

Effectiveness of Triethanolamine as Emulsifier in Chamomile Lotion Stability

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Abstract – Lotion is a cosmetic product with a lighter consistency than cream, consisting of a mixture of oil phase and water phase, with emulsifying ingredients, moisturizers, active substances, and fragrances. Its function is to hydrate the skin, reduce irritation, and protect from environmental influences. Chamomile extract and niacinamide provide additional benefits, such as anti-inflammatory characteristics and increased skin moisture. This study aims to evaluate the effectiveness of triethanolamine (TEA) as an emulsifier in lotion stability during storage, as well as the effect of stirring temperature on lotion quality. The research method used a 2 x 3 factorial design quantitatively. Of the 8 lotion formulas tested, only formula 3 met the standard requirements of organoleptically, pH, specific gravity and homogeneity tests. This formula has a TEA volume of 2 ml, mixing time for 25 minutes at 70°C, pH 8, foam texture, slightly yellow-green color, specific gravity 0.972, and homogeneity. This formula provides a moisturizing effect on the skin without side effects.

Keywords: chamomile extract; niacinamide; lotion; triethanolamine (TEA)

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INTRODUCTION

Skin is an important organ in the human body that functions as a barrier layer to protect the body from environmental influences and requires proper care to maintain its health (Subarnas et al., 2018). One way to care for the skin is to use cosmetic products, such as lotions, that contain beneficial active ingredients. Lotion is a cosmetic product from the emollient (softener) group in the form of emulsified oil in water that can be applied to the skin. The main function of lotion is to maintain skin moisture as an effort to protect against sun exposure on the skin. The main function of the use of skin lotion in addition to softening the hands is easy and quickly absorb on the surface of the skin, does not leave a thin layer, does not cause a sticky feeling on the skin after use, does not interfere with breathing, has a distinctive odor (refreshing) attractive and permanent color (Purwaningsih et al., 2014).

Chamomile flower (*Matricaria recutita*) is one type of plant that is found in several continents such as Europe, North Asia, and North Africa. Chamomile has 4 main compounds contained, namely Chamazulene, α - bisabolol, bisabolol oxide A, en-yn-dicycloethers, apigenin, quercetin, and luteolin, this is what makes Chamomile has good benefits for maintaining health and moisture in the skin (Aisah and Ketut, 2023). Chamomile flowers contain anti-inflammatory and antioxidant compounds so that the benefits of chamomile on the skin include relieving sensitive skin, leveling skin affected by hyperpigmentation due to sun exposure, and reducing wrinkles and premature aging of the skin (Bella, 2022).

Niacinamide is a substance derived from niacin (vitamin B3). Niacinamide is a substance that is widely used to treat acne-prone skin and acne spots or blemishes and helps control skin inflammation due to eczema and acne rosacea. This substance works by

inhibiting the release of inflammation-triggering chemicals in the body. In addition, niacinamide is also useful for brightening the skin. This benefit is obtained from the way niacinamide works which is able to slow down the process of transferring pigment granules (color-giving substances) into skin cells, so that the skin looks brighter (Hartini and Haqq, 2023).

Triethanolamine is one type of emulgator that is often used in lotion formulations (Adnan, 2022). The concentration of triethanolamine can be varied in formulations, and its effect on the properties of the final product needs to be studied to produce an optimal product. Therefore, this study aims to formulate a cosmetic lotion containing chamomile extract and niacinamide with varying concentrations of triethanolamine as an emulgator.

Emulsification is a process of forming a system consisting of two immiscible liquids, oil and water, one of which is dispersed as small droplets in the other (Cristine, 2012). Based on its type, emulsion is divided into oil-in-water (O/W) emulsion, water-in-oil (W/O) emulsion, water-in-oil-in-water (W/O/W) emulsion, and oil-in-water-in-oil (O/W/O) emulsion (Nawangasasi, 2017).

In this research, quantitative descriptive was used to make a description or descriptive objectively using numerical data, and using journals and books related to existing theories so that optimal results are obtained. Studies used to see a description of a phenomenon of description activities carried out systematically and emphasize factual data rather than conclusions (Nursalam, 2013). In this study also used the factorial design method with level 2 for the volume of triethanolamine, namely the volume of 0.6 mL and 0.8 mL, while level 3 is the variable mixing time, mixing temperature, and volume of triethanolamine, so that 8 factors will be tested.

Extract (*Matricaria recutita*) and niacinamide are two ingredients that are often used in cosmetic products because they have good properties for skin health. In addition, this research will also conduct quality tests on the lotion products produced. The quality test includes various parameters, such as organoleptically test, pH test, spread ability test, and homogeneity test. Thus, this study aims to provide a better understanding of the effect of triethanolamine concentration on lotion formulations containing chamomile extract and niacinamide and evaluate the quality of the resulting products on nurses' skin.

METHODOLOGY

Materials

In this research, the materials used include glycerin, niacinamide, stearic acid, cetyl alcohol, cocoa butter, liquid paraffin, chamomile extract. Meanwhile, the tools used include a hand mixer, thermometer, electric stove, beaker measuring cup, glass stirrer, plastic, and pH paper. The research was carried out in the Industrial Chemical Engineering Technology, Study Program Laboratory, Faculty of

Vocational School, Diponegoro University, Semarang.

Quantitative Descriptive Method

The research method used is quantitative descriptive. Quantitative descriptive is a research method which aims to create images or descriptions objectively using numerical data in them, as well as using journals and books to obtain related theories in a certain way in order to get optimal results. This research also uses the factorial design method 23 meaning level 2 is for the volume of triethanolamine volume of 0.6 mL and 0.8 mL, while power 3 is the variable mixing time, mixing temperature and volume of triethanolamine, so that 8 factors will be produced to be tested.

Lotion Preparation

The lotion making process begins with making a mixture with the water phase consisting of liquid paraffin (21 mL), triethanolamine (2 mL and 3 mL), and sufficient distilled water stirred for 7 minutes. Then make an oil phase mixture consisting of cocoa butter (2 grams), stearic acid (7.5 grams), cetyl alcohol (2 grams) which is stirred for 7 minutes. Then the water phase and oil phase were mixed and heated at a temperature between 70–80°C after the two phases were mixed then cooled and mixed again by adding chamomile extract (1.5 grams) and niacinamide (2 mL). After that, the lotion product was measured several times.

Organoleptic Test

According to Widyasanti et al. (2016), organoleptic test is a test that uses human senses in the form of sight, hearing, touch, smell, and taste to measure the texture, appearance, aroma, and taste of a sample where this organoleptic is carried out by panelists. In organoleptic testing, you can use the solving method which can be measured from several populations for sample testing.

$$n = \frac{N}{1 + ne^2} \quad (1)$$

where N is sample population; n = number of samples; e = tolerance error value (0.01).

pH Test

The pH test aims to determine the quality of the lotion preparation during use so that it does not cause irritation to the skin. pH is a parameter that states the acidity or alkalinity of a substance test product. Normal pH has a value of 7, Acid pH has a value <7, alkaline pH has a value >7 (Putra and Viswanantha, 2017). The pH test is carried out by weighing 1 gram of lotion preparation and diluting it with 10 mL of distilled water. Then use pH paper to measure the pH of the lotion preparation. Then it will be compared with the SNI lotion standard.

Density Test

In this process, weigh the empty pycnometer first, place the sample in the pycnometer and weigh it (Rheina,2019). Measure density with the Eq. 2

$$\rho = \frac{A - B}{V} \tag{2}$$

where ρ is density of sample (g/mL); A is mass of filled pycnometer (gr); B is mass of empty pycnometer (gr); V is volume of pycnometer (mL).

Homogeneity Test

In this process, place the sample in a petri dish and observe for a few minutes whether the sample combines or not, or the two mixtures separate (Usmadi,2020).

RESULTS AND DISCUSSION

There were eight runs in this study, with different treatment variations applied in each run. Table 1 shows the results of data processing using factorial experimental design, where the oil produced has a value corresponding to the sign of the variable level of extraction process time. By using a faster method to optimize this research, it is necessary to identify process variables that have a significant influence on the research and focus on calculating the main effects and interactions on the results produced.

Table 1. Results of making lotion with variable changes in mixing temperature, mixing time and TEA volume

Run	Variable changes			Interaction			pH Analysis	Density (gr/mL)	
	T	t	V	VT	Tt	Vt			VTt
1	-	-	-	+	+	+	-	8	0.961
2	+	-	-	-	-	+	+	8	0.981
3	-	+	-	+	-	-	+	8	0.972
4	+	+	-	-	+	-	-	8	1.028
5	-	-	+	-	+	-	+	8	1.043
6	+	-	+	+	-	-	-	8	0.964
7	-	+	+	-	-	+	-	8	0.559
8	+	+	+	+	+	+	+	8	0.657

Figure 1 shows the normal probability plot between the P value (%) and the effect obtained by regression (R2) of 0.989. The feeling obtained in the practical process is $y = 0.4532x - 1.8129$. It can be concluded that the volume of TEA can influence the results of the lotion.

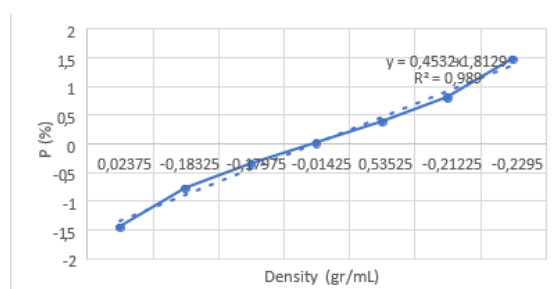


Figure 1. Normal Probability Plot Graph against Density Test

pH Analysis

In the pH test results, 1 gram of each sample is taken and then dissolved in 10 mL of distilled water and then homogenized, will be measured using a pH indicator, the pH value will be matched with the indicator at the location of the pH indicator, and it will be found that all samples get pH 8. From the pH value, the results for all treatments are still at the pH value determined by SNI 4399-1996 for lotions, which is in the range of 4.5-8.0. The cause of the sample can reach pH 8 is the presence of a mixture of TEA (Triethanolamine) and stearic acid which becomes triethanolamine stearate. According to Safitri and Jubaidah (2019) a pH value of less than 4.5 can cause irritation and itching on the skin, while a pH value of more than 8.0 can cause the skin to become slippery, dry, and affect skin elasticity.

Density Analysis

The specific gravity test results determine the specific gravity of each sample, whether the sample has a light or heavy specific gravity, which will affect the spreadability on the skin (Deniansyah, 2021). From the test results, the weight of an empty pycnometer is 11.75 gr/mL, while samples 7 and 8 are smaller than the SNI, namely 0.559 gr/mL and 0.657 gr/mL. This is due to the form that is too liquid or foamy, due to insufficient mixing time. While the other samples are in accordance with SNI 16-3499 1996 which is 0.95–1.05 gr/mL (Al-rimawi and Jaraiseh, 2014). Although the other samples also have a foam shape, the texture is more dense and homogeneous compared to samples 7 and 8.

Organoleptic Analysis

In the organoleptic results, almost all samples showed a foamy texture, except for samples 7 and 8. The foamy texture is caused by the oil phase and the water phase that does not dissolve evenly in the specified time variable (Lystiyaningsih and Ermawati, 2018). When TEA (Triethanolamine) does not bind stearic acid perfectly, it causes the surface tension of the water phase to decrease and the saponification reaction is not complete. Likewise with the gel form, the mixing of the oil phase and the water phase has not been perfectly integrated (Lystiyaningsih and Ermawati, 2018).

Based on the aroma, all samples smell fragrant, such as chamomile and lemongrass flowers. Then for color, almost all samples have a slightly greenish yellow color, except for sample 1 and sample 2 which are slightly green due to uneven mixing of lotion with chamomile extract. Organoleptic testing conducted on 10 panelists, obtained an n value of 9.92, the value is obtained from N as panelists (10 people), n as the

number of samples (8 samples), and e is the tolerance of error (0.01) (Yuniarti et al., 2014).

Comparison with SNI

Based on SNI, when compared to the product, all samples produce pH 8 and are still in accordance with SNI. As for samples 7 and 8, both appearance and density are not in accordance with SNI, the appearance of the two samples is not homogeneous and the sample weight is less than 0.95g (Al-rimawi and Jaraiseh, 2014).

CONCLUSION

Mixing time, mixing temperature, and TEA volume have a significant influence on lotion yield. These variables can have a single effect or interaction. In this practicum, the most optimal TEA volume is variable 3 with a mixing time of 25 minutes at 70°C. This result gives a moisturizing effect on the skin and leaves no side effects. From the factorial design analysis, the single most influential variable was the volume of TEA in accordance with the objective of the practicum, which was to determine the effectiveness of TEA as an emulsifier on lotion stability during storage.

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