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Formulation Of Coenzyme Q10 Liquid Foundation With a Variations Virgin Coconut Oil as The Oil Phase

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Abstract

Coenzyme Q10 is a compound with potent antioxidants that can protect the skin from exposure to U.V. rays. Therefore researchers formulated a liquid foundation moisturizer coenzyme Q10 with VCO oil phase, which is able to provide many benefits. In addition, VCO is able to provide good physical characteristics to the preparation. The purpose of this study was to determine the effect of variations in the concentration of virgin coconut oil on the physical characteristics of the preparation and to determine the formula with the most preferred concentration of VCO by the public. The methodology in this research is evaporation emulsification with a 500 rpm magnetic stirrer for 10 minutes. Moisturizer liquid foundation is made by mixing the oil phase into the water phase above a water bath at a temperature of 70oC and adding white pigment to form an ivory color. The results showed that the higher the concentration of VCO, the lower the pH, viscosity, and adhesion of the preparation, and the greater the spreadability. In addition to testing the physical characteristics, the researchers also conducted a preference test, and the results obtained were that the respondents preferred formula 3 with a VCO concentration of 7%. Data were analyzed by descriptive statistics and linear regression with a 95% confidence level.

Keywords: *Moisturizer liquid foundation, coenzyme Q10, VCO*

INTRODUCTION

Coenzyme Q10 is an antioxidant compound that is synthesized endogenously through the mevalonate pathway in the human body. This compound is the only natural antioxidant that is fat-soluble and shows strong antioxidant activity (Bhagavan and Chopra, 2006). Coenzyme Q10 can counteract free radical damage and provide significant protection against UV-induced cell membrane damage. Coenzyme Q10 is able to avoid the occurrence of wrinkles by preventing collagen and helping the production of elastin (Korkmaz et al., 2013). However, in Indonesia, the production of coenzyme Q10 is still rare in topical dosage forms, so to take advantage of the antioxidant function of coenzyme Q10, researchers formulate coenzyme Q10 in liquid foundation moisturizer preparations.

The use of coenzyme Q10 in preparations has several drawbacks, namely coenzyme Q10 has a large molecular weight causing coenzyme Q10 cannot penetrate the stratum corneum, low water solubility causes an inappropriate appearance of the preparation, and high lipophilicity resulting in a lack of ability of coenzyme Q10 to penetrate the stratum corneum (Martinefski, 2016).

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This problem can be overcome by using VCO with a concentration of 5%, which is able to provide optimal release of coenzyme Q10 in the skin. In addition, the use of VCO as an oil phase can increase the solubility of coenzyme Q10 (Thanatuksorn et al., 2009). According to Mu'awanah et al. (2014), 0-7% VCO concentration as the oil phase is able to provide good physical characteristics to the preparation so as to provide a comfortable feeling when used on the skin.
Therefore, a concentration of 3, 5, 7% virgin coconut oil was used in the manufacture of coenzyme Q10 liquid foundation moisturizer.

LITERATURE REVIEW

Moisturizer liquid foundation containing coenzyme Q10 and VCO oil phase is a dosage form that can provide many benefits when used, although there are some shortcomings of coenzyme Q10 but can be overcome by using VCO. Research by Jing et al. (2015) stated that coenzyme Q10 with concentrations of 10 and 25 g/ml was able to reduce ROS production for 24 hours.
The results of research Thanatuksorn et al. (2009) use of VCO can increase the solubility of coenzyme Q10 because it contains medium-chain fatty acids such as lauric acid. VCO is proven to be able to increase the penetration of coenzyme Q10 based on research conducted by Lestari and Binarjo (2013). The results of research by Mu'awanah et al. (2014) stated that VCO could provide good physical characteristics of preparations seen from the results of physical tests of preparations, research by Purnamasari (2020) and Asmara (2008) explains that VCO affects physical tests of preparations such as pH, viscosity, and spreadability. . The higher the concentration of VCO, the lower the viscosity and pH of the preparation, but the greater the dispersion of the preparation.
In addition to the physical characteristics of the preparation, it is also necessary to do a hedonic test to find out whether the preparation made is liked by consumers or not. Aung and Than's (2017) research related to hedonic testing involved ten panelists with the results of panelists' preference for products reaching a medium-high level. Research by Suena et al. (2020) states that panelists prefer preparations with good physical characteristics or are not significantly different from products on the market.

RESEARCH METHODOLOGY

The formula for liquid foundation moisturizer coenzyme Q10 with VCO oil phase is as follows:

ISSN 2828-1500 (Online) | 2828-1985(Print)

Table I. Formulation of Coenzyme Q10 *moisturizer liquid foundation*

Materials	F I (%b/v)	F II (%b/v)	F III (%b/v)
Coenzyme Q10	0.5	0.5	0.5
VCO	3	5	7
BHT	0.1	0.1	0.1
Veegum	2	2	2
Titanium dioxide	5	5	5
Kaolin	5	5	5
Red iron oxide	0.2	0.2	0.2
Yellow iron oxide	0.8	0.8	0.8
Propanediol	10	10	10
Glycerin	10	10	10
Stearic acid	3	3	3
cetyl alcohol	4	4	4
Tween 80	3.5	3.5	3.5
Span 80	1.2	1.2	1.2
Benzalkonium chloride	0.1	0.1	0.1
citric acid	0.8	0.8	0.8
Vanilla	3 gtt	3 gtt	3 gtt
Purified water Ad	100	100	100

Information :

F1 = Liquid foundation moisturizer formula with 3% VCO concentration
F2 = Liquid foundation moisturizer formula with 5% VCO concentration
F3 = Liquid foundation moisturizer formula with 7% VCO concentration

ISSN 2828-1500 (Online) | 2828-1985(Print)

Method: evaporation emulsification by mixing coenzyme Q10 with PVP 100 mg then dissolved with 96% ethanol stirred with a 500 rpm magnetic stirrer for 10 minutes. Moisturizer liquid foundation is made by mixing the oil phase into the water phase above a 70oC water bath and then mixing it with the white pigment titanium dioxide, which has previously been mixed with glycerin. The oil phase consisted of VCO, span 80, BHT, stearic acid, and cetyl alcohol. The aqueous phase consisted of propylene glycol, benzalkonium chloride, tween 80, iron oxide, kaolin, veegum, and aquades.

After all the ingredients are mixed and form a liquid foundation moisturizer, 3 drops of vanilla fragrance are added. The preparations were tested for physical and hedonic characteristics.

Evaluation: physical characteristics of the preparation were evaluated, namely, organoleptic tests were analyzed descriptively, and pH, viscosity, dispersibility, and adhesion tests were analyzed by linear regression with a 95% confidence level.

Hedonic test: 15 panelists were asked to fill out a stock assessment questionnaire. The hedonic test data were analyzed descriptively.

FINDINGS AND DISCUSSION

Making coenzyme Q10 liquid foundation moisturizer with variations of virgin coconut oil
The formula used in this study refers to the research previously conducted by Aung and Than (2017). In this study, modifications were made to the formula, among others, by removing some of the ingredients from the previous formula and replacing them with new ingredients whose function was to support the purpose of making liquid foundation moisturizers. The new ingredient added is the active substance coenzyme Q10 which serves to add to the function of the preparation, namely protecting from exposure to free radicals (Armia, 2018). VCO is used as the oil phase here because it is proven to be able to provide good physical characteristics to the preparation (Mu'awanah et al., 2014), while in previous studies, the resulting preparation had poor characteristics. In this study, researchers added BHT antioxidants to prevent the autoxidation of VCO. If VCO is exposed to air, it will indirectly be oxidized, triggering the formation of other compounds such as acids, aldehydes, and short-chain ketones, which are volatile and cause a rancid odor.

Figure 1. The process of making Moisturizer Liquid Foundation Coenzyme Q10

ISSN 2828-1500 (Online) | 2828-1985(Print)

Evaluation of moisturizer liquid foundation coenzyme Q10

a. Organoleptic test

The organoleptic test aims to determine the physical appearance of the preparation, such as the color, scent, and texture of the preparation (Dimpudus et al., 2017). Based on the research results, the 3 formulas of liquid foundation moisturizers shown in Table II have the same physical appearance. In terms of texture, in general, it has a texture that is not significantly different. Likewise with color, at concentrations of 3%, 5%, and 7% tend to have the same color, namely ivory. This color is formed from a combination of red iron oxide and yellow iron oxide in a ratio of 1:4 mixed with the white pigment titanium dioxide (Mitsui, 2006). The scent of the preparations from the 3 formulas has the same characteristics, namely a combination of VCO and vanilla aroma, but the formula with a concentration of 7% has a more concentrated VCO scent than the formula with a concentration of 3% and 5%. This is because the highest concentration of VCO in formula 3 is 7%.

Table II. Table of Organoleptic Test Results for Moisturizer Liquid Foundation Coenzyme Q10

Formula	Texture	Color	Scent
F1	Thick	*Ivory*	Coconut Vanilla
F2	Thick	*Ivory*	Coconut Vanilla
F3	Thick	*Ivory*	Coconut Vanilla

b. pH test

The pH test was carried out to determine the level of acidity and alkalinity of the preparation. The goal is to make the pH of the preparation according to the pH of the skin, so that when applied to the skin there is no irritation due to an inappropriate pH. Skin pH ranges from 4.5-6.5.

Based on Table III, the pH of the F1 preparation was 6.03, F2 5.97 and F3 5.93. These results indicate that the higher the concentration of VCO, the lower the pH of the preparation. This is because VCO has a high fatty acid content, so that if the VCO used is higher, the amount of acid will also be higher, this causes the pH of the preparation to be more acidic or lower. The results of this study are in accordance with research conducted by Purnamasari (2020) and Mu'awanah et al (2014).

ISSN 2828-1500 (Online) | 2828-1985(Print)

Table III. Table of pH Test Results for Moisturizer Liquid Foundation Coenzyme Q10

Formula	R 1	R 2	R 3	$\bar{X}$ ± S.D.
F1	6.02	6.04	6.03	6.03 ± 0.01
F2	6.00	5.96	5.95	5.97 ± 0.03
F3	5.93	5.92	5.94	5.93 ± 0.01

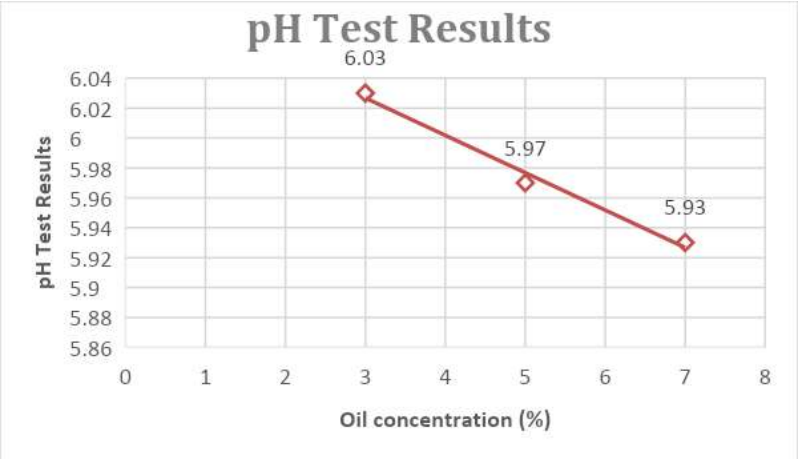

Figure 2. Graph of Relationship between VCO Concentration and pH

The results of the study were statistically analyzed, the results of the linear regression test the R2 value was 0.9868, meaning that 98.68% of the pH of the preparation was influenced by the concentration of VCO. The graph of the relationship between VCO concentration and pH can be seen in Figure 2.

c. Viscosity test

Viscosity test is carried out to determine the level of viscosity of the preparation, so that it feels comfortable when used on the skin. A good topical preparation has a viscosity between 2000-50000 cPas (Rasydy et al., 2021). Viscosity test results can be seen in Table IV.

Table IV. Table of Viscosity Test Results for Moisturizer Liquid Foundation Coenzyme Q10

Formula	R 1 (cPas)	R 2 (cPas)	R 3 (cPas)	$\bar{X}$ (cPas) + SD
F1	6800	6700	6800	6766 ± 57.74
F2	6400	6500	6300	6400 ± 100
F3	6000	6200	6100	6100 + 100

ISSN 2828-1500 (Online) | 2828-1985(Print)

Table IV shows the viscosity of F1 6766 cPas, F2 6400 cPas, 6100 cPas, meaning that the viscosity of the preparations in the 3 formulas is theoretically appropriate. The results showed that the higher the concentration of VCO, the lower the viscosity. This is in accordance with the research of Mu'awanah et al. (2014). The decrease in viscosity due to the higher concentration of VCO is due to the coconut oil used made from coconut milk, namely VCO, which has a high water content compared to ordinary coconut oil. According to Surdianto et al. (2014), VCO contains 0.21% water, so the higher the VCO concentration, the higher the water content. Harun (2013) states that the lower the viscosity is if the water content contained in the material is higher.

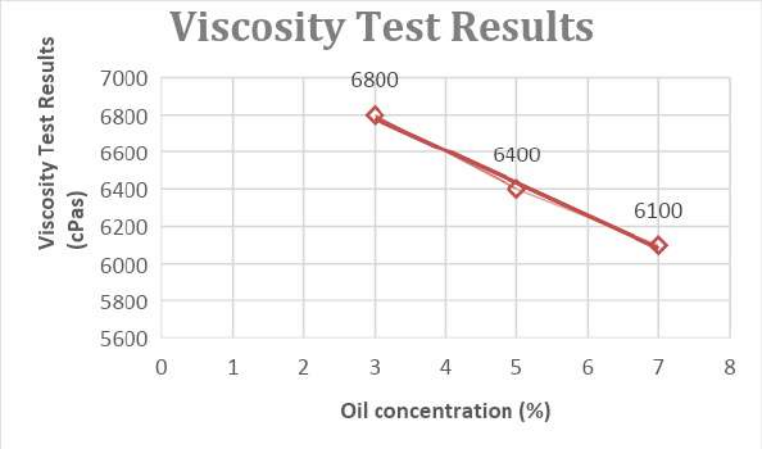

Figure 3. Graph of the Relationship between VCO Concentration and Viscosity

The results of the study were analyzed with linear regression statistics. The results of linear regression analysis were that there was an influence between variations in VCO concentration on viscosity. The magnitude of the effect shown from the value of R2, which can be seen in Figure 3 is 0.9932, meaning that 99.32% VCO concentration affects the viscosity of the preparation.

d. Spreadability test

The spreadability test was carried out to determine the even distribution of the preparation when applied to the skin. The greater the spreadability of the preparation, the more active substances are attached to the skin so that the pharmacological effect is maximized. Good dispersion of the preparation is between 5-7 cm (Swastika et al., 2013). Table 5 shows the dispersion of the preparations, respectively, namely 6.45 cm, 6.65 cm, and 6.80 cm. The research results are in accordance with the theory. The results showed

ISSN 2828-1500 (Online) | 2828-1985(Print)

that the higher the concentration of VCO, the greater the dispersion. This is in accordance with the research of Asmara (2008), which states that the dispersion is inversely proportional to the viscosity.

Table V. Table of Spreadability Test Results for Moisturizer Liquid Foundation Coenzyme Q10

Formula	R 1 (cm)	R 2 (cm)	R 3 (cm)	$\bar{X}$ (cm) ± SD
F1	6.30	6.47	6.60	6.45 ± 0.15
F2	6.70	6.75	6.50	6.65 ± 0.13
F3	6.90	6.70	6.90	6.80 ± 0.12

The results of the study were analyzed by linear regression to determine the effect of VCO concentration on dispersion. The results of the linear regression test stated that 97.84% of the VCO concentration affected the dispersion of the preparation. The graph of the relationship between the two can be seen in Figure 4.

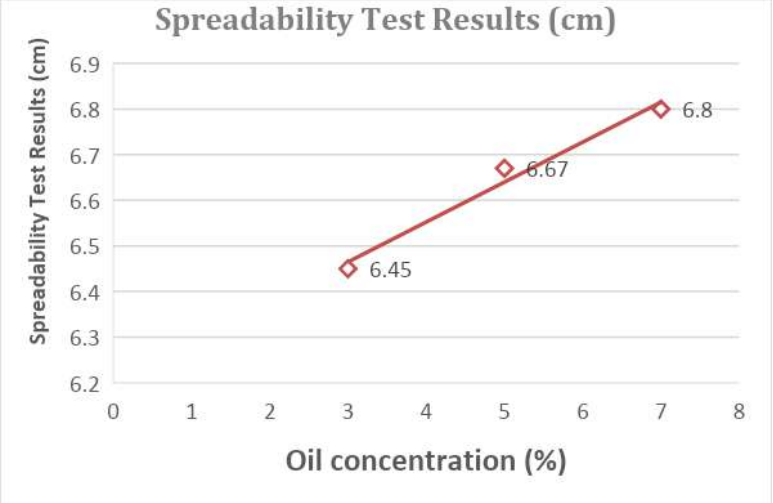

Figure 4. Graph of Relationship between VCO Concentration and Spreading Power

e. Adhesion test

The stickiness test aims to determine the length of time the preparation is in contact with the skin. Good adhesion is more than 4 seconds (Lumentut et al., 2020). The results of the adhesion test can be seen in Table VI. The value of F1 is 4.81 seconds, F2 is 4.39 seconds,

ISSN 2828-1500 (Online) | 2828-1985(Print)

and F3 is 4.13 seconds. According to Natalie (2017) adhesion is directly proportional to viscosity and inversely proportional to spreadability.

Table III. Table of Results of Adhesion Test for Moisturizer Liquid Foundation Coenzyme Q10

Formula	R 1 (s)	R 2 (s)	R 3 (s)	$\bar{X}$ (s) ± SD
F1	4.87	4.98	4.57	4.81 ± 0.21
F2	4.65	4.33	4.20	4.39 ± 0.23
F3	4.11	4.01	4.26	4.13 ± 0.13

The results of the statistical test of linear regression of adhesiveness stated that 98.19% VCO concentration affected the adhesion of the preparation. The graph of the relationship between VCO concentration and adhesion is in Figure 5.

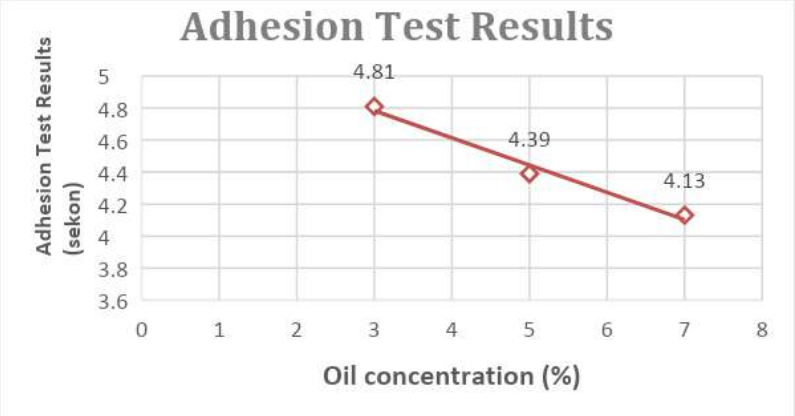

Figure 5. Graph of Relationship between VCO Concentration and Adhesiveness

f. Hedonic test

The hedonic test was carried out to determine the level of respondents' preference for the preparations made. Respondents were asked to provide an assessment of the preparations made according to the criteria determined by the researcher. Researchers used 15 respondents to assess the texture, aroma, color, and moisture of the preparations written in a questionnaire. The test results stated that respondents preferred formula 3 with a VCO concentration of 7% on the grounds of a strong aroma and texture, and humidity in accordance with preparations circulating in the market. This statement is in accordance with the research of Suena et al. (2020). The results of the descriptive statistical test showed a significance of >0.05, which means that there was no significant difference

ISSN 2828-1500 (Online) | 2828-1985(Print)

between the panelists' preference for F1, F2, and F3, or in general, the 3 formulas had the same attractiveness.

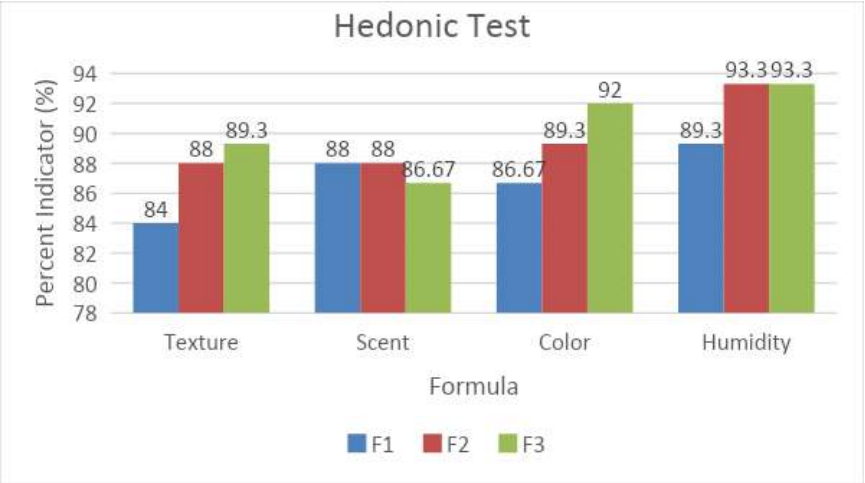

Figure 6. Hedonic Test Graph

CONCLUSION

Conclusion

The use of VCO (Virgin coconut oil) as the oil phase in the manufacture of a liquid foundation moisturizer has good characteristics, as evidenced by the results of the physical characteristics test that meet the theoretical requirements. Based on the linear regression test, the concentration of VCO affects the physical characteristics of the liquid foundation preparation of coenzyme Q10 moisturizer. The hedonic test (preferred test) shows that F3 is more preferred by the respondents, but based on descriptive statistical tests, there is no significant difference between respondents' assessments of the 3 formulas.

Suggestions

a. It is necessary to test the stability of the preparation to determine whether the preparation is stable in long-term storage.

b. It is necessary to test the particle size of coenzyme Q10 so that it can be seen the effect of VCO concentration on the particle size of the active substance of coenzyme Q10.

ISSN 2828-1500 (Online) | 2828-1985(Print)

REFERENCES

Armia, S. L. (2018). PHYSICAL CHARACTERISTICS AND pH OF LIPOSOME COENZIM Q 10 AND GLUTATHION AS ANTI AGING PHYSICAL CHARACTERIZATION AND pH OF LIPOSOME CONTAINING COENZYME Q 10 AND GLUTATHIONE AS. University of Surabaya Student Scientific Journal, 7(2), 866–885.

Asmara, S. D., 2008, Optimization of the Composition of Polysorbate 80 and Sorbitan Monooleate 80 as Emulsifying Agents in the Moisturizing Lotion Virgin Coconut Oil (VCO) Formula: Factorial Design Application, Thesis, Sanata Dharma University Yogyakarta, 55-58. Aung, T., & Than, S. S. (2017). Formulation of Foundation Makeup (Liquid) Using D-Optimal Mixture Design. 10(2).

Bhagavan, H. N., & Chopra, R. K. (2006). Coenzyme Q10: Absorption, tissue uptake, metabolism and pharmacokinetics. Free Radical Research, 40(5), 445–453. https://doi.org/10.1080/10715760600617843

Dimpudus, S. A., Yamlean, P. V. Y., & Yudistira, A. (2017). Formulation of Antiseptic Liquid Soap Preparations Ethanol Extract of Girlfriend Flower Water (Impatiens Balsamina L.) And Test Its Effectiveness Against Staphylococcus Aureus Bacteria In Vitro. Pharmacon, 6(3), 208–215. https://doi.org/10.35799/pha.6.2017.16885

Harun, Montolalu, and Suwetja, 2013, Physical Chemical Characteristics of Kappahycus alverezii Carrageenan at Different Harvesting Ages, Journal of Fishery Products Technology Media, 1, 10-11.

Jing, L., He, M. T., Chang, Y., Mehta, S. L., He, Q. P., Zhang, J. Z., & Li, P. A. (2015). Coenzyme Q10 protects astrocytes from ROS-Induced damage through inhibition of Mitochondria-Mediated cell death pathway. International Journal of Biological Sciences, 11(1), 59–66. https://doi.org/10.7150/ijbs.10174

Korkmaz, E., Gokce, E. H., & Ozer, O. (2013). Development and evaluation of coenzyme Q10 loaded solid lipid nanoparticle hydrogel for enhanced dermal delivery. Acta Pharmaceutica, 63(4), 517–529. https://doi.org/10.2478/acph-2013-0039

Lestari, M., & Binarjo, A. (2013). Cold Cream Propranolol Formulation For Transdermal Delivery With Emulsion Based Containing Vco (Virgin Coconut Oil). Pharmaciana, 3(2). https://doi.org/10.12928/pharmaciana.v3i2.429

Lucangioli, S., Tripodi, V. (2012). The Importance Of The Formulation In The Effectiveness Of Coenzyme Q10 Supplementation In Mitochondrial Disease. Therapy Der Pharmacia Sinica, 3(4), 406-407.

Lumentut, N., Edi, H. J., & Rumondor, E. M. (2020). Formulation and Physical Stability Test Preparation of Ethanol Extract Cream for Goroho Banana Peel (Musa acuminafe L.) Concentration of 12.5% As Sunscreen. MIPA Journal, 9(2), 42. https://doi.org/10.35799/jmuo.9.2.2020.28248

Martinefski, M., Samassa, P., Buontempo, F., Höcht, C., Lucangioli, S., & Tripodi, V. (2017). Relative bioavailability of coenzyme Q10 formulation for pediatric individualized therapy. Journal of Pharmacy and Pharmacology, 69(5), 567–573. https://doi.org/10.1111/jphp.12613

Mitsui, T. (2011). New Cosmetic Science. First Edition. Amsterdam: Elsevier Science. B.V., 342–345.

ISSN 2828-1500 (Online) | 2828-1985(Print)

Mu'awanah, I., Setiaji, B., & Syoufian, A. (2014). Effect of Virgin Coconut Oil (VCO) Concentration on Cosmetic Emulsion Stability and Sun Protection Factor (SPF) Value. Bimipa, 24(1), 1–11.

Natalie, A., Mulyani, S., & Admadi, B. H. (2017). THE RELATIONSHIP OF STORAGE LONG WITH QUALITY CHARACTERISTICS IN SOME FORMULATIONS OF SURPRISE EXTRACT CREAM (Curcuma domestica Val.). Department of Agricultural Industrial Technology, Student of Agricultural Technology Unud, Faculty of Agricultural Industrial Technology, Lecturer, 5(4), 21–30. https://ojs.unud.ac.id/index.php/jtip/article/download/35543/21434 Purnamasari, R. (2020). FORMULATION OF PURE COCONUT OIL GEL OR VCO (VIRGIN COCONUT OIL) USED AS A FACE MOISTURIZER Gel Formulation of Pure Coconut Oil or VCO (Virgin Coconut Oil) Used as A Waste of Face. Luwu Raya Health Journal, 6(2), 37–43. Rasydy, L. O. A., Zaky, M., & Surtiana, R. (2021). Formulation and Physical Evaluation of the Preparation of Hand Body Lotion Ethanol Extract of Miana Leaves (Pleactranthus scutellarioides (L.) R. Br.). Pharmauho: Journal of Pharmacy, Science, And Health, 7(1), 33. https://doi.org/10.33772/pharmauho.v7i1.16320

Suena, N. M. D. S., Meriyani, H., & Antari, N. P. U. (2020). Physical Quality Test and Hedonic Test of Jatiluwih Red Rice Maserat Body Butter. Medicamento Scientific Journal, 6(1), 59–65. https://doi.org/10.36733/medicamento.v6i1.843

Surdianto, Y. N., Sutrisna and Rahcman. (2014). Making Virgin Coconut Oil (VCO) by centrifugation method. 1995, 426–435.

Swastika, A., Mufrod, and Purwanto. (2015). ANTIOXIDANT ACTIVITY OF TOMATO (Solanum lycopersicum L.) extract. Traditional Medicine Journal, 18(3), 132–140. https://doi.org/10.14499/mot-TradMedJ18iss3pp132-140

Thanatuksorn, P., Kawai, K., Hayakawa, M., Hayashi, M., & Kajiwara, K. (2009). Improvement of the oral bioavailability of coenzyme Q10 by emulsification with fats and emulsifiers used in the food industry. LWT - Food Science and Technology, 42(1), 385–390. https://doi.org/10.1016/j.lwt.2008.03.006

ISSN 2828-1500 (Online) | 2828-1985(Print)