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The Effect of Cocamide Dea Concentration Variations on Physical Characteristics of Ginger Extract (Zingiber officinale) and Celery (Apium graveolens) Shampoo Preparations Rahmi Septiani 1, Desy Siska Anastasia 2 *, Isnindar 3 Tanjungpura University, Pontianak, West Kalimantan, Indonesia *desysiska@pharm.untan.ac.id ABSTRACT Ginger and celery extracts are recognized anti-dandruff agents. Managing dandruff can be accomplished by creating a cleanser formulation. Shampoo contains an essential cleansing ingredient known as surfactant. SLS enables good foams, but at >10% concentration, it irritates skin. Adding a nonionic surfactant like cocamide DEA reduces irritation. This study examined how cocamide DEA concentrations affected the physical qualities and hedonic evaluation of a shampoo containing ginger and celery extracts. The shampoo was produced in three formulas with differing cocamide DEA concentrations: F1 (6%), F2 (8%), and F3 (10%). The formulation is evaluated using organoleptic, homogeneity, viscosity, pH, bulk density, foam height, foam stability, cycling, hedonic, and irritant studies. The result of this study revealed that shampoo had a brownish-orange color, a ginger-mint scent, and different looks. All three formulations were homogeneous, did not separate during cycling, and had significant viscosity variances, pH, bulk density, foam height, and foam stability. The formula with an 8% cocamide DEA concentration was the most popular and did not produce irritation. In conclusion, varying cocamide DEA concentrations affect the physical properties and preferences of panelists in a shampoo formulation that includes ginger and celery extracts. Keywords: Ginger, Celery, Shampoo, Surfactant, Cocamide DEA INTRODUCTION Ginger and celery extracts are known to act as anti-dandruff agents. The concentration of 3% ginger ethanol extract was able to inhibit the Malassezia sp. fungus in 28 out of 30 people with dandruff (Aprilia, 2010)Celery ethanol extract as an anti-dandruff agent in shampoo preparation was able

to inhibit the growth of the fungus 26

Pityrosporum ovale

at a concentration of 0.1% **with an inhibition zone of** 20.98 **mm** (Mahataranti, Astuti **and** Asriningdhiani, 2012) **The** 16

combination of ginger and celery extracts is expected to increase the effectiveness of antifungal shampoo preparations as a way to treat dandruff. Surfactants are important cleaning agents in shampoo due to they are able to lower the surface tension of the solution, so that dirt is suspended in the aqueous phase (Lestari et al., 2021). The surfactant that is often used is Sodium lauryl sulfate (SLS), which is an anionic surfactant, but it has great skin irritating power. Thus, a combination with nonionic surfactants, such as cocamide DEA, is required in order to reduce the irritation caused (Prayadnya et al., 2017).

This study aims to see **the** effect **of** cocamide DEA variations **on the physical** characteristics **and** 20

panelists' preferences for shampoo preparations. METHODOLOGY Materials Tools: rotary evaporator (Buchi), oven (Reverberi), Brookfield DV-E viscometer (Ametek), dry blender (Philips), vacuum pump (Rocker), analytical balance (Bel Eingineering), hot plate (Schott), moisture balance (Kern), UV lamp (Camag), water bath shaker (Memmert), weighing bottle, analytical balance (Radwag), maceration vessel, evaporator cup, mortar- stamper, test tube rack, glassware (Iwaki), pH-meter, and picometer (Iwaki). Ingredients: celery herb, ginger rhizome, 96% ethanol, silica gel plate F254, filter paper, mayer reagent, dragendroff reagent, wagner reagent, FeCl3, AlCl3, distilled water, acetic acid, sulfuric acid, acid chloride, magnesium, gelatin, sodium chloride, toluene, ethyl acetate, formic acid, sodium lauryl sulfate (cosmetic grade), viscolam (cosmetic grade), triethanolamine (cosmetic grade), cocamide DEA (cosmetic grade), dimethicone (cosmetic grade), methyl paraben (cosmetic grade), menthol (cosmetic grade). Methods Manufacturing of Plant Extracts Celery and ginger plants were extracted using the meseration method with 96% ethanol as a solvent (Mahataranti, Astuti and Asriningdhiani, 2012)The yield obtained is weighed and calculated using the formula (Kementrian Kesehatan RI, 2017). $arrraar\ riaka\ raiahr\ (ar)$ % $Errraar\ Yiaka$ = $ikiriak\ rikkkiaia\ raiahr\ (a)\ r$ 100% Extract Standardization a. Organoleptic extract Extracts were observed and described in terms of color, smell, and taste (Kementrian Kesehatan RI, 2017) b. Determination of Ethanol Soluble Juice Content Weigh accurately ± 5 grams of simplicia powder and put it into the corked flask. Add 100 mL of ethanol, shake for 6 hours using a shaker, and let stand for 18 hours. Filter and evaporate 20 mL of the filtrate to dryness in a preheated evaporator cup at 105°C and tare. Heat at 105°C until constant weight. Requirements for determination of ethanol-soluble essence content in ginger extract not less than 5.8% and celery not less than 5.2% (Kementrian Kesehatan RI, 2017)Calculate the % soluble essence of ethanol using the formula (Supriningrum, Fatimah and Purwanti, 2019) : $arhakkk\ arrakaa\ raiahr\ (ar)$ 100 % $Erhakkk\ rkkraka\ arrakaa\ akkrakr$ = $ikiriak\ kaririak\ raiahr\ (a)$ 20 r 100% r c. Drying Shrinkage Drying shrinkage test using moisture balance. The drying shrinkage requirement for ginger and celery plants is no more than 10% (Kementrian Kesehatan RI, 2017) Phytochemical Screening a. Alkaloid Test Put the extract in

a test tube and add 1 **ml of** 2N **HCL and**	2

9

ml of distilled water. Heat for 2 minutes, cool, and strain. The filtrate obtained was divided **into** three **test**	3

tubes. Add Mayer, Wagner, and Dragendorf reagents, which will give rise to white, brown, and orange- red precipitates (Rahmi, Noviyanto and Pratiwi, 2017). b. Flavonoid

Test The extract was put into a reaction **tube** , 5 **ml of** ethanol **was added, and**	13

the mixture was heated for 5 minutes. Add magnesium

powder and a few drops of concentrated HCl . Shake and observe **the**	3

changes that occur. The formation of a yellowish-black to reddish color indicates the presence of flavonoids (Septia Ningsih et al., 2020). c. Saponin Test

The extract was put into a reaction **tube** , added 10 **ml of distilled water, and** 2

heated for 5 minutes. It was then cooled, shaken vigorously for 10 seconds, and left for 10 minutes (Minarno, 2015) (Rahmi, Noviyanto and Pratiwi, 2017). The saponin test showed a positive result, which was indicated by the presence of 1 cm of foam for 10 minutes (Rustini, Ismed and Nabila, 2022). d. Test Steroids and Terpenoids Extract and 3 mL of ethanol. Add 2 mL of anhydrous acetic acid and sulfuric acid through the tube wall.

The presence of triterpenoids **was indicated by** a red **color** 12

change, while

the presence of steroids **was indicated by** a green **color** 12

change.(Rahmi, Noviyanto and Pratiwi, 2017) (Septia Ningsih et al., 2020). f. Tannin Test

The extract was put into a test tube, and 5 **ml of** NaCl **and** 2

gelatin solution were added. A positive result is indicated by the presence of a precipitate (Ikalinus, Widyastuti and Setiasih, 2015). g. Phenol test The extract is put into the reaction tube; add 3–4 drops of FeCl3. Positive results

are indicated by a change in color from bluish black **to** 9

dark black (Septia Ningsih et al., 2020). Identification of Compounds with TLC a. Flavonoid Test A flavonoid identification test was carried out on celery extract. The

mobile phase used was toluene: ethyl acetate: formic acid (7:2,5:0,5 6

) (Kementrian Kesehatan RI, 2017)

The stationary phase used was a **silica gel GF254 plate. The** 19

spot viewer used was the AlCl3 spot viewer (Rusmawijayanto and Luliana, 2019). The appearance of a yellow stain indicated the presence of flavonoids. Detection using UV366 and UV254 light (Nurmila, Sinay and Watuguly, 2019). b. Phenol Test A phenol identification test was carried out on ginger and celery extracts. The ginger extract uses toluene as its mobile phase. ethyl acetate (7:3) (Talia, Wijaya and Setiawan, 2019) Meanwhile,

the mobile phase of celery uses **toluene: ethyl acetate : formic acid (7:2,5:0,5**	7

) (Kementrian Kesehatan RI, 2017). The stationary phase used GF254 silica gel plates. The spots will be seen under UV366 and UV254. The spot viewer used with FeCl 3 will show a blackish blue color. Spots will be seen under UV366 and UV254 light (Manongko et al., 2020). c. Terpenoid Test A terpenoid identification test was carried out on ginger and celery extracts. The ginger extract used

the mobile phase of **toluene, ethyl acetate (93:7**	25

) (Kementrian Kesehatan RI, 2017). Meanwhile, celery uses toluene:ethyl acetate (93:7) mobile phase {Formatting Citation} (Fajriaty et al. , 2018). Shampoo Manufacturing The shampoo formulation can be seen in Table 1. The method of making shampoo begins by first dissolving Sodium Lauryl Sulfate (SLS) in distilled water. While waiting for the dissolution process, put the viscolam into the beaker and add a little distilled water because the viscolam forms a gel in liquid media (Yoshita, 2003). Next, dissolve the methyl paraben into the propylene glycol and put it into the viscolam. After the propylene glycol and methyl paraben solution is homogeneous in viscolam, add the triethanolamine little by little, accompanied by stirring, until a clear base is obtained (Nurdianti, 2015). Ginger extract and dimethicon are mixed into cocamide DEA. These three ingredients are mixed and stirred until homogeneous, then slowly added to the gel base while stirring. When it is homogeneous, add the SLS solution. Add SLS slowly while stirring until homogeneous. Dissolve the menthol with a few drops of ethanol and add it to the preparation while stirring until homogeneous. Add celery extract to the preparation and stir until homogeneous. The shampoo preparation changes color from orange to green. After that, add distilled water up to the mark of 100 ml (Sari et al., 2021) (Nasmety et al., 2019). Table 1. Formulation of shampoo preparations No Material 1 Ginger Extract 2 Celery Extract 3 Sodium Lauryl Sulfate 4 Cocamide DEA 5 Viscolam 6 TEA 7 Dimethicone 8 Propylene glycol 9 Methyl paraben 10 Menthol 11 Aquades Concentration (%) F1 F2 F3 Ad 100 Ad 100 Ad 100 3 0.1 10 6 6 3 1 14 0.15 0.25 3 0.1 10 8 6 3 1 14 0.15 0.25 3 0.1 10 10 6 3 1 14 0.15 0.25 Function Active ingredients Active ingredients Surfactant Foam stabilizer Thickening agent Alkalizing agent Emollient Cosolvent, Humectant Preservative Corigen Solvent Shampoo Characteristics Testing a. Organoleptic Test Organoleptic testing is done by looking at the shape, color, and scent (Sambodo and Salimah, 2021).

b. Homogeneity Test The homogeneity test on the	10

shampoo preparation

was carried out by applying the shampoo **preparation to the**	10

glass slide and then observing the parts that did not mix well (Sambodo and Salimah, 2021). c. Viscosity Test Viscosity test using Brookfield DV-E viscometer (Rashati and Eryani, 2019). Viscosity is measured with the appropriate speed and spindle. Conditions for acceptable viscosity in shampoo based on SNI are 400–4000 cp (Tee and Badia, 2019). d. Foam Height and Stability Test The ability of surfactants to form foam was determined by taking 1 mL of a sample. Put it in a

test tube and **add** 9 **mL of distilled water** to **it** . Shake **for**	3

1 minute, calculate the foam height after shaking, and calculate the final foam height after standing for 5 minutes (Purwati et al., 2021) (Gunawan, 2020). The height requirement for shampoo foam, according to Harbone (1996), is 1.3–22 cm (Lailiyah et al. , 2022). Meanwhile, according to Rosmainar (2021), the foam stability requirement is > 60%. The foam stability value can be calculated using the following formula (Purwati et al., 2021) : final foam height Foam stability = initial foam height x 100 % e. pH test

The pH test was **carried out using a pH meter** . Previously, **the pH-meter** was calibrated with **a** 15

solution of pH 6.86 or 9.18. The pH of shampoo that meets SNI requirements is 5.0– 9.0 (Rashati and Eryani, 2019). f. Specific Weight Specific weight test using pycnometer. Specific weight requirements based on SNI are a minimum of 1.01–1.10 gram/mL. How to calculate specific gravity using the formula (Andriani et al., 2022) : $Waiahr\ ka\ krakkkarar\ akkraikika\ krakararikkr - raiahr\ ka\ akkrr\ krakkkarar$ Specific Weight = $rkkrka\ kikkkkarar$ g. Hedonic Test The hedonic test is

carried out with the aim of knowing the response or impression **of the** 5

five human senses to a stimulus caused by a product. Assessment of the shampoo product, including the amount of foam, texture, color, and aroma, using the hedonic scale. The hedonic test was carried out on a scale of one indicating (dislike very much, number 2 (dislike), number 3 (neutral), number 4 (like), and number 5 (very like). The test was carried out with 30 people (Anasri et al., 2020). h. Irritation Test The volunteers consist of 12 volunteers. The part used is behind the ear. Clean the skin of the volunteer to be tested and mark with a marker

a certain area (2.5 x 2.5 cm) behind **the** 21

ear, then apply shampoo using cotton buds to the place to be tested and leave it for 4 hours (Untari and Robiyanto, 2018). Observations made included the occurrence of erythema, papules, vesicles, and edema. If erythema occurs, it is marked (+), erythema and papules are marked (++), erythema occurs, papules and vesicles are marked (+++), edema and vesicles are marked (++++), and if it does not occur, reactions are marked (0) (Harefa et al. , 2017). Requirements for volunteers are that they are 20–30 years old, physically and mentally healthy at the time the test takes place, and have no previous history of skin allergies (Untari and Robiyanto, 2018). RESULTS AND DISCUSSION Standardization of Ginger Extract and Celery Extract Table 2. Results of Standardization of Ginger and Celery Extracts Extract Ginger Celery Standardization Test Results Literature Results Organoleptic Condensed Shape It tastes spicy, brown and has a distinctive aroma Condensed Shape It tastes spicy, brown and has a distinctive aroma Condensed Shape It has a distinctive taste, is dark green in color and has a distinctive aroma Drying Shrinkage 3.56 ± 0.648 <10 3.27 ± 0.908 Test Ethanol Soluble 46.67 ± 0.0577 >5.8 76.67±15.275 Juice Content Test Literature Condensed Shape It has a distinctive taste, is dark green in color and has a distinctive aroma <10 >5,2 In Table 2 it can be seen that ginger and celery extracts have composed extract standardization based on the Indonesian Herbal Pharmacopoeia standards. Extract Qualitative Test Results Table 3. Phytochemical Screening Test Results Screening Test Results Ginger Celery Alkaloids - - Tannins Phenol Terpenoids/ Steroids Saponins Flavonoids + + + + + Terpenoids + Steroids + + + + Table 4. TLC Test Results TLC test Literature Rf value Ginger Celery Phenol Terpenoids Flavonoids Blue-black spots when sprayed with FeCl3 Blue-violet or red-violet spots when sprayed with Liberman Burchad and heated The spots are yellow when sprayed with AlCl3 0.28;0.44;0.60 and 0.25;0.34;0.40; 0.70 0.61; and 0.83 0.26;0.86; and 0.56 0.67; and 0.83 Are not done 0.46; and 0.89

The results of the qualitative extract tests **can be seen in Table 3** 18

and Table 4. Phenol, terpenoid and flavonoid compounds can act as antifungals by disrupting the formation of fungal cell walls and can reduce membrane permeability (Rahminiwati et al., 2010) (Sutejo, Purwanti and Susanti, 2022) (Komala et al., 2019). Test of Physical Characteristics of Ginger and Celery Extract Shampoo Table 5. Results of Physical Characteristics Test of Ginger and Celery Extract Shampoo Physical Average value Characteristics Test Cocamide DEA Cocamide DEA Cocamide DEA Condition 6% 8% 10% Viscosity(Cp) Foam Height(cm) Foam Stability(%) Specific Weight(g/ml) pH a. Organoleptic test 523.33±13.35 10.13±0.15 81.25±0.28 1.0461±0.0013 8.55 873.33±20.30 10.73±0.15 83.85±0.33 1.0470±0.0008 8.60 1063.33±8.50 11.30±0.10 85.88±0.89 1.0480±0.0006 8,62 400-4000 1,3-22 >60% 1.01-1.10 5.0- 9.0 Figure 1. Organoleptic Test Results Based on the observations of ginger and celery extract shampoo, there was a significant difference in the form of

Formula 1, Formula 2 , and **Formula 3** . In **Formula** 1, **the** 24

preparation looked a little runny; in Formula 2, the preparation looked a little thick; and in Formula 3, the preparation looked thick. This is because the higher the concentration of cocamide DEA added, the greater the viscosity, so that the preparation becomes thicker (Nasmety et al. , 2019). Observations of shampoo preparations can be seen in Figure 1. The colors of the three formulas are brownish-orange in color, and the aroma parameter of the shampoo comes from the addition of ginger and menthol extracts. The dominant aroma of ginger is due to the content of essential oils in ginger extract. The essential oils in ginger that cause a fragrant aroma are zingiberen and zingiberol (Handrianto, 2016). So it was concluded that increasing the concentration of cocamide DEA did not affect the color or aroma of the preparation. b. Homogeneity Test The homogeneity test

aims to determine the presence or absence **of** coarse particles **in the** 9

shampoo preparation (Tee and Badia, 2019). The results obtained showed that the three formulas were homogeneous and there were no visible coarse particles or lumps. Homogeneous preparations will produce good shampoo quality because they can show that the active ingredients in them are evenly dispersed (Rohmani et al. , 2022). c.

Viscosity Test The results of the viscosity test 5

when analyzed using Oneway Anova in SPSS Var 25 show that there is a significant difference between the formulas with a

value (p-value = 0.000) < 0.05 . In Table 5, **it can be** seen **that** 17

the higher the concentration of cocamide DEA, **the higher the** 8

viscosity of the shampoo preparation. This result is because Cocamide DEA has a hydrophilic and lipophilic structure, so it has

the ability to reduce **the surface tension between water and dirt** 22

(Lestari et al. , 2021). d. Foam Height Test The foam in the shampoo can prevent the strands of hair from sticking together so that the hair is not tangled (Lestari, Gultom and Yulianis, 2020). Foam is an air-in-liquid emulsion (Rantika, 2017). The results of the high foam test data, when analyzed using the one-way Anova Test, get a value (

p-value = 0.000) < 0.05 , which **indicates that there is a significant difference between the** 1

formulas. Based on the results of the foam height test data, which

can be seen in Table 5, **the higher the** concentration **of** cocamide DEA, **the** higher **the** foam **of** 4

the shampoo preparation. This is due to the addition of cocamide DEA, indicating that more and more parts are adsorbed at the gas/liquid interface. Cocamide DEA has water- loving and water-disliking parts. The water-loving part will lead to solutions, while the other part will lead to air or gas. When there is stirring, the air will enter the surfactant solution. Then the surfactant will be adsorbed

at the gas-liquid interface , trapping the gas **and** air to **form bubbles** 4

. The more cocamide DEA, the more bubbles will be produced (Sari et al. , 2019) (Kurniawati et al. , 2015). e. Foam Stability Test Foam stability test results using Oneway Anova on SPSS Var 25 The result (

p-value = 0.000) < 0.05 indicates that there is a significant difference between the 1

formulas. The value of the foam stability test for shampoo preparations can be seen in Table 5, which shows that the higher the concentration of cocamide DEA, the longer the foam in the shampoo will disappear. Foam stability is affected by the addition of cocamide DEA. This is because cocamide DEA functions as a foam stabilizer and is able to hold bubbles so they don't burst within a certain time. Decreasing foam stability indicates the inability of foam bubbles to maintain their main characteristics, such as foam size, amount of liquid, and total volume of foam (Prayadnya et al. , 2017). The addition of cocamide DEA concentration will make the bubble layer thicker so that it takes longer to burst (Baranovich, 2020). In addition, the foam resistance is longer when the viscosity is higher. The foam will lose its stability if lamellae or bubble walls leak. Under conditions of good viscosity (thickness), the surfactant micelles combine with the thickening agent, thereby supporting the foam and maintaining its stability (Emmawati et al. , 2016). f.

PH test The pH test is **carried out to** determine **the** degree **of acidity** and alkalinity **of** a **preparation** 14

(Nasmety, Pramesti and Septiani, 2019). Data obtained when analyzed using the Walis Crustal Test on SPSS Var 25 shows a

value (p-value = 0.001) < 0.05 , which **indicates that there is a** significant difference **between the** formulas. **The** 11

pH test values can be seen in Table 5, which shows

that the higher the concentration of cocamide DEA, **the higher the** 8

pH. Cocamide DEA is alkaline, so the addition of cocamide DEA will increase the pH of the preparation (Prayadnya et al. , 2017). Formulations 1, 2, and 3 meet the requirements of the shampoo test, which are in the 5–9 range. If the shampoo preparation is too acidic or alkaline, it can irritate the scalp (Rohmani et al. , 2022) (Pravitasari et al. , 2021). The pH of a shampoo that is too alkaline will damage the disulfide bonds, and if it is too acidic, it will damage the hydrogen bonds and salt bridges in the hair structure (Kartikasari and Yuspitasari, 2017). If the disulfide bonds, hydrogen bonds, and salt bridges are lost, the hair will become tangled, damaged, and rough (Pravitasari et al. , 2021). g. Specific Gravity Test Specific gravity is determined to predict the ease with which the shampoo preparations flow from the packaging or the ease with which the product is poured (Pravitasari, 2021). When the specific gravity

test results were tested and **analyzed** using **one-way ANOVA, the results** 23

were (

p-value = 0 .007) < **0.05** , which **indicates that there is a significant difference between** 1

formulas. It

can be seen in Table 5 that **the higher the** concentration **of** cocamide DEA, **the** higher **the** specific gravity **of** 4

the preparation. This can be caused by the fact that the more components present in the preparation, the higher the dosage weight. Variations in the concentration of cocamide DEA at 6%, 8%, and 10% certainly make the components increase. However, the value of specific gravity is also influenced by the composition of the preparation and its physical properties (Prayadnya et al. , 2017). h. Cycling Test The cycling test aims to see whether phase separation occurs in shampoo preparations during the storage process (Sambodo and Salimah, 2021). The results obtained showed that for six cycles, the three formulas did not experience any separation and no organoleptic changes occurred. These results indicate that extreme temperature changes during storage do not affect the organoleptic properties of the preparations. i. Hedonic Test Table 6. Hedonic Test Results for Shampoo Preparations Premeter F1 F2 F3 Amount Average Category Amount Average Category Amount Average Category Lots of Foam 104 3,4 Enough 124 4 Like 118 3,9 Enough Texture 97 3,2 Enough 111 3,7 Enough 111 3,7 Enough Color 102 3,4 Enough 98 3,2 Enough 90 3 Enough 12 Aroma 91 3 Enough 110 3,6 Enough 97 3,2 Enough The hedonic test is

carried out with the aim of knowing the response or impression **of the** 5

five human senses to a stimulus caused by a product (Anasri et al. , 2020). From the average rating score of the volunteers in Table 6, it can be seen that the hedonic test parameters, including color, aroma, and texture, received quite favorable responses from volunteers. The hedonic test is a subjective test that depends on the preferences of each panelist. Of the three formulas, the aroma parameter of Formulation 1, which contained 6% cocamide DEA, had the lowest value but was still considered quite liked by the volunteers, which was equal to 3. The aroma of the preparation was quite liked by the volunteers because it smelled like ginger candy but was still too strong. The texture parameters in formulations 2 and 3 containing cocamide DEA 8% and 10% got the same value, and the highest was 3.7 compared to a concentration of 6%. The texture of the 8% and 10% formulations is quite preferred because they contain high amounts of cocamide DEA, which is sufficient to give a soft texture but is a little difficult to pour. For the last parameter, namely the parameter of lots of foam, the concentration of 8% cocamide DEA is preferable to 6% and 10% cocamide DEA. j. Irritation Test A B Description: A = Before treatment; B = After 4 hours of treatment Figure 2. Irritation Test Results Based on the physical characteristics test, all various cocamide DEA concentrations met the requirements of a good shampoo preparation. Thus, the best formula was determined from the hedonic test results, namely shampoo with an 8% cocamide DEA concentration. Irritation is a skin reaction to chemicals such as strong alkalis, strong acids, solvents, and detergents. The irritation test is a test that aims to see whether or not irritation occurs in healthy participants so that it can prove that the preparation is safe to use (Untari and 13 Robiyanto, 2018).

The results of the irritation **test showed that the** ginger and celery **extract** 2

shampoo preparations did not cause irritation. One of the results can be seen in Figure 2. CONCLUSION

The conclusion of this study is that variations **in** the **concentration of** 1

cocamide DEA affect the physical characteristics of shampoo preparations, including pH, viscosity, specific gravity, stability, and foam height. As well as having an influence on the level of product preference among shampoo users. REFERENCES Anasri, Prasetyati, S.B. and Salsabil, D.R. (2020) 'Analisis kualitas shampo rumput laut jenis rumput laut Bogor, ProvinsI Jawa Barat', Jurnal Bluefin Fisheries, 2(1), pp. 1–11. Andriani, L.N., Putra, I.G.N. and Tunas, I.K. (2022) 'Pengaruh Kombinasi Sodium Lauril Sulfat Dan Natrium Klorida Terhadap Karakteristik Sampo Ekstrak Lidah Buaya', Jurnal Riset Kefarmasian Indonesia, 4(3), pp. 366–384. Aprilia, F. (2010) 'Efektivitas Ekstrak Jahe (Zingiber Officinale Rosx.) 3,13% DIbandingkan Ketokonazol 2% Terhadao Pertumbuhan Malassezia sp. pada Ketombe', Universitas Diponegoro, pp. 1–14. Awaludin, Maulianawati, D. and Kartina (2021) Aplikasi Bahan Alam untuk Pertumbuhan dan Reproduksi. Banda Aceh: Syiah Kuala University Press. Baranovich, D.L. (2020) 'Development of Foaming Shampoo Base for the Treatment of Seborrheic Dermatitis', Journal of Advanced Pharmacy Education & Research, 10(1), pp. 143–149. Departemen Kesehatan RI (2000) Parameter Standar Umum Ekstrak Tanaman Obat, Departemen Kesehatan RI. Jakarta: Dapartemen Kesehatan Republik Indonesia. Emmawati, T. et al. (2016) 'Optimasi Formula dan Teknik Pembuatan Sampo Susu Sapi Segar Menggunakan Kombinasi Surfactant d an Co- Surfactant', Majalah Kesehatan FKUB, 3(2), pp. 93–111. Fajarwati, K., Kusriani, R.H. and Fauza, M.R. (2021) 'Penetapan Kadar Fenol dan Flavonoid Total Ekstrak Daun Syzygium samarangense (Blume) Merr. & Perry Dan Syzygium aqueum (Burm.F) Alston', Jurnal Farmasi Galenika, 8(1), pp. 23–33. Fajriaty, I. et al. (2018) 'Skrining Fitokimia Lapis Titpis Dari Ekstrak Etanol Daun Bintangur (Calophyllum soulattri Burm . F .)', Jurnal Pendidikan Informatika dan Sains, 7(1), pp. 54–67. Gunawan, A. (2020) 'Optimasi Formula Sampo Ekstrak Lapisan Putih Kulit Buah Semangka (Citrullus Vulgaris Schrad) Dengan Kombinasi Hpmc

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