✓	
6.	Cetyl Alkohol	✓	
7.	Gliserin	✓	It can be said halal because it was a pure compound obtained from PT. Brataco
8.	Liquid Paraffin	✓	
9.	Triethanolamine	✓	
10.	Oleum Rosae	✓	
11.	NaCL 0,9%	✓	
12.	Medium Nutrient Agar	✓	It can be said to be halal because it was not from unclean or unclean growth media
13.	Culture of Staphylococcus aureus Bacteria	✓	It can be said halal because the bacteria used were obtained in a halal way
	Instruments		
1.	Analytical Scales	✓	
2.	Spatula	✓	
3.	Stirring rod	✓	
4.	Mortar & Stirrer	✓	It can be said halal, that all the equipments had not been used before.
5.	Waterbath	✓	
6.	Porcelain cup	✓	
7.	Petri dish	✓	
8.	Coark Boar	✓	

No	Criteria	Halal	Haram	Information
	Process			
1.	Extraction of potato peels	✓		It can be said haram because it used ethanol solvents but became halal because the ethanol used was not the result of the khamar industry
2.	Manufacture of lotions	✓		It can be said halal because the lotioon preparation process of mixing ingredients did not close together and were not mixed with unclean ingredients or tools.
3.	Testing of antibacterial activity	✓		It can be said halal because the microbial growth media used was not derived from unclean ingredients

Based on the stages of potato peels extract production, it seemed that there was immersion process with solvent that was 70% ethanol but then macerate was evaporated (removed the ethanol) using Vacum Rotary Evaporator and concentrated using Water bath. The result was potato peels extract was thick and did not contain alcohol residue. The Indonesian Ulama Council allowed the usage of ethanol as a solvent if the final product did not contain alcoholic residues. Alcohol used might not be the product of the *Khamar* industry (AIFDC ICU 2008; AIFDC ICU 2009). Potato peels extract was used as an active ingredient in the formulation of antibacterial lotion. All plants were halal for consumption, since they did not a toxic effect. According to Taylor (2001), galenic preparations (extracts, essential oils, infusions or plant solutions, etc.) could be said to be halal.

The product was an antibacterial lotion of potato peels extract. It paid attention its halalness in which process its production which is related to the addition of excipients which are mixed together to form a product. In relation to the stage of lotion production from ethanol extract of potato

peels, it seems that these ingredients, for instance, glycerin, triethanolamine, methylparaben, aquadest, stearic acid, liquid paraffin, oleum rosae and cetyl alcohol were synthetic chemicals, but these chemicals were obtained from PT. Brataco which did not contain pig derivatives and others forbidden materials classified as unclean, such as carcasses, human organs, feces, and etc. In the manufacture of lotion, the instruments used was tools in the laboratory which did not use contain pig derivatives.