



FORMULATION AND PHYSICAL ASSESSMENT OF DIFFERENT TOPICAL PRODUCTS USING BANDOTAN HERB (*Ageratum conyzoides* L.) EXTRACT

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ABSTRACT

Bandotan (*Ageratum conyzoides* L.) is one of the Asteraceae family plants that has bioactive compound components in the form of polyphenol compounds, terpenoids, and alkaloids. 70% ethanol extract of bandotan herb (*Ageratum conyzoides* L.) is known to have antioxidant activity. This makes herba bandotan has the potential to be developed into cosmetic preparations to prevent premature aging of the skin. This study aims to determine the herba bandotan topical preparation that has the best physical properties. Bandotan herb was extracted with 70% ethanol in the amount of 1: 10 at 28°C for 24 hours using the shaking method at 100 rpm. The ethanol liquid filtrate obtained was then evaporated to obtain a thick extract. Thick bandotan extract is then made into gel, cream, and lotion preparations and evaluated. The resulting % yield of bandotan herb extract was 11.3%. The concentration of 1%, 3% and 5% bandotan herb active substances in the preparation affects the organoleptics, viscosity, spreadability and adhesiveness of the preparation. The best topical preparations of bandotan herb extract that meet the requirements of the pH test, viscosity test, spreadability test, and adhesion test is cream preparations.

Keywords: anti-aging; cosmetics; cream; gel; lotion

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INTRODUCTION

Aging is a physiological process characterized by a continuous loss of homeostatis involving all parts of the body (Sparavigna et.al., 2017). Skin aging will affect an individual's social life, which is supported by the fact that the skin is the part of the body that is most often exposed to external factors and is also the first thing an individual sees when interacting with others (Ahmad Zahrudin, 2018). The process of premature aging has been shown to be prevented by using antioxidants because they can provide additional protection from sun damage, slow premature aging, reduce inflammation and improve skin appearance (Yamamoto et.al., 1991). Synthesized compounds such as kojic acid, mercury, hydroquinone, have dangerous side effects if used in the long term and relapse often occurs when therapy is stopped (Ting Fang et.al., 2015). These side effects encourage the emergence of alternatives from natural materials that are safe in long-term use. One of these natural alternatives is using bandotan herb. Bandotan (*Ageratum conyzoides* L.) is one of the Asteraceae family plants that has bioactive compound components in the form of polyphenol compounds, terpenoids, and alkaloids (Yamamoto et al., 1991). The results of research by Ting Fang et al in 2015 stated that 70% ethanol extract of bandotan (*Ageratum conyzoides* L.) has an oxidant activity of 32.2 ppm.

The activity of herba bandotan makes herba bandotan has the potential to be developed into cosmetic preparations. However, research related to the formulation of herba bandotan is currently still limited to the formulation of herba bandotan cream preparations with a

combination of various active substances for wound healing (Kotta et.al., 2020) and herba bandotan gel formulations for pain relief gels (Sirikunya, S. et.al., 2019). There has been no research that formulates herba bandotan into lotion preparations, and compares the physical properties between the various topical preparations. On the other hand, lotion formulations have a high water content that helps maintain skin moisture (Iskandar et al., 2021) and are popular among consumers due to their comfort on the skin. Therefore, the researcher intends to formulate lotion preparations and compare their physical properties with cream and gel preparations to obtain topical preparations that have the best physical properties. Lotion preparations have the advantage of being more comfortable to use, as a skin lubricant and skin protector (Anief, M., 2006). The aim of this research was to develop a bandotan herb extract formulation with superior physical properties. In addition to effectiveness, topical formulations must prioritize user comfort. Hence, conducting this research is crucial.

METHOD

Preparation and extraction of bandotan herb extract.

The extraction method of bandotan herb was carried out with modifications from the research conducted by (Abdullah et.al., 2021). All parts of the bandotan plant (roots, stems, leaves, and flowers) that have flowered (previously tested for determination) were harvested, then washed thoroughly with running water. Bandotan herbes were chopped and dried using an oven at 60° C. The dried leaves were then pulverized with a blender and sieved using a No.40 mesh sieve. The blended bandotan herb samples were then extracted using the maceration method for 5 days with a sample: solvent ratio of 1:10. The solvent used was 70% ethanol.

Formulation of bandotan herb extract in topical preparations.

The herba bandotan lotion was modified from the research of (Dominica & Handayani, 2019) with the formula composition as in Table 1.

Table 1.
Formulation of bandotan herb lotion

No	Materials	Formula		
		F1(%)	F2(%)	F3(%)
1	Bandotan herb extract	1	3	5
2	Cera alba	2	2	2
3	Stearic acid	5	5	5
4	NaOH	0,2	0,2	0,2
5	Carbopol934	0,5	0,5	0,5
6	BHT	0,01	0,01	0,01
7	Tween 80	8,9	8,9	8,9
8	Span 80	1,1	1,1	1,1
9	Oleum citrii	0,5	0,5	0,5
10	Nipagin	0,18	0,18	0,18
11	Nipasol	0,02	0,02	0,02
12	Aquadest	Ad 100	Ad 100	Ad 100

Bandotan herb cream was modified from the research of (Andriani & Pratimasari, 2018) with the formula composition as in Table 2. Formulation of bandotan herb gel showed in Table 3.

Table 2.
Formulation of bandotan herb cream

No.	Materials	Formula		
		F1(%)	F2(%)	F3(%)
1	Bandotan herb extract	1	3	5
2	Propylene glycol	2,4	2,4	2,4
3	Stearic acid	4,5	4,5	4,5
4	Cera alba	0,6	0,6	0,6
5	Vaseline album	2,4	2,4	2,4
6	Triethanolamine	0,45	0,45	0,45
7	Methylparaben	0,25	0,25	0,25
8	Aquadest	Ad 100	Ad 100	Ad 100

Table 3.
Formulation of bandotan herb gel

No	Materials	Formula		
		F1(%)	F2(%)	F3(%)
1	Bandotan herb extract	1	3	5
2	Menthol	4	4	4
3	Carbopol 934	1	1	1
4	Glycerine	30	30	30
5	Methylparaben	0,1	0,1	0,1
6	Propylparaben	0,05	0,05	0,05
7	Aquadest	Ad 100	Ad 100	Ad 100

Characterization Test of Physical Properties of Bandotan herb Gel, Cream, and Lotion.

The physical properties characterization test of various bandotan herb topical preparations was carried out using the modified ones from studies (Andriani & Pratimasari, 2018) and (Dominica & Handayani, 2019).

a. Organoleptical Test

Samples of 0.25 grams of preparation were observed organoleptically including shape, taste, smell and color which were carried out visually and replicated 3 times.

b. pH measurement test

pH measurement using a pH meter, replicated 3 times. Prepared sample into the container then the pH meter is dipped let a few seconds, read the pH on the tool.

c. Homogeneity Test

A total of 0.5 grams of preparation is placed on a glass plate and then observed whether there are coarse grains or not, said to be homogeneous if there are no coarse grains.

d. Viscosity Test

The viscosity test was carried out using a rion viscometer using spindle no. 3. The viscosity results were recorded after the viscometer needle showed a stable number after five turns.

e. Spreadability Test

The spreadability test was carried out by calculating the diameter of the glass on which 0.5 grams of sample was placed and given a load of 50 grams. Then the load was added up to 150 grams, the diameter was calculated.

f. Adhesion Test

The adhesion test was carried out by calculating the release time of the preparation on a glass plate. A total of 1 gram was placed on a glass plate then the two plates were affixed, then given a release load of 80 grams for testing. Observed the time until the two plates separated.

RESULTS

Preparation and extraction of bandotan herb extract

The % yield of bandotan herb resulting from the maceration process for 5 days is 11,30%. Details of the resulting yield are shown in table 4.

Table 4.
% yield of bandotan herb extract

Simplisia of bandotan herb (g)	Bandotan herb extract (g)	% yield
300	33,94	11,3

Characterization Test of Physical Properties of Bandotan herb Gel, Cream, and Lotion.

The results of the physical properties of various bandotan herb preparations are shown based on the test parameters that have been carried out.

a. Organoleptical Test

Organoleptical tests carried out include: shape, smell, color, taste. Based on the results of the organoleptical test on the three preparations, they produce almost the same color, namely dark green and the distinctive smell of bandotan herb. Organoleptical test can be seen in table 5.

Table 5.
Organoleptical Test Results of Bandotan Herb Topical Preparations

Preparations	Formula	Shape	Color	Smell
Gel	F1	Gel	Light green	Menthol fragrance
	F2	Gel	Green	Menthol fragrance
	F3	Gel	Dark green	Menthol fragrance
Cream	F1	Cream	Light green	Bandotan light smell
	F2	Cream	Green	Bandotan light smell
	F3	Cream	Dark green	Bandotan light smell
Lotion	F1	Lotion	Brown	Bandotan smell
	F2	Lotion	Green	Bandotan smell
	F3	Lotion	Dark green	Bandotan smell

b. pH Measurement Test

The pH values of lotion, gel and cream preparations are between the range of 5-7. The average pH values of the various bandotan preparations were gel > cream > lotion. The pH value profile of each preparation is shown in Figure 1.

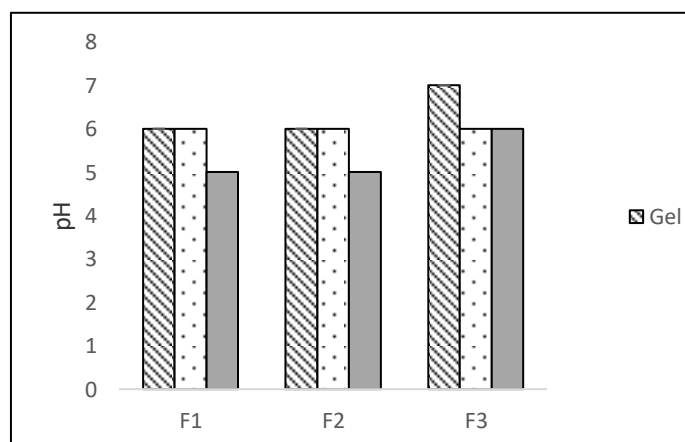


Fig.1. Results of pH test of various bandotan herb topical preparations. F1 is using 1% active ingredient of bandotan herb extract; F2 is using 3% active ingredient of bandotan herb extract; F3 is using 5% active ingredient of bandotan herb extract.

c. Homogeneity Test

Homogeneity test results show that lotion, gel and cream preparations from bandotan herb are homogeneous and there are no coarse grains in each preparation

Table 6.

Homogeneity Test Results of Bandotan Herb Topical Preparations. F1 is using 1% active ingredient of bandotan herb extract; F2 is using 3% active ingredient of bandotan herb extract; F3 is using 5% active ingredient of bandotan herb extract

Preparations	Formula	Results
Gel	F1	Homogeneous
	F2	Homogeneous
	F3	Homogeneous
Krim	F1	Homogeneous
	F2	Homogeneous
	F3	Homogeneous
Lotion	F1	Homogeneous
	F2	Homogeneous
	F3	Homogeneous

d. Viscosity Test

The viscosity values of lotion, gel and cream preparations are between the range of 3300 cp -13.000 cp . The average viscosity values of the various bandotan preparations were cream > lotion > gel. The viscosity value profile of each preparation is shown in Figure 2.

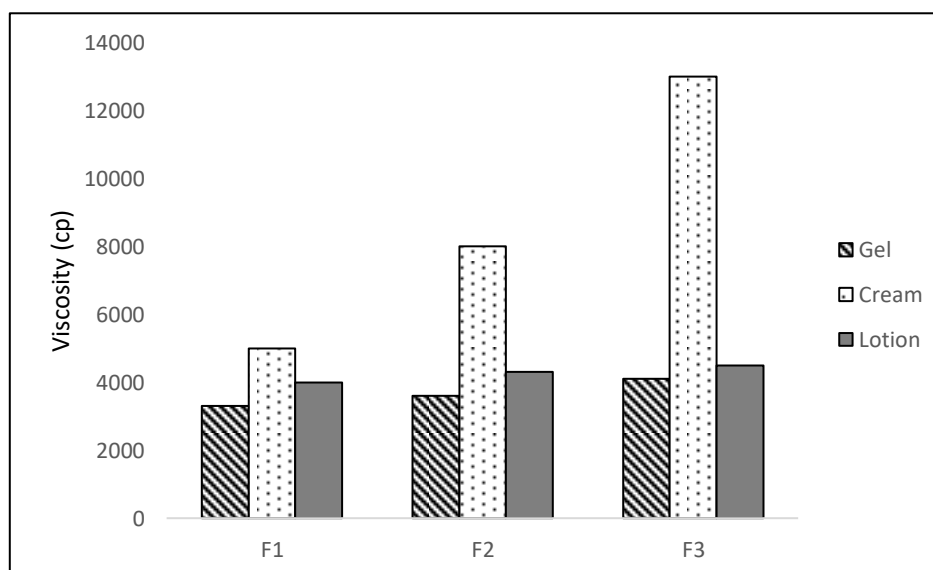


Fig.2. Results of viscosity test of various bandotan herb topical preparations. F1 is using 1% active ingredient of bandotan herb extract; F2 is using 3% active ingredient of bandotan herb extract; F3 is using 5% active ingredient of bandotan herb extract

e. Spreadability Test

The results of the spreadability test on each dosage form show the range of spreadability that occurs in each formula is 4.92 cm - 6.75 cm. The order of spreadability in each preparation is gel > lotion > cream. Details of the spreadability profile of each formula are shown in Figure 3.

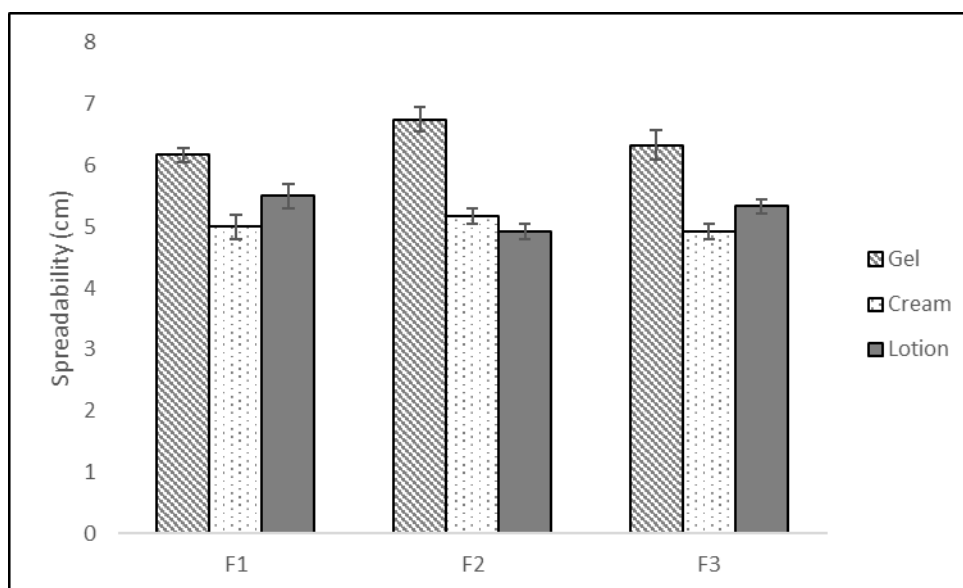


Fig.3. Results of spreadability test of various bandotan herb topical preparations. F1 is using 1% active ingredient of bandotan herb extract; F2 is using 3% active ingredient of bandotan herb extract; F3 is using 5% active ingredient of bandotan herb extract

f. Adhesion Test

The results of the adhesion test in Figure 4 (a) and (b) show the adhesion ability of the cream formula which is much longer than the adhesion of gel and lotion preparations. The formula with the longest adhesion ability is cream formula 3, which is 403.33 seconds.

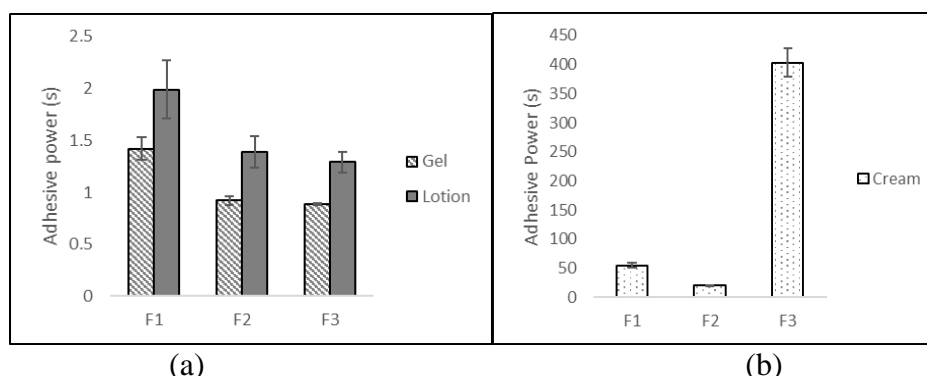


Fig.4. (a) Results of adhesion test of bandotan herb in gel and lotion preparations. (b) Results of adhesion test of bandotan herb in cream preparations. F1 is using 1% active ingredient of bandotan herb extract; F2 is using 3% active ingredient of bandotan herb extract; F3 is using 5% active ingredient of bandotan herb extract.

DISCUSSION

Preparation and extraction of bandotan herb extract

Table 4 shows that the bandotan herb extract obtained in this study has a higher % yield value than the reference study (Abdullah et.al., 2021) which only has a % yield of 2.36%. This is due to the comparison of the number of solvents used in this study more, so that the ability to attract compounds in simplisia is greater. This aligns with the research conducted by (Miftahurrahmah et al., 2021), who compared the ratio of solvent volume in the maceration method to the % yield obtained. The study revealed that a sample-to-solvent ratio of 1:9 produced a higher yield than a 1:5 ratio. This is because a larger solvent volume increases the extraction of compounds.

Characterization Test of Physical Properties of Bandotan Herb Gel, Cream, and Lotion.

Characterization of the physical properties of gel, cream and lotion preparations was carried out through organoleptic parameters, pH, homogeneity, viscosity, spreadability and stickiness. Based on the organoleptical observations shown in table 5, increasing the concentration of each preparation increases the color and aroma of the preparation. Based on the aroma parameter, the cream and lotion preparations still have the aroma of bandotan, although in the cream preparation the aroma of bandotan is lighter than in the lotion. Bandotan is a herb with a strong scent similar to that of a "goat," attributed to the presence of coumarin compounds (Kotta et al., 2020). Therefore, masking the aroma of bandotan is a key challenge for researchers. As shown in Table 5, the gel formulation is the most effective in masking the scent of bandotan, due to the addition of menthol in the formula.

The next physical properties testing parameter is pH. The pH test aims to see the pH of the preparation. The pH range of the skin is between 4.5 - 7.5. The pH value must be in that range, it will irritate the skin if the pH is very acidic and the skin is scaly if the pH is very alkaline (Mawazi et al., 2022). Based on the test results shown in Figure 1, all topical preparations tested have a pH value that meets the requirements. Gel preparations have a higher pH than other preparations due to the presence of glycerin which has a pH of 6-7 and in large enough quantities. The cream preparation has a lower pH than the gel preparation because there are stearic acid ingredients that have a pH that tends to be acidic. The lotion preparation has the lowest pH among other preparations because in the lotion preparation there are 2 acidic ingredients, namely stearic acid and carbopol so that the pH becomes acidic. Homogeneity examination aims to determine whether all ingredients are homogeneous or evenly distributed in all parts, homogeneous preparations if there are no grains (Olivia H Naibaho et.al., 2013). The results at table 6 show that the three preparations are homogeneous because there are no coarse grains (table 6). The homogeneity of the preparation affects the distribution of the active substance of the preparation which results in the effectiveness of the preparation (Afriani et.al., 2021). The homogeneity of the preparation can be influenced by various factors, including the speed and duration of stirring and the extract dissolution process (Putri & Azzahra, 2023).

The viscosity test of semi-solid preparations is related to the viscosity of a preparation. A good topical preparation is not thick and not runny. This is related to the ease of use of the preparation. Topical preparations that are too thick can inhibit the release of active substances. A good viscosity value for topical preparations is 500-10,000 Cps (St.Rahmatullah, et.al., 2020). Figure 2 showed that all formulas meet the requirements for good viscosity. Based on the results of the viscosity test, the viscosity of the cream preparation > lotion > gel, this is because the viscosity of the cream preparation is greater than that of the gel due to differences in the constituent components of the gel and cream, where in the gel preparation the gelling agent is dispersed in an aqueous medium while in the cream preparation the use of the oil phase of the stearate group will increase the viscosity value. In addition, the concentration of water added will also affect the viscosity of the preparation where the water content in the lotion is higher than in the cream, resulting in a thicker cream viscosity than the lotion viscosity (Rowe et.al., 2009). This research has differences with the results of (Lubis et al., 2023) research. The study showed that the gel preparation had a greater viscosity than the lotion. This is due to the different gelling agents used. The gelling agent used in the study was Na-CMC, while this study used carbopol 934 as a gelling agent.

Spreadability test is one of the evaluation tests on semisolid preparations that ensure ease of application to the skin so that it provides comfort when used. Spreadability is related to

viscosity, the higher the viscosity, the smaller the spreadability and vice versa, the lower the viscosity, the greater the spreadability (Silva Hati Nurani & Anasthasia Pujiastuti, 2023). Based on the results of the spreadability test in Figure 3, all bandotan herb preparations meet the requirements for good spreadability, which ranges from 5-7 cm. Gel preparations have higher spreadability values than creams and gels because in the manufacture of gels, the gelling agent component is dispersed in an aqueous medium which causes a low degree of viscosity. Decreased viscosity will cause the ability to spread to increase and the pressure required for the preparation to spread will be smaller, so it can be interpreted that viscosity and spreadability are inversely proportional (Kulawik-Pióro & Miastkowska, 2021). This is consistent with the research conducted by (Chen et al., 2016), who compared the physical properties of cream and gel formulations, finding that gel preparations exhibited greater spreadability than cream formulations.

The last characterization of topical preparations is the adhesion test. Adhesion testing aims to determine the ability of the gel to adhere to the skin surface. The bond between the gel and the skin will be stronger if the adhesion is higher. This will increase the absorption of the drug into the skin. Conversely, if the adhesion is low, the bond between the gel and the skin is less than optimal so that the drug absorbed is small. Good gel adhesion is more than 4 seconds (Suen et al., 2017). Based on the results of the adhesion test, only the cream preparation meets the requirements (Figure 4). The adhesion of the preparation is also related to viscosity. An increase in viscosity will increase the adhesion of the preparation (Wibowo et al., 2021). The addition of oil phase concentration can also increase adhesion due to the inherent properties of oil (Rowe et al., 2009). The result of adhesion is related to the comfort of the preparation when applied. If the preparation is too sticky, consumer acceptance can be reduced (Agoes, G., 2008). Testing adhesion is also related to the release of drugs into the skin. It is expected that the preparation has optimal adhesion for maximum absorption of drugs into the skin (Puspitasari et al., 2018) (Tungadi et al., 2023). The results of this study illustrate that different dosage forms can affect the physical properties produced, especially on viscosity and adhesion. An increase in the concentration of the active substance in the preparation is directly proportional to the color and aroma of the preparation, but an increase in the concentration of the active substance in the preparation is not always directly proportional to the spreadability and stickiness. Furthermore, this research can be continued in activity testing to ascertain the effect of active substance concentration on the activity of the preparations produced.

CONCLUSION

The best topical preparations of bandotan herb extract that meet the requirements of the pH test, viscosity test, spreadability test, and adhesion test is cream preparations.

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