Utilisation of Biopolymer Combination as a Material for Making Gel Peel Off Mask

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Abstract. Utilisation of biopolymers combination as a material for making gel peel off masks has been carried out. The purpose of this research to determine the combination of biopolymers. It can be formulated in dosage form Gel peel off mask and find out that single and combination biopolymers have different viscosity effects in the preparation of gel peel off masks. Tests on the preparation of peel off gel masks include homogeneity test, organoleptic observation, pH measurement, determination of viscosity, time testing of the preparation dried up, stability observation and statistical analysis test with SPSS 16.0 software which includes viscosity stability test using ANOVA parametric analysis method (Analysis of Variance) and continued with Duncan's test. The results showed that each formula of peel off gel mask combined with a single biopolymer and a combination of biopolymers had a pH of 5.4 - 5.8, viscosity 31790 cp - 38240 cp, and the time needed to dry up 21-27 minutes in storage for 12 weeks. The results of the statistical analysis of the viscosity stability test of the six formulas of peel off gel mask using ANOVA method showed a significant difference between each formula (P value <0.05). The combination of biopolymer in formula 5 (Chitosan 0.0625% + Xanthan gum 0.0625%) in the preparation of peel-off gel mask gave a higher viscosity effect compared to other formulas

Keywords: Biopolymer, Chitosan, Gelling agent, gel peel off mask

1 Introduction

The skin is a cover’s layer of the body and as a body protector from various kinds of dangers that come from outside. For women, the skin is a part of the body that needs special attention in terms of beauty, especially on the facial skin. This causes a lot of women who will always try to beautify themselves by using cosmetics (Wibowo, 2008).

Facial cosmetics which are commonly used are available in various dosage forms, one of which is in the form of a mask. Facial masks are cosmetic beauty treatments that are very popular for improving skin quality (Yeom et al., 2011). Mask products are practical in their use, one of which is wearing a peel off mask.

Peel off mask is a cosmetic form of gel-shaped facial skin care that is applied to the skin at a certain time. It will form a layer of elastic transparent film, after drying the mask can be directly lifted or released without rinsing (Hary, 1973). Physical quality gel facial mask peel off is influenced by the composition of the ingredients used, especially the composition of polyvinyl alcohol (PVA). PVA plays a role in giving the peeloff effect because it has adhesive properties so it can form a layer of film that is easily peeled off after drying (Birck et al., 2014).

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In this study, biopolymers were used as gelling agents. Biopolymer as a polymer that is formed naturally produced by living things such as plants, animals or microorganisms and is found in nature. Natural polymers have many advantages over artificial polymers. One of the advantages of natural polymers compared to synthetic polymers is their abundance. For example, cellulose is the most abundant natural polymer in nature, while chitin and chitosan are second only to cellulose (Yang, et al., 2008).

The biopolymers used in this study were Chi-tosan, Xanthan gum and Carboxymethyl cellulose (CMC). Chitosan is a polymer of saccharides (poly-saccharides) obtained from the deacetylation process of chitin compounds contained in the outer skin of animals of the Crustacean class, for example shrimp, crabs, and others (Tiyaboonchai, 2003). Chitosan has the ability to form gel, film and fiber, because of its high molecular weight and solubility in dilute acidic solutions (Suhardi, 1992). Xanthan gum is a natural polysaccharide and an important industrial biopolymer. Xanthan gum has three superior properties, which are a high viscosity at low concentrations, pseudoplastic, it is not sensitive to temperature, pH and electrolyte concentration. These three superior qualities make xanthan gum very important in the food, cosmetics, pharmaceutical, paper, paint, textile and adhesive industries (Jeeva, et al., 2011).

Carboxymethyl Cellulose (CMC) is a natural polymer derivative that is most widely used in vari-ous industries, such as food, pharmaceuticals, deter-gents, textiles and cosmetic products. This is be-cause CMC has certain functions as thickener, stabilizer, gelling agent, binder and emulsifier (Kamal, 2010). Carboxymethylcellulosa is widely used for oral and topical pharmaceutical formulations, mainly because of the level of viscosity it has as a gelling agent (Zath and Kushla, 1996).

Based on the background above, the researcher was interested in conducting research on the formu-lation of peel off gel mask with a combination of biopolymer namely Chitosan, Xanthan gum and Carboxymethyl cellulose (CMC) as gelling agents.

2 Method

This research method was conducted experimental-ly. The study included the manufacture of peel-off gel masks, using a single biopolymer namely Chi-tosan, Carboxymethyl cellulose (CMC), and Xan-than gum with a concentration of 0.125% while the combination of biopolymers with a concentration of 0.0625%: 0.0625%. Examination of the preparation includes physical evaluation of the preparation (ho-mogeneity test, organoleptic observation, pH meas-urement, determination of viscosity, test time of preparation to dry) and observation of stability of the preparation made. And statistical analysis test with SPSS 16.0 software which includes viscosity stability test using ANOVA parametric analysis method (Analysis of Variance) and followed by Duncan test

2.1 Instruments and materials

2.1.1Instruments

The instruments used include: analytical scales, wa-ter baths, spatulas, shovels, tissues, measuring cups (pyrex), beaker (pyrex), stirring rods, porcelain cups, peel off gel mask containers, transparent glass, Brookfield Viscometer and pH meters (Hanna) and glass objects..

2.1.2Materials

Ingredients Materials used include: polyvinyl alco-hol, glycerin, propylene glycol, methyl paraben, propyl paraben, triethanolamine, alcohol 96%, aquadest and biopolymers such as chitosan, xanthan gum, and carboxymethyl cellulose

2.2Formulation of gel peel off mask

2.2.1Preparations standard formula for peel off gel mask

The basic formula chosen for the manufacture of gel peel mask preparations is in this study with composition (Rieger, 2000).

R/	Polyvinyl alcohol	5 – 10%
	Humectant	2 – 10%
	Surfactant	2 – 5%
	Alcohol	10 – 30%
	pH buffer	pH 4-7
	Preservative	Qs
	Perfume	Qs
	Coloring	Qs
	Distilled water	ad 100

2..2.2Biopolymer combination formula

The Formula of Biopolymer Combination in table 1

Table 1. The formula design of the gelpeel off mask.

No	Material	Formula (g)						
		F0	F1	F2	F3	F4	F5	F6
1	Chitosan	-	0,125	-	-	0,0625	0,0625	-
2	Xanthan gum	-	-	0,125	-	0,0625	-	0,0625
3	Carboxymethylcelulosa	-	-	-	0,125	-	0,0625	0,0625
4	Polyvinyl alkohol	10	10	10	10	10	10	10
5	Glycerin	10	10	10	10	10	10	10
6	Propylene glycol	10	10	10	10	10	10	10
7	Methyl paraben	0,20	0,20	0,20	0,20	0,20	0,20	0,20
8	Propilparaben	0,03	0,03	0,03	0,03	0,03	0,03	0,03
9	Trietanolamine	0,5	0,5	0,5	0,5	0,5	0,5	0,5
10	Etanol 96%	15	15	15	15	15	15	15
11	Aquadest	ad 100	ad 100	ad 100	ad 100	ad 100	ad 100	ad 100

2.2.3Procedure for making gel peel off mask

In a glass beaker, polyvinyl alcohol (PVA) was add-ed with distilled water and glycerin, then heated on a water bath and stirred constantly to form a gel (Mass 1). Xanthan gum and aquadest were added to the evaporating dish to be stirred and heated (Mass 2). Propylene glycol was added to the beaker glass, methylparaben and propyl paraben were added, stirred until homogeneous (Mass 3). Mass 2 inserted to the mass 1, stirred homogeneously then entered mass 3 stirred homogeneously. The mixture solution was added triethanolamine stirred constantly and homogeneously. After cooling ethanol was added to form a homogeneous mass of peel off gel mask.

2.2.4Physical preparations evaluation of gel peel off mask

Physical quality checks were carried out on each preparation. Physical quality checks include: homo-geneity test, organoleptic observation, pH measure-ment, determination of viscosity, the preparation dries testing and observations of the stability of the preparation made.

2.2.5Homogeneity test

A certain number of preparations if applied to a piece of glass or other transparent material that is sufficient. The preparation must show a homogene-ous arrangement and there is no visible coarse grain (DG POM, 1979).

2.2.6Observation of organoleptic

Organoleptic observation was carried out by observ-ing changes in shape, color, and odor from the prep-aration of gel peel off mask (Septiani, 2011)

2..2.7pH measurement

Determination of the pH of the preparation was done by using a pH meter. The tool was first calibrated using standard buffer solution (pH 7.01) and acid pH buffer solution (pH 4.01) until the device shows the pH price. Then the electrode was washed with distilled water, then dried with tissue. The sample was made in 1% concentration, ie weigh 1 g of the preparation and dissolved in distilled water to 100 ml. Then the electrode was dipped in the solution. Let the tools showed the pH considered to be constant. The figure shown by pH meter is the pH of the preparation (Rawlins, 2003)

2.2.8Determination of viscosity

A total of 100 ml of gel inserted into a 250 ml beak-er glass then the viscosity is measured with Brookfield Viscometer. Not only the spindle was set but also the speed to be used (Septiani, 2011).

2.2.10Test time drying preparation

Each mask formula was put into a plastic pot, stored at room temperature and measured stability parameters such as odor, color, pH, time of preparation dried, and viscosity evaluated during 12 weeks storage with observations every 2 weeks (National Health Surveillance Agency , 2005)

2.2.11 Data analysis

The results of the viscosity stability test data were analyzed using statistical package processing for SPSS 16.0. The data input for statistical included normality test, homogeneity test, ANOVA (Analysis of Variance) test and continued with Duncan test.

3Result

Preparation of gel-off mask is made using a standard gel-off mask mask formula (Rieger, 2000). This standard formula was modified when removed some material. The preparation of peel off gel masks is made in 6 formulas using different biopolymers. The biopolymers used to make peel off gel masks were Chitosan, Xanthan gum, and Carboxymethyl Cellulose (CMC). As blanks, peel-off gel masks without biopolymers were used. Each formulation of peel off gel mask was made with a single biopolymer and a combination of biopolymer. Biopolymer was single with a concentration of 0.125% while in the combination of biopolymers a concentration of 0.0625%: 0.0625% was used. The mask preparations were obtained in the form of peel off gel mask with clear and cream color.

3.1 Physical quality preparations evaluation of peel off gel mask

3.1.Homogeneity test

Homogeneity test is done by applying the prep-aration on a piece of glass or other transparent material, then leveling. If there are no granules then the preparation can be said to be homogeneous (DG POM, 1979).Test results of the homogeneity of gel peel off mask in Fig 1.

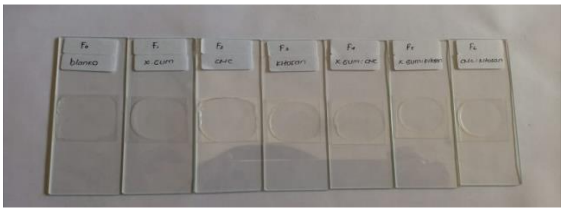

Fig 1. Test results of the homogeneity of gel peel off mask

The results of homogeneity examination on the preparation of peel off gel mask showed that all preparations did not show any coarse grains. It showed that the preparation had a homogeneous arrangement, as shown in Figure 2.

Table 2. Observation results of homogeneity of GelPeelOff Mask preparations

Preparations	Homogeneity
F0	Homogeneous
F1	Homogeneous
F2	Homogeneous
F3	Homogeneous
F4	Homogeneous
F5	Homogeneous
F6	Homogeneous

Information:
F0 = Formula without biopolymers
F1 = Formula Xanthan gum 0.125%
F2 = Formula Carboxymethyl Cellulose 0.125%
F3 = Chitosan Formula 0.125%
F4 = Formula Xanthan gum 0.0625% + Carboxymethyl Cellulose 0.0625%
F5 = Chitosan Formula 0.0625% + Xanthan gum 0.0625%
F6 = Chitosan Formula 0.0625% + Carboxymethyl Cellulose 0.0625%

The results of organoleptic examination on F3 Gel Peel Off mask (Chitosan 0.25%), F5 (Chitosan 0.0625% + Xanthan gum 0.0625%) and F6 (Chitosan 0.0625% + Carboxymethyl Cellulose 0.0625%) gave odor which was a little sour and creamy. This is due to the addition of acetic acid to dissolve chitosan because chitosan is slightly soluble in water and not soluble in ethanol (Rowe, et al., 2009). Chitosan is more soluble in acetic acid (Tang, et al., 2007).

3.1.2 pH measurement

pH preparation was carried out using a pH meter (Hanna instruments). The results can be seen in Ta-ble 3 below.

pH stability is an important parameter that de-termines whether a preparation is stable or not. pH testing aims to determine the safety of the prepara-tion when used. Thus, it did not irritate the skin (Anief, 2004). The pH test results on all peel off gel masks showed a pH of 5.4-5.8. The pH test results on the formula F2 (Carboxymethyl Cellulose 0.125%) gave a more alkaline result of 5.7 while at F3 (chitosan) gave a more acidic result of 5.5. The pH of all formulas for the peel off gel mask is still in the normal pH range of the skin, which is between 4.5 and 7.0 (Wasita atmadja, 1997) 1997).

Table 3. The results of the pH test observations of Peel Off Gel Mask preparations

Preparation	pH
F0	5,4
F1	5,6
F2	5,7
F3	5,5
F4	5,8
F5	5,7
F6	5,7

3.1.3 Analysed of viscosity

Viscosity examination was done using a brook field viscometer. The results can be seen in Table 4.

Table 4. The results of the viscosity test observations of Peel Off Gel Mask preparations preparation Viskositas (cp)

preparation	Viskositas (cp)
F0	11773
F1	33350
F2	31790
F3	32440
F4	33090
F5	38240
F6	37060

The determination of the viscosity value of the preparation of peel off gel mask using xanthan gum, CMC, and chitosan biopolymers the viscosity of the gel was influenced by the concentration and proper-ties of the gelling agent. An increase in the amount of gelling agent can strengthen the gel matrix which causes an increase in viscosity (Zats and Kushla, 1996).

The viscosity value of the peel off gel mask preparation showed that the different viscosity val-ues in each formula ranged from 31790 Cp -38240 Cp which can be seen in Table 4.4. The viscosity value at F0 as blank gives a lower yield of 11773 Cp because there was no addition of gelling agent or without biopolymer. The lowest viscosity was found in F2 (Carboxymethyl Cellulose 0.125%) with 31790 Cps while the highest viscosity is found in F5 (Chitosan 0.0625% + Xanthan gum 0.0625%) which is 38240Cp.

3.1.4 Preparation time test results dry

The test of the time the preparation dries was done by observing the time needed for the preparation to dry, ie the time from when the peel-off mask is applied to the skin of the arm with a length of 7 cm and width of 7 cm. until a dry layer forms. The results can be seen in Table 5.

The most influential factor on dry time is the concentration of ethanol in the formulation. Increasing ethanol concentration will shorten the dry time of the preparation, this is because ethanol has a higher level of volatility compared to pure water (Beringhs et al., 2013). The formulation of peel off gel mask formulation used 15% ethanol concentra-tion. It based on the formulation contained in Hary's Cosmeticology book which stated that ethanol concentration can be used up to 30% in the gel peel off mask.

Table 5. Observation results when drying *Peel Off* Gel Mask preparations

Preparation	Time to dry (minutes)
F0	23
F1	25
F2	24
F3	25
F4	27
F5	29
F6	29

3.1.5 Preparation stability check results

The stability evaluation of the preparation was carried out during 12 weeks storage with observation interval every 2, 4, 6, 8, 10, and 12 weeks. The preparation of peel-off gel mask was stored at room temperature and observed changes in odor, color, pH, time of preparation to dry, and viscosity. The test results showed that the preparation of peel-off gel mask experienced changes during storage, where viscosity and preparation time to dry up increased. The results of the evaluation of the stability of each test parameter can be seen in Table 6.

Table 6. Observation Results of Stability Test for Peel-off Mask Preparation Formula for Time Parameters (Weeks)

Formula	Parameters	Time (Weeks)					
		2	4	6	8	10	12
F0	Color	TB	TB	TB	TB	TB	TB
	Smell	TB	TB	TB	TB	TB	TB
	pH	5,4	5,4	5,4	5,4	5,4	5,4

	Time dries (minutes)	21	21	21	21	22	23
	Viscosity (cp)	11773	11773	11773	11773	11773	11773
	Color	TB	TB	TB	TB	TB	TB
	Smell	TB	TB	TB	TB	TB	TB
F1	pH	5,6	5,6	5,6	5,6	5,6	5,6
	Time dries (minutes)	23	23	24	24	24	25
	Viscosity (cp)	27540	31240	31320	31390	32440	33350
	Color	TB	TB	TB	TB	TB	TB
	Smell	TB	TB	TB	TB	TB	TB
F2	pH	5,7	5,7	5,7	5,7	5,7	5,7
	Time dries (minutes)	22	22	23	23	23	24
	Viscosity (cp)	26490	27230	27 850	28740	31290	31790
	Color	TB	TB	TB	TB	TB	TB
	Smell	TB	TB	TB	TB	TB	TB
F3	pH	5,5	5,5	5,5	5,5	5,5	5,5
	Time dries (minutes)	23	23	24	24	24	25
	Viscosity (cp)	26720	27640	28320	31170	32330	32440
	Color	TB	TB	TB	TB	TB	TB
	Smell	TB	TB	TB	TB	TB	TB
F4	pH	5,8	5,8	5,8	5,8	5,8	5,8
	Time dries (minutes)	25	25	26	26	26	27
	Viscosity (cp)	28810	29260	30920	32010	32650	33090
F5	Color	TB	TB	TB	TB	TB	TB
	Smell	TB	TB	TB	TB	TB	TB
	pH	5,7	5,7	5,7	5,7	5,7	5,7
	Time dries (minutes)	27	27	28	28	28	29
	Viscosity (cp)	32620	34750	35120	37620	38010	38240
F6	Color	TB	TB	TB	TB	TB	TB

Smell	TB	TB	TB	TB	TB	TB
pH	5,7	5,7	5,7	5,7	5,7	5,7
Time dries (minutes)	27	27	27	28	28	29
Viscosity (cp)	31030	31860	33790	34810	35730	37060

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Information:

TB = Not changed
B = Change

The observation results of peel-off gel mask showed that the color and odor of the mask preparation did not change during 12 weeks of storage at room temperature. Observations can be seen in Appendix 1.

The results of the observation of the viscosity of the peel-off gel mask during 12 weeks storage showed that the preparation had increased viscosity. This can be caused by long storage, so that old preparations are affected by the environment such as air (Black, et al., 1997).

The increase in viscosity during storage was also caused by the water in the preparation being ab-sorbed by the gelling component so that the addition of gel volume (Zatz et al., 1994). The test time of the preparation dried was done by observing the time needed for the preparation to dry, ie the time from when the peel-off gel mask was applied to the skin of the arm with a length of 7 cm and a width of 7 cm to form a dry layer. The most influential factor on dry time is the concentration of ethanol in the formulation. Increasing ethanol concentration will shorten the dry time of the preparation.It's appear because ethanol has a higher level of volatility compared to pure water (Beringhs et al., 2013). The results indicated that the longer storage time, the time preparation of peel-off gel masks to dry up increases. This can be caused by ethanol which evaporates when the packaging was opened too long during testing. Ethanol in the peel off gel mask formula serves to speed up the drying time of the mask, so that when ethanol evaporates it will give effect to the preparation in the form of increased for dry time up for longer. One factor that must be considered that the packaging should be tightly closed in order to maintain the preparation from the effects of envi-ronmental changes that can reduce the quality (Beringhs et al., 2013).

4 Discussions

After observing the viscosity stability test of peel off gel mask, the next step was statistical test analysis using SPSS (Statistical Package for the Social Sci-ences) 16.0 software using parametric one way ANOVA (Analysis of Variance) analysis method at 95% confidence level and continued with the Dun-can test to find out whether the viscosity stability test can change significantly.

The results of the statistical analysis of the vis-cosity stability test of the six formulas of peel off gel mask using one-way ANOVA method with a 95% confidence level showed a significant differ-ence between each formula (P value <0.05). This shows that there is a difference in the gelling prop-erties of the biopolymer agent which affects the viscosity level of the gel peel off mask. The highest viscosity of F5 (Chitosan: Xanthan gum 38240 cp) and the lowest on F2 (Carboxymethyl Cellu-lose31790 cp).

5 Conclusion

1. The combination of biopolymer can be formulated in the dosage form of peeled gel mask. Biopolymers are Chitosan, Xanthan gum and Carboxymethylcelulos
2. The single and combination biopolymers have different viscosity effects in the preparation of exfoliating gel masks. The single biopolymer has the highest viscosity was Xanthan gum with 33350 cp. The second viscosity result was Chitosan 32440 cp so that the lowest viscosity was Carboxymethylcelulosa with 31790 cp. The highest viscosity results of the combination of biopolymer were Chitosan + Xanthan gum which was 38240 cpupun the second was Chitosan + Carboxymethyl Cellulose with a yield of 37060 cp and the lowest viscosity result was xanthan gum + Carboxymethyl Cellulose 33090 cp. Data obtained from one-way ANOVA results with a 95% confidence level showed that each formula showed a significant difference ($P < 0.05$), namely the highest viscosity F5 (Chitosan + Xanthan gum 38240 cp) and the lowest on F2 (Carboxymethylceluloseie 31790 cp)

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