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Formulation of Coenzyme Q10 Liquid Foundation With a Variations Linseed Oil as The Oil Phase

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Abstract

Antioxidant Coenzyme Q10 (CoQ10) has properties as a sunscreen that can protect the skin from the aging process accelerated by UVB rays. Linseed oil (LO) formulated in cosmetics aims to find out the characteristics of moisturizer liquid foundation with LO as oil phase. In this study, cosmetic formulations were carried out using a modified method of emulsification evaporation. In the moisturizer liquid foundation CoQ10, three other formulas were used with LO concentrations of 3%, 5%, 7% to determine the effect of vegetable oils used on cosmetic characteristics. Evaluation of physical properties includes organoleptic, pH, viscosity, spreadability, and adhesivity. Evaluation of the acceptance of preparations was carried out to 15 panelists. The results of the study showed that the use of LO influences the characteristics of moisturizer liquid foundation CoQ10. The increase in LO concentration increases viscosity value, adhesivity, and decreased pH and spreadability, but the results obtained still meet the criteria. The results of the hedonic test showed no significant difference from the three formulas of 0.911 (P>0.05). It was proven that the panelists preferred formula one, which has a texture that is not too thick.

Keywords: *CoQ10, Sunscreen, Linseed oil, Moisturizer Liquid Foundation*

INTRODUCTION

Along with the development of the times, the use of cosmetics has become a necessity for the community to encourage cosmetic manufacturers to increase competitiveness by producing cosmetics with many advantages, but it makes some people produce illegal cosmetics. Based on their usefulness, cosmetics are classified as products for skincare as well as to enhance the appearance of individuals or are known as decorative cosmetics (Anwar and Rizkamiarty, 2020).

Based on the results of BPOM supervision of the Republic of Indonesia, many illegal cosmetics with hydroquinone and mercury content are found. The content of hydroquinone in cosmetics used for a long time will increase the risk of developing skin cancer and can make the skin lose its ability to be protected from ultraviolet light (Pangaribuan, 2017). Skin that loses the ability to be protected from UV rays will make the skin wrinkle quickly, dry skin, and rough. Therefore the active ingredients in cosmetics are needed to protect the skin from the bad effects of UV rays. CoQ10 is an alternative to this problem.

In the field of cosmetics, CoQ10 is used to reduce the aging of the skin, but in a recent study conducted by (Wu et al., 2020), CoQ10 can be used as a sunscreen that effectively inhibits skin

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damage from UVB rays. The problems arising from the use of CoQ10 in topical preparations are the large molecular weight of 863.3 g/mol, high lipophilicity (P > 10), poor solubility of CoQ10 (0.7 μg/mL at 37°C), and resulting in low permeation and bioavailability (Ryu et al., 2020). Therefore is necessary to add an enhancer to improve the delivery of CoQ10. The enhancer used in the study was LO which was varied into three different concentrations to know the effect of the use of LO on the characteristics of the moisturizer liquid foundation CoQ10.

LITERATURE REVIEW

CoQ10 is a natural antioxidant compound that can protect the skin from the bad effects of UV rays. As a sunscreen in cosmetic preparations, CoQ10 can prevent the signs of aging accelerated by UV rays by the mechanism of increasing the skin's antioxidant capacity in the epidermis and preventing collagen degradation by suppressing the production of malondialdehyde and metalloproteinase-1 (Wu et al., 2020). The use of CoQ10 in cosmetics for daily use in addition to sunscreen can also restore the cellular antioxidant content of the epidermis that is lost due to environmental influences.

Research conducted by (Prahl et al., 2008) uses CoQ10 can restore cellular CoQ10 antioxidant levels lost from the skin. To improve the ability of CoQ10 in penetrating the skin, use enhancer linseed oil. Linseed oil contains a combination of omega-3,-6, and -9 fatty acids that play a role in increasing coQ10 delivery through the mechanism of interaction with keratin in the stratum corneum so that it will eventually increase the rate of release of CoQ10 (Tou et al., 2019).
Decorative cosmetics and treatments, namely moisturizers liquid foundation, is used to increase the aesthetic value of the physical appearance of individuals whose use should be easily applied to the skin, not make the skin dry or oily, not sticky, and produce a final natural appearance. The final result of the formulation of the manufacture of moisturizer liquid foundation will affect the physical characteristics of the preparation (Sivamani et al., 2016).

RESEARCH METHODOLOGY

Materials
Coenzyme Q10 (contributed from PT. Konimex, Indonesia), Linseed oil (purchased from Bali, Indonesia), BHT, Veegum, Titanium dioxide, Kaolin, Red iron oxides, Yellow iron oxides, Propilenglikol, Glycerin, Tween 80, Benzalkonium chloride, Citric acid, Stearic acid, Cetyl alcohol, Span 80, Vanilla.

Methods
Preparation of Moisturizer Liquid Foundation CoQ10
Moisturizer Liquid foundation preparations are made using a combination method of emulsification evaporation. Firstly, CoQ10 with PVP was mixed into 5 mL of 96% ethanol and then stirred using a magnetic stirrer at a speed of 500 rpm for 10 minutes. Secondly, oil phase materials

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are melted over water handlers at 70°C. Third, titanium dioxide is mixed with glycerin until homogeneous. Fourth, water phase materials are put together into the purified water that has been heated at 70° C while stirring over the water handler with the temperature maintained at 70° C. Moisturizer liquid foundation is made by mixing the oil phase into the water phase slowly while continuing stirring over the water handler for 5 minutes. The mixture of the two phases is then added titanium dioxide and glycerin then the mixture is stirred until it reaches a temperature of 40° C. After the previous mixture has been homogeneous, add CoQ10, then do constant stirring with the addition of the remaining purified water and the addition of Vanilla as much as 3 drops, stir until homogeneous then the moisturizer liquid foundation preparation is put into the appropriate container.

Evaluation of Moisturizer Liquid Foundation CoQ10
The evaluation of moisturizer liquid foundation CoQ10 includes organoleptic, pH, viscosity, spreadability, and adhesivity.
Investigation of Panelists Acceptance for Formulated Moisturizer Liquid Foundation CoQ10 by Hedonic Test
The acceptance for moisturizer liquid foundation CoQ10 conducted by the hedonic test was performed visually on 15 panelists. The test is conducted by asking panelists to apply a moisturizer liquid foundation CoQ10 with an oil phase of LO on the back of the skin of the hand. Panelists were then asked to choose the most preferred Moisturizer Liquid Foundation CoQ10.

FINDINGS AND DISCUSSION

The use of CoQ10 in this study is based on CoQ10's ability to protect the skin from UVB exposure so that the purpose of adding CoQ10 to the formulation of moisturizer liquid foundation is as a sunscreen with its mechanism of action is to prevent skin aging from UVB exposure by increasing the skin's antioxidant capacity and preventing collagen degradation by suppressing the production of malondialdehyde and metalloprotease-1 (Wu *et al*., 2020).

Preparations of moisturizer liquid foundation CoQ10 are made into three formulations with a difference in concentration in LO (see table 1). The first characteristic evaluation is organoleptic testing. The three moisturizer liquid foundation formulas CoQ10 have a distinctive vanilla smell because, in the manufacturing process, there is the addition of a fragrance that is Vanilla. From the aspect of color that is resulted in is the color ivory. In the addition of higher oil phase concentrations making the preparations increase thicken even more, observations of organoleptic test results are presented in (see table 2).

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Table 2. Moisturizer liquid foundation evaluation results organoleptic

Formula	Texture	Color	Odor
F1	Slightly viscous	Ivory	Vanilla
F2	Pretty viscous	Ivory	Vanilla
F3	Viscous	Ivory	Vanilla

Table 1. Formula of moisturizer liquid foundation CoQ10

Material	F I (% b/v)	F II (% b/v)	F III (%b/v)
CoQ10	0,5	0,5	0,5
Linseed oil	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 oxides	0,2	0,2	0,2
Yellow iron oxides	0,8	0,8	0,8
Propylene glycol	10	10	10
Glycerine	10	10	10
Tween 80	3,5	3,5	3,5
Benzalkonium Chloride	0,1	0,1	0,1
Citric acid	0,8	0,8	0,8
Stearic acid	3	3	3
Cetyl alcohol	4	4	4
Span 80	1,2	1,2	1,2
Vanilia	3 gtt	3 gtt	3 gtt
Purified water Ad	100	100	100

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In formulating a preparation for use on the skin, the pH of the preparation is one of the main factors that must be considered. A pH of a preparation that does not enter the pH range of the skin can irritate. Therefore the pH of the preparation must enter the physiological pH range of the skin, which is 4.5-7 (Siva and Afriadi, 2019). The pH measurements carried out in this study aimed to determine the acidity or numbness of the preparations made. Results of pH moisturizer liquid foundation CoQ10 test can be in table 3.

Table 3. Results of pH moisturizer liquid foundation CoQ10 evaluation

Formula	R1	R2	R3	$\bar{X} \pm$ SD
F1	6,14	6,22	6,15	6,17 $\pm$ 0,043
F2	6,14	6,10	6,13	6,12 $\pm$ 0,020
F3	6,16	6,01	5,95	6,04 + 0,108

The average pH measurement for F1 is 6.17, F2 is 6.12, and F3 is 6.04. The results obtained from pH in F1, F2, and F3 have met the standard criteria for physiological pH of the skin, which is 4.5-7. The results of pH measurements show that the higher the concentration of linseed oil used, the pH value will decrease to the more acidic. This is because the greater the concentration of vegetable oil added will affect the degree of acidity of the preparation due to the influence of high fatty acid content that is stearic acid on vegetable oil used.

Linseed oil has a fairly high fatty acid content, one of which is 12.34% saturated fatty acids consisting of palmitic acid and stearic acid (Pali and Mehta, 2014). The pH measurement decline data is analyzed using linear regression tests. The results of the linear regression test showed that a signification value of 0.042 ($P<0.05$), i.e., there was an influence between the use of variations in the concentration of linseed oil to decrease the pH moisturizer liquid foundation CoQ10.

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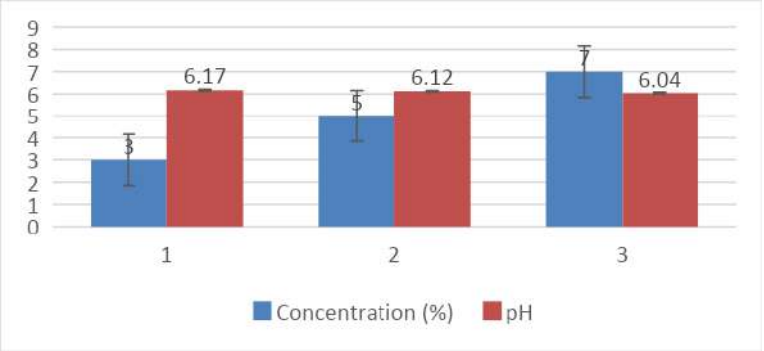

Figure 1. pH evaluation graph of moisturizer liquid foundation CoQ10

Viscosity testing aims to find out the viscosity of preparation to be able to flow. Viscosity testing aims to determine the effect of LO concentrations on the viscosity of the moisturizer liquid foundation CoQ10. Viscosity testing is done using a rion viscometer using spindle No. 1. moisturizer liquid foundation CoQ10 preparations are said to meet the quality requirements of topical preparations when the results of viscosity testing enter in the range of 2000-50.000 (cPas) (Rasydy *et al.,* 2021). The results of the viscosity test can be seen in table 4.

Table 4. Results of viscosity moisturizer liquid foundation CoQ10 evaluation

Formula	R1 (cPas)	R2 (cPas)	R3 (cPas)	$\bar{X} \pm$ SD
F1	4.800	4.800	4.800	4.800 cPas $\pm$ 0
F2	6.200	6.200	6.200	6.200 cPas $\pm$ 0
F3	8.700	8.700	8.700	8.700 cPas $\pm$ 0

Viscosity testing results showed that the greater the concentration of LO used, the viscosity of the preparation would increase. This is because LO has a saturated fatty acid content consisting of stearic acid and palmitic acid (Pali and Mehta, 2014). Based on research by Warnida *et al.* (2019), The increase in viscosity in the preparation is due to the presence of stearic acid content in vegetable oils.

The results of the increased viscosity of preparations were analyzed using linear regression tests. The results of the linear regression test showed that the signification value of 0.000

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(P<0.05), i.e., there was an influence between the use of variations in the concentration of linseed oil to increase the viscosity of the moisturizer liquid foundation CoQ10.

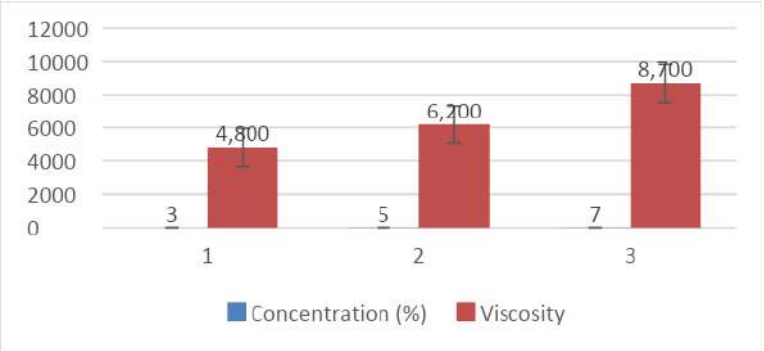

Figure 2. Viscosity evaluation graph of moisturizer liquid foundation CoQ10

The spreadability test aims to find out the ability of the preparation to be able to spread well when the preparation is applied to the skin. The spreadability test is a simulation of testing when the preparation is used on the skin which the higher the stock power of the stock it will make the active ingredients contained in it easily spread evenly on the skin (Rasydy *et al.,* 2021). The spreadability test results can be seen on table 6.

Table 6. Results of spreadability moisturizer liquid foundation CoQ10 evaluation

Formula	R1 (cm)	R2 (cm)		R3 (cm) $\bar{X} \pm$ SD
F1	6,33	7,10	6,40	6,61 cm ± 0,427
F2	6,30	6,65	6,53	6,49 cm ± 0,177
F3	6,25	5,85	5,90	6,00 cm ±

The results of the spreadability test are inversely proportional to the viscosity of the stock, which the higher the viscosity of the stock makes the distribution power value smaller. Furthermore, the stock diameter data of the preparation is analyzed using a linear regression test. The results of the linear regression test showed that the signification value obtained was 0.037 (P<0.05), which is an influence on the use of variations in the concentration of LO to the diameter of the spread of moisturizer liquid foundation CoQ10 (Figure 3)

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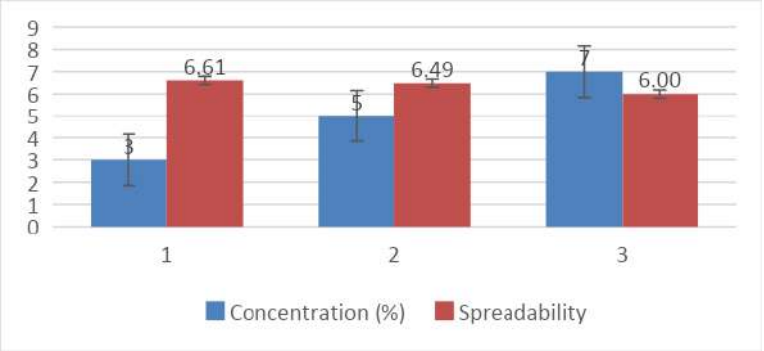

Figure 3. The spreadability evaluation graph of moisturizer liquid foundation CoQ10

The adhesivity test aims to find out the ability of a preparation to be attached to the skin. The adorable power test is carried out using round-scale glass. The criteria for testing the sticking power of topical preparations is no less than 4 seconds (Lumentut *et al.,* 2020). The results of the moisturizer liquid foundation CoQ10 sticking test can be seen in table 7.

Table 7. Results of adhesivity moisturizer liquid foundation CoQ10 evaluation

Formula	R1 (Second)	R2 (Second)	R3 (Second)	$\bar{X} \pm$ SD
F1	4,87	4,37	4,28	4,51 second ± 0,318
F2	5,66	5,23	5,34	5,41 second ± 0,223
F3	6,36	6,63	6,18	6,39 second ± 0,226

Based on the results of these tests, the adhesivity of the Moisturizer Liquid Foundation CoQ10 preparation has met the criteria of topical preparation. A preparation, if it can stick longer, will be better because it shows that the active ingredients absorbed into the skin will be more maximal. The ability of the dosage adhesivity is directly proportional to the viscosity of the preparation so that when the viscosity of the preparation is getting thicker, then the adhesivity of the preparation will be longer (Lumentut *et al.,* 2020).

Furthermore, the preparation adhesivity data is analyzed using a linear regression test. The results of the linear regression test showed that the signification value obtained from the adhesivity was 0.000 ($P<0.05$), which affects the use of variations in the concentration of LO against the increased adhesivity of the moisturizer liquid foundation CoQ10 (Figure 4).

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The hedonic or favorite test is a test used to find out the acceptance of liquid foundation moisturizer CoQ10. This test is used to assess the final result or quality of the product that has been produced. In hedonic tests involve humans assessing the quality of the product subjectively. Thus panelists are required to give their responses about the good or bad quality of the product honestly.

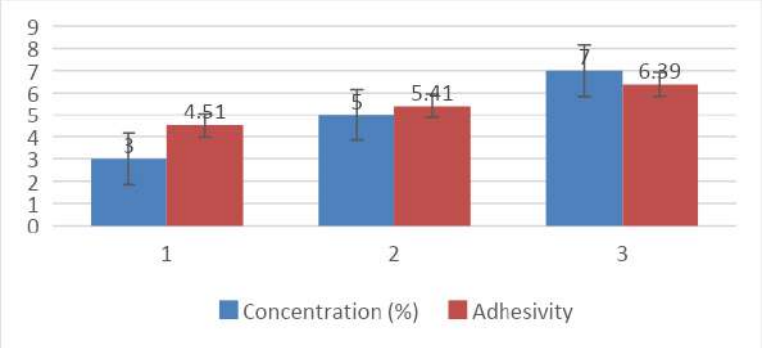

Figure 4. The adhesivity evaluation graph of moisturizer liquid foundation CoQ10

The hedonic test is done by applying moisturizer liquid foundation CoQ10 on the back of the panelist's hand, and then the panelist is asked to provide a personal response regarding the like or dislike of the preparation by assessing the texture of the preparation, aroma, color, and moisturizing ability of the moisturizer liquid foundation CoQ10. The inclusion criteria in this study are women aged 18-30 years. This is because at that age, it is a productive age where women often use decorative cosmetics, while for exclusion criteria are women with sensitive skin types. The total percentage of hedonic tests can be seen in figure 5.

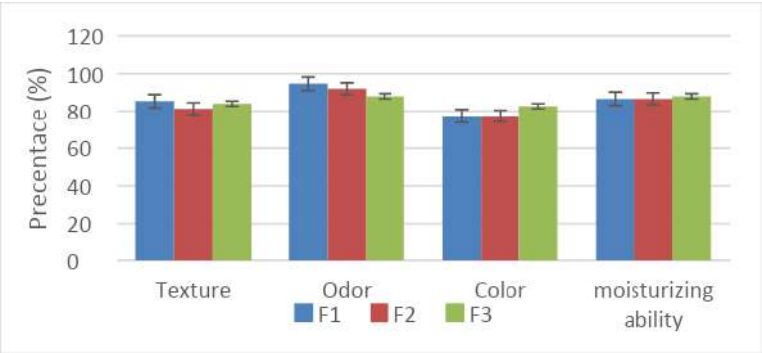

Figure 5. Graph of hedonic test results of moisturizer liquid foundation CoQ10

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The average percentage of hedonic test results in formula 1 is 86%, followed by formula 2, which is 84.22%, and formula 3 is 85.67%. Based on the data, it can be concluded that 15 panelists prefer formula 1 and formula 3 with a percentage of indicators for each texture, aroma, color, and moisturizing ability in formula one, which is 85.33%, 94.67%, 77.33%, and 86.67%. For formula 3 the percentage of 4 indicators of acceptance is 84%, 88%, 82.67%, and 88% while for formula 2 is 81.33%, 92%, 77.33%, and 86.67%. Based on the tests that have been carried out, the results show that the liquid moisturizer formula. The hedonic test data were then analyzed statistically using one-way ANOVA. The significance value obtained is 0.911 (P>0.05), indicating there is no difference from the third formula. Moisturizing liquid foundation CoQ10 with the use of variations in the concentration of linseed oil that the panelists most favored was formula 1 with a total percentage of 86%.

Figure 6. Hedonic cosmetic test moisturizer liquid foundation CoQ10

CONCLUSION

In conclusion, research conducted shows that the use of variations in the concentration of LO influences the characteristics of moisturizer liquid foundation CoQ10. The greater the concentration of LO added makes the preparations more viscous. In the hedonic test, 15 panelists preferred formula 1 because it has a more dilute texture than formula 2 or 3. In future studies, stability tests, irritation tests, and permeation tests are needed against moisturized liquid foundation CoQ10.

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