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Abstract. Anti Aging dosage which form formulas that contain antioxidants are important to be developed. Grapeseed oil (GSO) has a higher antioxidant capacity than other parts of grapes at 42.18 mmol of Trolox equivalent/g. This study aims to develop a peel-off mask formula containing GSO in the emulgel system with Hydroxypropyl methyl cellulose (HPMC) as a gelling agent. Emulgel was made in four formulas (F1-F4) with 1-4% HPMC concentrations and one control formula (F0) of 3% HPMC without GSO. This was then evaluated for homogeneity and phase separation (centrifugation and freeze-thaw methods). Physical stability was observed during 28 days of storage with various parameters including organoleptic, pH, drying time, spreadability, viscosity, rheological flow, tensile strength, and elongation. The evaluation results showed that the emulgel was homogeneous and did not undergo phase separation by centrifuge and freeze-thaw. During the storage period, the five emulgel pH was within acceptable ranges, and there was no significant change in viscosity at 25C. Meanwhile, at 40°C, there was a trend of decreasing viscosity. Moreover, HPMC based GSO emulgel showed good physicochemical stability during the storage period at 25°C and 40°C for 4 weeks. In summary, the developed GSO emulgel are good candidates for topical peel-off mask in anti aging dosage form.

1. Introduction

Skin is one of the most essential organs in our body. Generally, women, as well as men, wish to have clean and bright skin. As a result, along with the increasing demand of the cosmetic market, there is a growing need of producing clean and bright skin and anti aging. Cosmetic preparations to maintain cleanliness and facial skincare are the usage of face masks (1). Face masks are divided into four types: sheet masks, peel-off masks, rinse-off masks, and hydrogel (2).

The peel-off face mask has unique characteristics, especially in its use of adhering film-forming polymers, which creates a cohesive elastic layer that can manually remove and leave no residue after complete drying. The firming effect of this formulation results in a clean skin sensation (3). Also, it provides a moisturizing action, which increases the effect of the active compound on the epithelium, mainly due to the occlusive effect caused by the elastic polymer layer, and minimizes pores (3,4). The selection of the peel-off mask formula is generally controlled by the drying agent and the concentration of the matrix. The matrix concentration determines viscosity, film formation, and thickness of the application. Most peel-off masks are formulated on polyvinyl alcohol (PVA) or polyvinyl acetate (PVAc), which cause occlusion and tensor effects (2). The polymer used in this

study was Hydroxypropyl methyl cellulose (HPMC), which was formulated in an emulgel system with the active ingredient Grapeseed Oil (GSO).

HPMC is a semi-synthetic gelling agent derived from cellulose, which is phenol-resistant and stable at pH 3-11. This polymer produces a clear and neutral gel and has a stable viscosity on long-term storage (5). Low-viscosity HPMC is used in film coating solutions with aqueous solvents, while high viscosity levels are used in organic solvents. Depending on the viscosity grade, the concentration of 2-20% w/w is used for the film-forming solution of the film-coated tablet (6). HPMC-based films have characteristics of a uniform film that is light and non-greasy with a pleasant texture, does not interact significantly with other ingredients, and water-absorbing surfactants which makes it easy to spread, to provide lubrication, and have a comfortable feeling in an occlusive condition when applied to the skin (7). Emulgel is an oil in water or water in oil type emulsion preparation mixed with a gel base that can be used as a carrier for various substances, including hydrophobic substances (8). Emulgel has beneficial properties such as good consistency; longer contact time; transparent; moisturizing; easy to absorb, spread, and remove; and easy to dissolve in water and to mix with other excipients (9).

Grape seeds contain 8-20% oil on a dry basis. GSO has hydrophilic constituents such as phenolic compounds, including flavonoids, carotenoids, phenolic acids, tannins, stilbene, and gallic acid; it also has lipophilic constituents such as polyunsaturated linoleic acid (10). The most prominent activity of the GSO phenolic compound is its antioxidant capacity to scavenge ROS and to inhibit lipid oxidation. Grape seeds provided the highest antioxidant capacity, measured by the oxygen radical absorbance capacity test in the amount of 42.18 mmol of Trolox equivalent/g (11). High antioxidant capacity is associated with gallic acid, catechins, epicatechins, procyanidins, and pro-anthocyanidins in GSO (10). With these considerations, this study aims to develop an HPMC-based peel-off mask formulation with GSO active ingredients that have antioxidant activity as an alternative to facial skincare products.

2. Methodology

Materials

Grapeseed oil (GSO) was obtained from Textron Tecnica S.L. Meanwhile, HPMC, glycerin, butylated hydroxytoluene (BHT), methylparaben, ethanol 96%, tween 80, span 80, and aqua dest were obtained from Bratacochem (Indonesia).

Preparation of Emulgel

Table 1. Formula of GSO peel-off mask emulgel with varying gelling agent concentration

Materials	Concentration (%)				
	F0	F1	F2	F3	F4
GSO	-	3	3	3	3
HPMC	3	1	2	3	4
Glycerin	20	20	20	20	20
Methylparaben	0,1	0,1	0,1	0,1	0,1
BHT	0,1	0,1	0,1	0,1	0,1
Span 80	3,7	3,7	3,7	3,7	3,7
Tween 80	1,3	1,3	1,3	1,3	1,3
Aqua dest ad	100	100	100	100	100

Span 80 and BHT were dissolved in GSO as an oil phase, while the water phase was prepared by dissolving tween 80 in aqua dest. Each phase was heated at 70-75ºC. The oil phase was added to the water phase. The mixture was stirred using a homogenizer at 2500 rpm until room temperature, and emulsion was formed—gel base made by dispersing HPMC with hot aqua dest until swelling. Methylparaben was diluted with 96% ethanol, and HPMC swelled. The emulgel was made by adding gel base into emulsion gradually using homogenizer with 2000 rpm for 30 min or until homogeneous emulgel was formed (12).

Evaluation and Physical Stability Test of Peel-off Mask

Emulgel was tested for homogeneity and phase separation by centrifugation and freeze-thaw methods. Furthermore, emulgel physical stability was observed for 28 days. The evaluation parameters included organoleptic, pH, drying time, spreadability, viscosity, and flow properties.

Homogeneity test

A-0.1g emulgel spread on the surface of the object-glass, and its homogeneity was observed. Emulgel must show a similar arrangement, indicated by the absence of coarse grains on the object-glass. The test was carried out for six weeks (13). Spreadability of 5-7 cm indicated the consistency of the semisolid dosage form, which is comfortable to use (13).

Phase separation test

This test consisted of two parts: (1) Centrifugation test: A-5g of emulgel was added into the tube and was centrifuged at 3750 rpm speed for 60 min. Afterwards, it was observed if phase separation occurred or not (14). (2) Freeze-thaw test: Emulgel was stored at 4°C for 48 hours. It was then transferred to 40°C for 48 hours (1 cycle). After that, it continued for five cycles. Every time a cycle was completed, the emulgel could see whether there was phase separation (14).

Organoleptic and pH test

Observations were focused directly on color, smell, and dosage form of emulgel during storage time. pH measurement was carried out by dipping pH meter into emulgel, and as much as 1g of emulgel dissolved in 10mL of distilled water. Before it was used, a pH meter electrode was washed and rinsed with distilled water and then was dried—the electrode was calibrated using standard buffer solutions pH of 4 and 7.

Drying time

A-1g emulgel was applied on the arm of hand with a size of 5 x 5 cm. The time required for dosage to completely dry and to form a layered film that easily peeled was recorded as drying time. Results showed as averages of three measurements. Proper drying time was less than 30 mins (15).

Spreadability test

A-1g of emulgel was placed on a glass sized 20x20 cm and was given 125g weight on it. Diameter formed was then measured after 1 minute. The same test was performed for six weeks (16).

Viscosity test and rheological flow

Viscosity determination was carried out using Brookfield LVDV-E viscometer with an appropriate spindle and speed. Emulgel was inserted into beaker glass until it reached a 500mL volume; spindle was attached to the specified limit (13). Measured values were recorded as the viscosity of emulgel. Flow properties were determined by viscosity measurements using a suitable spindle from low to high rotating speeds and vice versa.

Tensile strength dan elongation

Tensile strength and elongation were determined using Strograph-R1 (Toyoseiki, Japan) with a force of 0.01-0.30 kg. The film was cut with a Dumbbell ASTM-D-1822-L Crosshead at a speed of 25mm/minute.

Statistically analysis

Data pH and viscosity during storage were statistically analyzed using one-way ANOVA to determine whether there was a difference between formulas. Tukey test was also performed to determine any significant differences between formulas.

3. Result and Discussion

HPMC-based emulgel with GSO was successfully made to produce homogeneous dosage forms characterized by an equal distribution of fine particles and no visible coarse grains. Results of phase separation by centrifugation and freeze-thaw did not show phase separation on the fifth formula. It proves that the system generated emulgel that is stable and not easily damaged by extreme temperatures and centrifugation. The stability observed in the centrifugation test showed the ability to maintain the bonds formed between the GSO globule and the water phase against the applied centrifugal force (17).

Physical stability was observed for 28 days at 25 and 40°C. Organoleptically, emulgel did not change the color, odor, and form during storage at two temperature conditions. At the initial observation of the dosage form acidity, the study measured pH of five formulas ranged from 6.13-6.42. Observation results during storage for 28 days can be seen in Figures 1 and 2. Figure 1 shows a graph of pH stability at 25°C, while Figure 2 shows a decreasing pH at 40°C. The decrease in pH that occured was still within an acceptable level for the topical dosage form. Based on the statistical analysis results with ANOVA, the significance value was 0.000; 0.012; and 0.001 ($P < 0.05$) at F0, F2, and F4, respectively, which indicated that there was an effect of length of time on dosage form pH value. Meanwhile, F1 and F3 provided significance values of 0.469 and 0.705 ($P > 0.05$), which indicated the opposite.

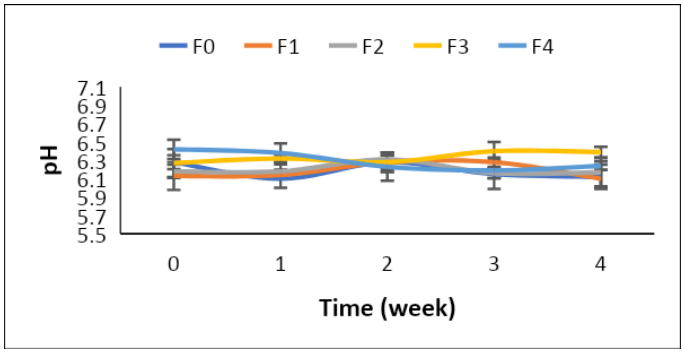

Figure 1. Graphic of pH variation of GSO peel-off mask during storage at 25°C

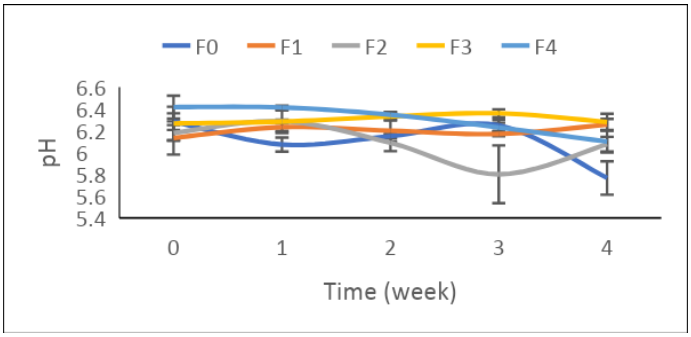

Figure 2. Graphic of pH variation of GSO peel-off mask during storage at 40°C

Table 2. Summary of evaluation results of GSO peel-off mask

Parameters	F0	F1	F2	F3	F4
Visual appearance	Translucent and homogenous	Translucent and homogenous	Translucent and homogenous	Translucent and homogenous	Translucent and homogenous
pH	6.13 ± 0.15	6.28 ± 0.08	6.18 ± 0.07	6.27 ± 0.15	6.42 ± 0.10
Viscosity (cps)	305000 ± 5000	102667 ± 6429	170000 ± 20000	334667 ± 17474	429333 ± 11015

Drying time (min)	15 ± 0.0	15 ± 0.0	15 ± 0.0	15 ± 0.0	15 ± 0.0
Spreadability (mm)	48.5 ± 6.3	49.1 ± 11.8	47.9 ± 0.8	46.8 ± 3.3	45.9 ± 2.5
Thickness (mm)	0.319 ± 0.047	0.123 ± 0.021	0.086 ± 0.032	0.436 ± 0.074	0.225 ± 0.064
Tensile strength (N/mm^2)	2.02 ± 0.71	2.49 ± 0.14	2.34 ± 1.46	1.82 ± 0.54	4.56 ± 1.64
Elongation (%)	283.3 ± 87.4	316.7 ± 76.4	160.0 ± 34.6	251.0 ± 1.7	240.0 ± 17.3

From Table 2, it can be observed that during the storage period, emulgel drying time did not change at either 25°C or 40°C. The drying time's stability relied on the drying agent and emulgel constituent matrix in the formula (2). These five mask formulas did not contain volatile/drying agents (such as alcohol), which significantly affected the drying time of masks, and HPMC could retain moisture loss at the observed temperature. The effect that emerged was able to retain moisture and optimize GSO activity in the skin epithelium.

Emulgel spreadability measurement showed that the five formulas produced semisolid dosage forms were included in the semi-stiff category. Table 2 shows that spreading diameter ≤ 50mm where Arvout-Grand et al. categorize to be semi-stiff, the dosage form of this type can be used for longer contact times and thus the semisolid consistency was higher than semi-fluid type for compression impregnation purposes (16).

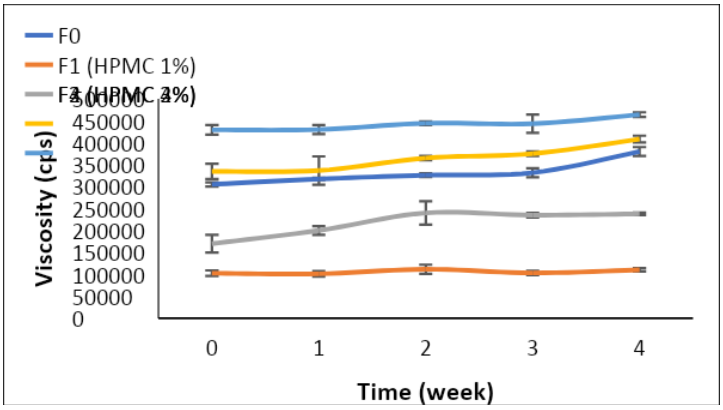

Figure 3. Graphic of viscosity variation of GSO peel-off mask during storage at 25°C

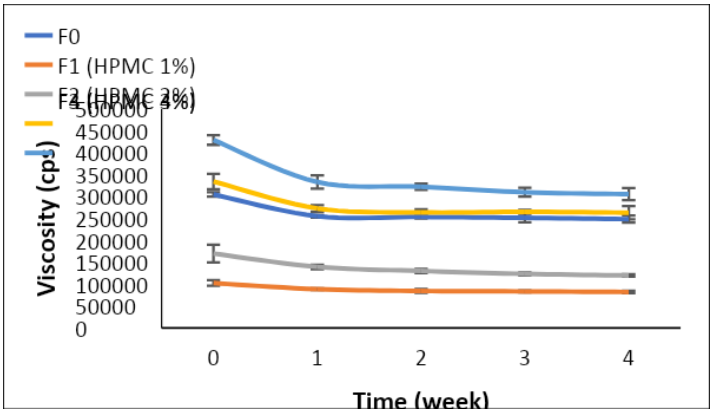

Figure 4. Graphic of viscosity variation of GSO peel-off mask during storage at 40°C

Viscosity results measurement is demonstrated in Figures 3 and 4. Both graphs show that emulgel F1-F4 had to increase viscosity because the number of polymer molecules HPMC increased while the number of waters was decreasing. These graphs also showcase a relatively stable viscosity at 25°C, while it tended to decrease at 40°C. Based on ANOVA, the significance values of F2 and F3 were 0.01

and 0.02 (P <0.05) showing that there was an influence of storage time on emulgel viscosity while F1 and F4 obtained significance values of 0.263 and 0.029 (P> 0.05) which indicated the opposite. These data showed that FO's viscosity is close to that of F3 because it uses the same concentration of HPMC.

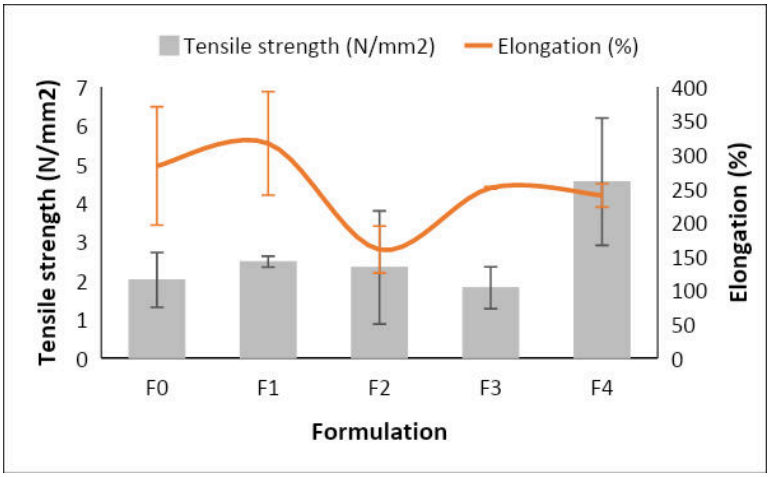

Figure 5. Graph of tensile strength and elongation of GSO peel-off mask

To characterize the mechanical properties, this study converted five GSO emulgel within 15 minutes to obtain a film layer with a thickness ranging from 0.086-0.436 mm. The thickness variations that were created can affect the measurement of mechanical properties, i.e., tensile strength and plasticization (18). When peeled from the skin, F1 and F2 films tear more easily than F3 and F4. The tensile strengths of the five formulas ranged from 1.82-4.56 N/mm2 and the % elongation at break was in the range 160.0-316.7%. Other studies have reported films which were formed from the alpha-mangostin gel with various film-forming produced tensile strength ranging between 1.32-2.15 N/mm^2 and elongation of 178-211% (19). These values are close to the mechanical characteristics of F1-F3 films; the film formed comes with flexibility and easiness to be peeled off. F1-F4 films showed the same physicochemical characteristics compared to F0; it shows that GSO loading did not change the nature of the film base.

4. Conclusion

The peel off mask emulgel from GSO has the potential to be developed into cosmetic preparations that have anti aging properties. The use of HPMC as a gelling agent base can form a homogeneous emulgel structure which is more gently and can easily spread on the face surface evenly.

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