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The physical properties and stability of purple yam (*Ipomoea batatas* (L.) Lam) lipstick

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ABSTRACT

The purple yam (*Ipomoea batatas* (L) Lam) has a useful anthocyanin as a natural dye which safer compare to the synthetic dyes. Anthocyanins have the antioxidant effect that can capture free radicals. The purpose of this study was to assess the effect of purple yam extract in various concentrations on the physical properties and physical stability of lipstick. Lipstick was made in three formulas that is L01, L02, L03. To evaluate the quality of the product, the physical properties, and stability test for purple yam lipsticks were conducted. Physical properties test consisted of organoleptic tests, melting point test, hardness test, homogeneity test, the Pap test, and pH test. Lipstick stability tests were performed by stored lipstick for 30 days at room temperature 25 °C, then observed the change of shape, color, and odor during storage. "W" a top market leader lipstick in Indonesia was used as a control. Observed data of melting point, strength, and pH of lipstick were analyzed using One Way ANOVA and continued with Tukey. Organoleptic data, homogeneity, topicality and lipstick stability were described descriptively. The results showing no significant differences between lipstick L01, L02, L03 in organoleptic, homogeneity, pH and lipstick physical stability. However, when comparing with W lipstick, there is a significant difference in the melting, hardness and smearing points between L01, L02, L03 lipstick with W lipstick. It was concluded that purple yam extract may influence the physical properties of lipstick in particular melting point and hardness of lipstick. Although it has no effect on the stability of purple yum lipstick.

Keywords: lipstick, purple yum extract, physical properties, physical stability

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INTRODUCTION

Lipstick is a cosmetic that is used for coloring the lips with an artistic touch to improve the aesthetics of makeup (Rosidah, 2010). Based on results of the investigation and laboratory testing by BPOM RI (2007) against marketed cosmetics, it was found 27 brands of cosmetics that contain hazardous and banned compounds as a dye such as a rhodamine B (red K.10) and red K.3. Therefore, natural dyes substances are increasingly required because it is reported safer than synthetic dyes that contain carcinogenic substances and can cause liver damage, allergic reactions and swelling on the face (BPOM RI, 2007). Anthocyanin is a natural dye that widespread in plants flowers, leaf, and fruits.

Research conducted by Yudiono (2011) states the amount of anthocyanin that is contained in purple yum for 0,59 mg/gram and, according to research by Winarti, *et al*. (2008) the concentration of anthocyanin contained in purple yum that is equal 1,3170 mg / 100gr. In the analysis of antioxidant activity using DPPH method (using 2,2- diphenyl-1-picrylhydrazyl), anthocyanin has a physiological function as an antioxidant with IC 50 3,68 mcg/mL (Jiao *et al*., 2012). Moreover, Kano *et al.* (2005) has reported that anthocyanins have antioxidative activity in vivo as well as in vitro. Hence, it makes anthocyanin could be developed as a potential natural dye in lipstick. Anthocyanins from Rambutan (*Nephelium lappaceum* L.) Rind extract as natural dye application in lipstick has been reported by Azhary *et al*. (2017). Those research conclude that it had good physical quality (color, homogeneity, melting point, physical strength, stability, and spread ability) and no skin irritation. However, the use of purple Yam as a natural dye in lipstick has not been conducted. It is important to develop alternative natural dyes for the lipstick from the various source in particular purple yam extract and its effect on lipstick physical quality.

MATERIALS AND METHODS

Collection and determination of purple yam

Purple yum was collected from the farm in the village of Karang Lewas Kidul, Banyumas, Central Java, Indonesia. Determination of purple yam is conducted in Laboratory of Plant Taxonomy the Ministry of Research, Technology and Higher Education of the Republic of Indonesia Faculty of Biology, University of Jendral Soedirman Purwokerto.

Extraction of purple yam

Purple yam was extracted by maceration. Purple yam was sliced with ± 0,3cm thick, after that it crashed with a blender add the solvent with a ratio of ingredients, solvents (1: 2) for 3 minutes. Solvents used in the form of ethanol: acetic acid: water at a ratio of 5: 1: 25. Then removed from the blender and filtered then evaporated with a rotary evaporator at temperature of 50 °C in order to obtain the concentrated extract. The extract was then evaporated in a water bath until the liquid lost and yielded viscous extract (Winarti *et al.*, 2008)

Formulation lipstick

Table I. Formulation lipstick purple yam concentration of 15%, 20% and 25%, 1 piece lipstick weighs 3 grams

Material	Formula (gram)		
	L01	L02	L03
Carnauba Wax	0.405	0.405	0.405
Paraffin Wax	0.344	0.344	0.344
Cetyl alcohol	0.240	0.240	0.240
Adeps lanae	0.240	0.240	0.240
Propylene glycol	0.300	0.300	0.300
Tween 80	0.240	0.240	0.240
Purple yum extract	0.450	0.600	0.750
Talk	0.060	0.060	0.060
Nipasol	0.006	0.006	0.006
Oleum rosae	0.006	0.006	0.006
Castor Oil	0.709	0.559	0.409
Total weight	3	3	3

Source: (Gumbara, 2015)

Preparation of purple yam lipstick

Lipstick was made by measuring the weight of the material used in formula with an analytical balance and adding 50% of the formula for the molten material to avoid shrinkage of the material during heating. Furthermore, paraffin wax, carnauba wax, cetyl alcohol and adeps lanae were melted by Bunsen flame until melted carnauba wax started to melt while stirring with a spatula spoon, the mixture is called mixture A. Purple yam extract and propilenglikol mixed homogeneously in a mortar added tween 80 and then mixed homogeneously. After that, inserted into talc and nipasol, poured portion per portion, crushed into homogeneous and this process produced a ready-mix B. Heated mortar prepared, then castor oil poured into a hot mortar and added to the mixture B in shear zones until homogeneous then added a mixture A in shear zones until homogeneous. The mixture is melted by bunsen fire until melting is then placed on top of the bath and homogenized with a magnetic stirrer at 600 rpm for 30 minutes at a temperature of 50 ^{0}C. Thereafter, the mixture was poured into a lipstick mold and put into the freezer for 10 minutes and then removed from the mold.

Organoleptic test

This test includes examining the color, shape, and smell generated preparations (Rosita, 2015).

Melting point test

Melting point observation method by entering lipstick in the upper hole melting point tester with a starting temperature of 50 °C, was observed to melt lipstick, lipstick melt the initial time is recorded as the melting point of lipstick (Yusraini, 2012).

Hardness test

Observations were made on the strength of lipstick by way of lipstick placed horizontally and then hung from the load that serves as a suppressor. Every 30 seconds plus 10 grams of weight suppressant. Weight gain as a suppressor carried out continuously until the lipstick broken, when a broken lipstick, it is strength values lipstick (Rosita, 2015).

Homogeneity test

Each lipstick was checked by applying a certain amount of preparation on a transparent glass (Yusraini, 2012).

Smear tests

Topical smear tests was carried out visually by applying the lipstick on the back of the hand skin and then observing the number of colors that stick with treatment 5 times basting (Risnawati, 2012).

pH test

Determination of pH using a pH indicator. Where the pH indicator paper inserted or dipped into the still liquid lipstick. Figures indicated a pH indicator pH lipstick preparation. Human normal skin pH value ranging between 4-6 (Yusraini, 2012).

Stability test of lipstick

Lipstick stored at the room with temperature 25 °C for 30 days, then was observed a change in shape, color, and aroma lipstick on days 1, 5, 10, 15, 20, 25, and 30 days (Rosita, 2015), and compared with lipstick top brand market leader "W".

Data Analysis

The data observation melting point, strength, and pH lipstick were analyzed using one-way ANOVA followed by Tukey's test and data organoleptic, homogeneity, smear and stability of lipstick were descriptive.

RESULTS AND DISCUSSION

Collected Purple yams were sorted, purple yams with good quality were selected. A determination is conducted through a reference study was started from 30 October to 3 November 2016 and the results showed that the plant is Purple yam with Latin *name Ipomoea batatas* (L.) Lam. from Convolvulaceae by reference Table. Encycl.1: 265.1792 [30 Jul, 1792] (GCI). The extraction resultsed viscous purple purple extract with distinctive smell sour, with a total extract of 58,37gr / 1000gr with randemen percentage of 5.837%. Furthermore, the extract was formulated into the lipstick with the characteristic of lipstick properties as shown in Table II:

Table II. The organoleptic properties of purple yam lipstick

Lipstick	Shape	Color	Smell
Brand "W"	Torpedo	Brownish red	Typical brown
L01	Torpedo	Brownish red	Typical rose oil with a slight odor of wax
L02	Torpedo	Brownish red	Typical rose oil with a slight odor of wax
L03	Torpedo	Brownish red	Typical rose oil with a slight odor of wax

Refer to Table II, the purple yam lipstick has a similar organoleptic with the color of branded lipstick "W". However, both, purple yam lipstick and W lipstick, have distinction shape and scent. The purple yam lipstick texture is harder than W lipstick. and the scent of sweet purple lipstick has the aroma of rose oil with a slight scent of wax, on the other hand, fragrance lipstick brand "W" has a vanilla scent. This is because corigen odoris which added into purple yam lipstick differ with W lipstick.

Table III. The melting point of purple yam lipstick and W lipstick

Replication	L01	L02	L03	Brand "W"
1	82	82	82	40
2	82	82	82	39
3	82	82	82	41
Average	82	82	82	40
± SD	± 0,00	± 0,00	± 0,00	± 1.00

According to Table III, the results of melting point test for purple yam lipstick formulation has yielded the same value for three replication that is 82 °C. these results do not fulfill the requirement of a good lipstick melting point which is 42 °C (Ministry of Health, 2010). However, from the other reference, the perfect lipstick has melting point >50 °C (Hayati and Chatib, 2016; Maher, *et al*., 2011). a high melting point (55-65 C) of lipstick so that it will not melt in the heat (e.g. of a car's glove compartment), will not run, and is firm enough to withstand pressure when applied (Norazlin, *et al*., 2015). Although, if it's too high it will influence the spread ability of lipstick (Norazlin, *et al*., 2015).

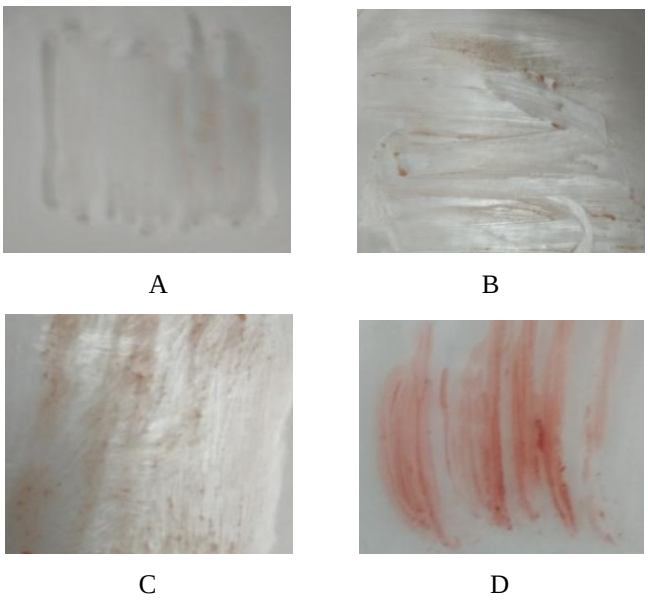
From the analysis of the one-way ANOVA between lipstick L01, L02, L03 and W lipstick are obtained the p-value of 0.000 <0.05 so that there are significant differences in the value of the melting point of purple yum lipstick and W yam lipstick. The high melting point on purple yam lipstick is because of the use of a combination of the wax bases in the form of paraffin wax and carnauba wax. Based on tests performed by Gumbara (2015), analyzing the optimum use of the base of carnauba wax and paraffin wax in a lipstick using the analysis of the Simplex Lattice Design, the test results showed that the carnauba wax and paraffin wax can increase the melting point of lipstick, with carnauba wax showed an increase in the melting point of the dominant. In this study, the use of carnauba wax base more than the base paraffin wax. those may influence the purple yam lipstick melting point value. Moreover, the quantity of castor oil also can influence the melting point (Hayati and Chatib, 2016).

Table IV. The hardness of purple yam lipstick and w lipstick

Replication	L01	L02	L03	Brand "W"
1	1200	1000	1000	600
2	1000	1600	1000	600
3	800	1000	1000	600
Average (g)	1000	1200	1000	600
± SD	± 200	± 346.41	± 0,00	± 0,00

The analysis of one-way ANOVA between purple yum lipstick L01, L02, L03 and W lipstick was obtained p-value of 0.035 <0.05 for hardness test result (Table IV), which means that there are a significant differences in hardness among groups. Furthermore, the post hoc test, showed a difference between L02 lipstick with W lipstick with a p-value 0.026 <0.05. Lipstick L02 is two times harder than W lipstick.

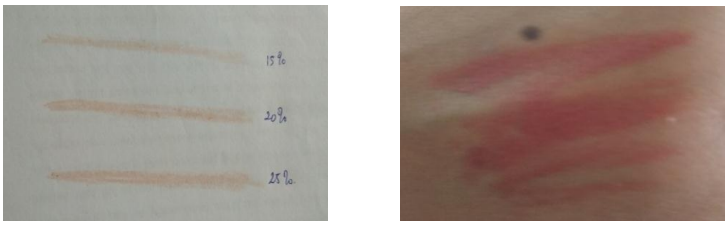
There is no absolute requirement for lipstick hardness (Gumbara, 2015). Thus, in this study used W lipstick as control where W lipstick hardness is 600 grams and the purple yam lipstick hardness is higher than W lipstick (Tabel IV). It could be influenced by castor oil and beeswax (carnauba wax) consentration (Perdanakusuma and Wulandari, 2012).



A B C D

Figure 1. Homogeneity of purple yam lipstick L01 (A), L02 (B), L03 (C) and W lipstick (D)

Based on Figure 1, homogeneity test results showed that all formulas have a homogeneous composition. Thus, when it applied,it will make the lipstick color scatter homogeneously, and do not cause sores on the lips because there is no coarse grain lipstick. The homogeneity of the mixture indicates lipstick formula homogeneously mixed.



A B

Figure 2. The smear of Purple yam lipstick L01, L02, L03 (A) and W lipstick (B)

Based on Figure 2, topical smear tests performed by applying lipstick in the leather back of the hand, but the results are the colors come out in an unclear and only looks shiny, unlike W lipstick that is easily smeared and produce hazel when smeared on the skin of the back of the hand with the number of the color attached much. Lipstick purple yum is not easily smeared due to the texture of the lipstick are significantly hard by the use of a combination of the wax bases that will boost the hardness lipstick, and according to Gumbara (2015) states the lipstick harder then the color will tough it out when smeared, so that because of the hardness lipstick generated in this study is very high then topical smear becomes low due to tough out while applying color. However, when the lipstick smeared on paper the color attached clearly (figure 2). Reducing the hardness and melting point of the lipstick so that the lipstick will be more soft and visible creamy, then when smearing lipstick color would easily come out (Perdanakusuma and Wulandari, 2012). Moreover, the concentration of purple yam extract in the lipstick may also influence the result of topical smear test. Not only the concentration but also the lipstick color similarity with the skin color might the topical smear test result look unclear.

Table V. The pH of purple yam lipstick and W lipstick

Replication	L01	L02	L03	Brand "W"
1	5	5	5	4
2	5	5	5	5
3	5	5	5	4
Average	5	5	5	4.3
± SD	± 0,00	± 0,00	± 0,00	± 0.57

The observation of the pH which aimed to find out how much pH lipstick of each formula so that the safety of lipstick is known to be used on the skin. Results of pH measurement preparation lipstick purple yam extract have a pH value of 5 to L01, L02, L03 so increasing the number of purple yam extract concentrations do not affect the pH of the resulting. The results of the pH value is included in the normal pH range of human skin that is 4-6 (Ali and Yoshipovitch, 2013) which means that the lipstick will not irritate the skin when a user or application. As for the comparison W lipstick having a pH of 4.3 and according to human normal skin pH so it does not irritate. Hence, purple yum lipstick all three formulations have a safe pH, such as pH lipstick comparison.

Based on the analysis of one-way ANOVA purple yum lipstick L01, L02, L03 with W lipstick is obtained p-value 0.052> 0.05 so there is no difference between the pH value of purple yam lipstick with W lipstick. Moreover, based on the value of SD obtained L01, L02, L03 ± 0.00 and W lipstick ± 0.57 (Table V). The absence of differences in pH between the L01, L02, L03 as the formula used the same extract.

After physical properties evaluation, the other tests that were conducted in this research is stability test. Lipstick stability test conducted to determine the level of quality of lipstick based on length of time on room temperature, the result of observation of the stability of lipstick can be seen in the figure 3:

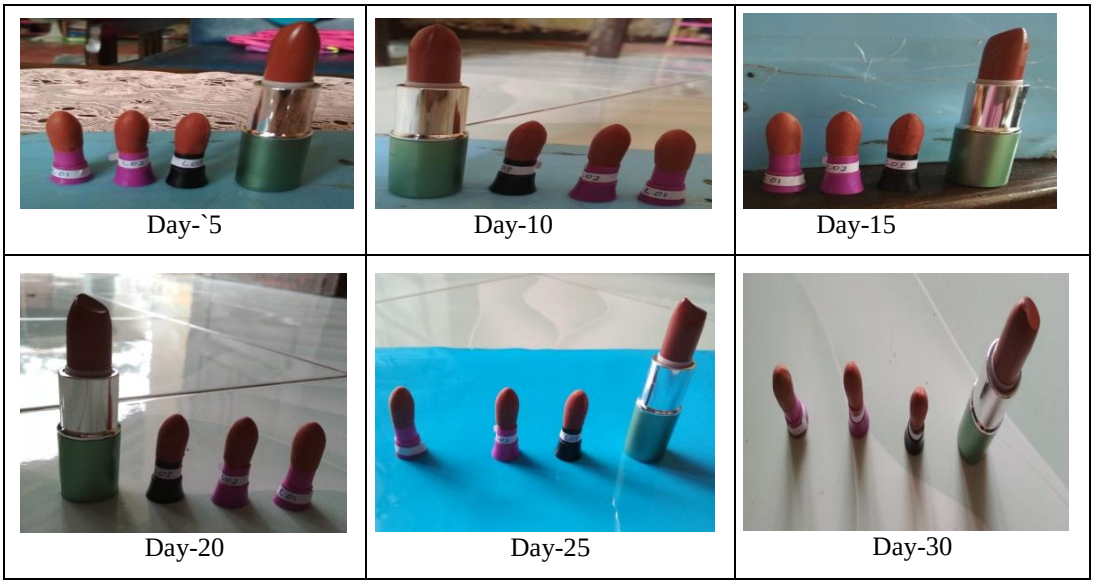


Figure 3. Stability of purple yam lipstick and W lipstick for 30 days

The result during the observation no change in shape, color and smell in lipstick purple yam extract of the earliest forms of printing. Likewise with W lipstick there is no change in shape, color and smell. It can be said lipstick purple yum extract is made stable at room temperature storage within 1 month, and the same stability with the W lipstick. This means purple yum lipstick will be durable and there will be no change in scent, shape, and color in storage for 1 month.

CONCLUSION

Our study conclude that concentration of purple yum extract may influence the physical properties of lipstick in particular melting point and hardness of lipstick. However, it has no effect on stability of purple yam lipstick.

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