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LIPSTICK FORMULATION: EFFECT OF COMPOSITION VARIATION ON PHYSICAL PROPERTIES AND CONSUMER ACCEPTANCE

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ABSTRACT. Cosmetics have become one of the daily necessities of all groups in society. Every year, users were introduced to various new cosmetic products of the latest trend. Lipstick is one of the beauty products that command a unique market. The quality of lipstick is directly linked to the basic material used in the formulation. Natural-ingredient based products are getting popular, as a public concern towards the long-term effect of synthetic material in cosmetic formulations increased. In this work, natural-ingredient based lipsticks were produced. Various compositions of cutina wax, castor oil, glycerin and colorant were used to prepare the lipstick formulations. The effect of the cutina wax, castor oil, glycerin and colorant compositions on the lipstick's physical properties such as viscosity, melting point and hardness were studied. The consumer acceptance was also investigated using the Leveler test and the Hedonic Scale test. Analyses of the data were conducted by using the Scientific Package For Social Science (SPSS) software in order to obtain the best lipstick formulation.

KEYWORDS. Lipstick Formulation, Natural Wax, Consumer Acceptability

INTRODUCTION

In recent years, the rise of worldwide living standard has created a demand for cosmetic products. Malaysian import for personal care products, which includes skin care, makeup, hair care and fragrances, was RM1255 million while export was RM 592 million (Afieza Khan, 2000).

The consumer demands that cosmetic products be of high quality, safe for daily application (without creating any long or short-term side effects to skin), reasonably priced to be affordable to the working class, contain ingredients that have multiple abilities, functioning as two in one formulations, and long-lasting (Synder, 1995). Cosmetic formulations vary greatly in texture, color, and physical and chemical properties.

In general, cosmetics ingredients are classified into two groups, i.e. the vehicle and the active ingredients. Vehicle group materials are actually spreading agents, yet they do not alter the appearance of the skin. The active ingredients group includes emollients, humectants, binders and surfactants. This group cause changes in the physical appearance of skin (Larmond, 1977).

Lipsticks are mixtures of waxes, oils, and pigments in varying concentration, which determine the characteristics of the final product. Lipstick contains a variety of emollients, emulsifiers, preservatives, colorants and binders (Sackheim and Lehman, 1998; Castelbajac, 1995). The ingredients commonly incorporated into lipstick formulations are vegetable oil (50%), Carnauba and/or beeswax (18%), Lanoline (25%), Colorant (4%-8%) and preservatives (Bettelheim and March, 1995). However, the formulations depend on the type of lipstick to be produced (Spires and Collins,1991). For example, a lipstick designed to remain on the lips for a prolonged period of time is composed of high percentage of wax, with low percentage of oil, and high percentage of pigment concentrations. On the other hand, a product designed for a smooth creamy feel on the lips is composed of low percentage of wax, and high percentage of oil.

The ingredients and basic material used in cosmetic formulations become the important criteria for customers in choosing the cosmetic product, as their interest in health and safety issues grew. The natural ingredients are preferable. In order to meet these challenges, application of natural cosmetic ingredients play an important role in modern cosmetic production (Pallingstone, 1998; Synder, 1995).

In this work, natural-ingredient based lipsticks were produced. Cutina wax, castor oil, glycerin and colorant were used to prepare lipstick formulations. The effect of cutina wax, castor oil, glycerin and colorant composition on lipstick's physical properties such as viscosity, melting point and hardness were studied. The consumer's acceptance was also investigated to determine the best formulation.

MATERIAL AND EXPERIMENTAL METHOD

Lipstick Formulations

The essential ingredients used in lipstick formulation were cutina wax (Cognis Oleochemicals), castor oil (Sigma Aldrich), glycerin (J.T Baker) and FD & C Red #3 Powder Color (Standardcon). The mixture of cutina wax, castor oil and glycerin was heated to 75°C to 85°C before the colorant was added. The mixture was then homogenized by using high-speed homogenizer with speed 100rpm until the colorant fully dispersed. Then, the hot

mixture was poured into lipstick molds, and left to cool into shape. 20 different formulations that contain different composition of cutina wax, castor oil, glycerin and colorant were made. The composition of each formulation is stated in Table 1 to Table 4.

Table 1. Cutina wax composition as variable parameter in lipstick formulations

Parameter/Sample	W1	W2	W3	W4	W5
	g	g	g	g	g
Castor oil	28.8	28.8	28.8	28.8	28.8
Cutina Wax	24.0	26.0	28.0	30.0	32.0
Glycerin	3.0	3.0	3.0	3.0	3.0
Colorant	3.0	3.0	3.0	3.0	3.0
Total	58.8	60.8	62.8	64.8	66.8

Table 2. Colorant composition as variable parameter in lipstick formulations

Parameter/Sample	C1	C2	C3	C4	C5
	g	g	g	g	g
Castor oil	29.4	29.4	29.4	29.4	29.4
Cutina Wax	28.8	28.8	28.8	28.8	28.8
Glycerin	1.8	1.8	1.8	1.8	1.8
Colorant	1.0	2.0	3.0	4.0	5.0
Total	61.0	62.0	63.0	64.0	65.0

Table 3. Glycerin composition as variable parameter in lipstick formulations

Parameter/Sample	G1	G2	G3	G4	G5
	g	g	g	g	g
Castor oil	28.2	28.2	28.2	28.2	28.2
Cutina Wax	27.6	27.6	27.6	27.6	27.6
Glycerin	2.0	3.0	4.0	5.0	6.0
Colorant	3.0	3.0	3.0	3.0	3.0
Total	60.8	61.8	62.8	63.8	64.8

Table 4. Castor Oil composition as variable parameter in lipstick formulations

Parameter/Sample	O1	O2	O3	O4	O5
	g	g	g	g	g
Castor oil	26.4	28.8	30.0	31.2	32.4
Cutina Wax	28.8	28.8	28.8	28.8	28.8
Glycerin	1.2	1.2	1.2	1.2	1.2
Colorant	3.0	3.0	3.0	3.0	3.0
Total	59.4	61.8	63.0	64.2	65.4

Characterization of Lipstick's Physical Properties

Viscosity

The viscosity measurement was carried out using Brookfield viscometer model HA DV-E with spindle #6 and speed 100rpm. After the sample was heated to 80°C, the spindle was then immersed into the sample to obtain the viscosity reading. The viscosity was measured at 80°C, 70°C, 60°C, 50°C, and 40°C for each formulation in the entire range of wax, castor oil, glycerin and colorant composition.

Melting Point

The melting point of the lipstick was observed with SMPI Melting Point Apparatus (Stuart Scientific). A small quantity of lipstick placed into the capillary tube of the apparatus. The vertical standing capillary tube is then attached to the bench, and then heated. The melting point of the sample defined at the temperature of which the first appearance of the liquid formation.

Hardness

Lipstick hardness determined based on the penetration time using Vicat Apparatus (Matest). A needle with a load of 100g was applied to penetrate 5mm into sample. The penetration time is then recorded. The penetration tests were repeated for 10mm and 15mm penetration for the entire range of formulation.

Investigation of Costumer Acceptance

Consumer acceptance was investigated using The Ranking test and Hedonic Scale test (Fisher and Rothamstead, 1982). Analysis of the Ranking test and Hedonic Scale test data were conducted by using The Scientific Package For Social Science (SPSS) software to obtain the best lipstick formulation (Larmond, 1977).

Ranking Test

Twenty lipstick samples were prepared. 5 samples represents each parameter or attribute known as C1, C2, C3, C4 and C5 for colorant parameter; C2, G1,G2, G3, G4 and G5 for glycerin parameter; W1, W2 ,W3, W4 and W5 for wax parameter; and O1, O2, O3, O4 and O5 for castor oil parameter. The Ranking test was repeated four times using 30 respondents each time, in order to obtain the best three formulations from each parameter studied.

Hedonic Scale Test

Hedonic scale test was used to examine the overall costumer acceptance. Fifty respondents were used in selecting the best formulation from the three best samples obtained in Ranking test. Analyses of the Hedonic Scale test data were conducted using The Scientific Package For Social Science (SPSS) software to obtain the best lipstick formulation.

RESULTS AND DISCUSSION

Effect of Composition Variation on Physical Properties of The Lipsticks

Viscosity

The effects of the various compositions of cutina wax, castor oil, glycerin and colorant on lipstick viscosity are shown in Figure 1 and Figure 2. The graphs show that the viscosity of the lipstick increases with increasing amounts of cutina wax and colorant in the formulation. On the other hand, the viscosity decreases with an increase of the castor oil and the glycerin content.

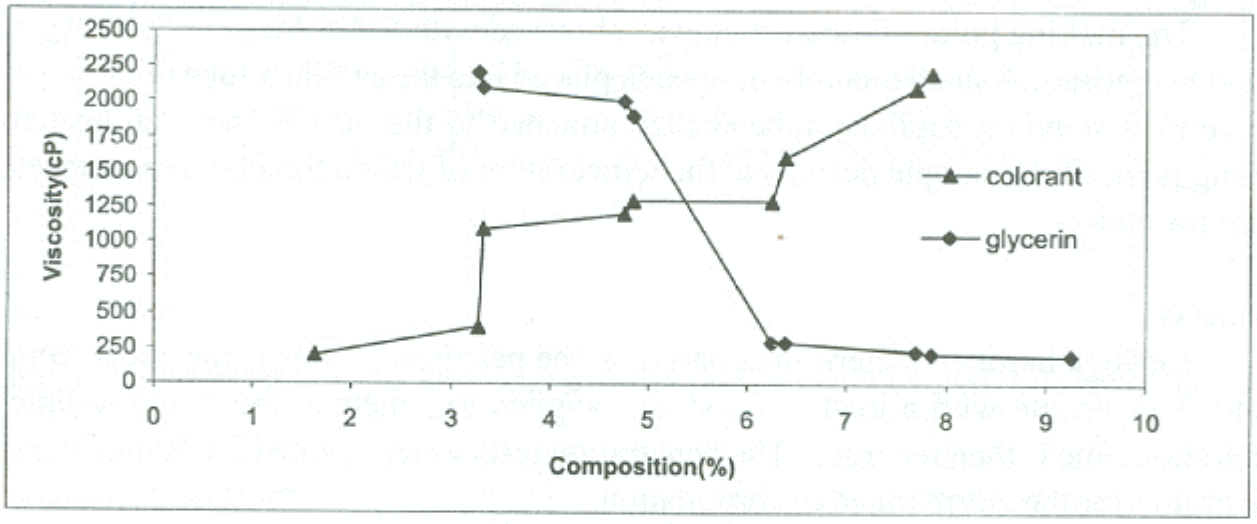

Figure 1. Effect of colorant and glycerin composition on the viscosity of the lipsticks at 50°C.

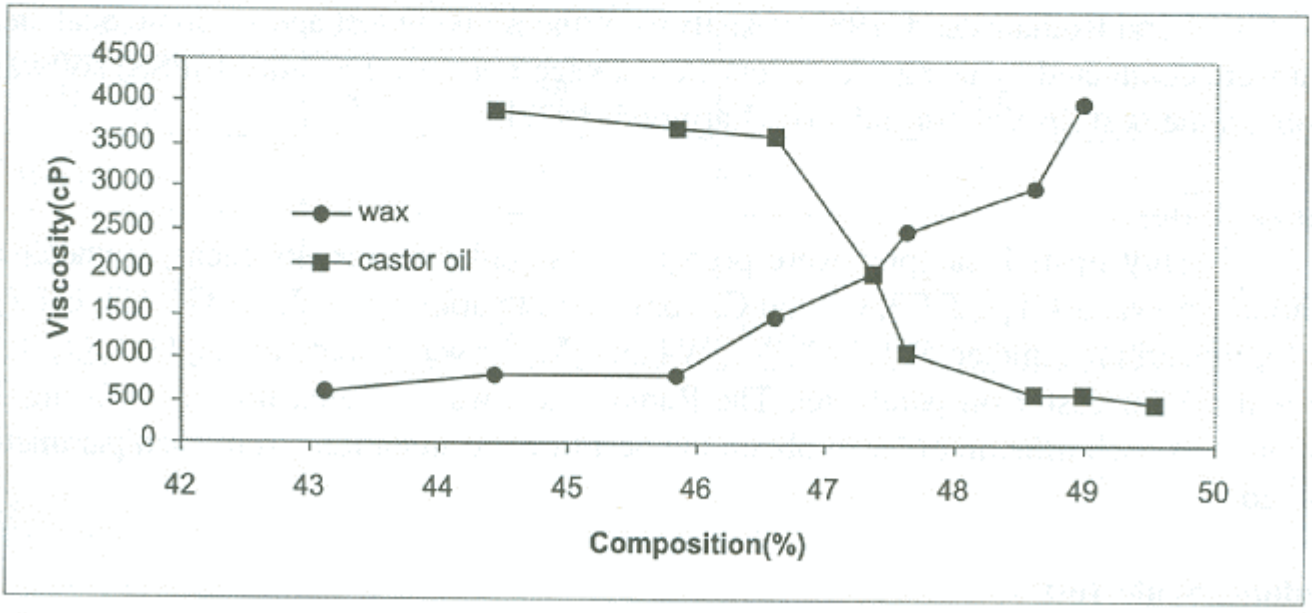

Figure 2. Effect of cutina wax and castor oil composition on the viscosity of the lipsticks at 50°C.

Melting Point

The graph shows in Figure 3 and Figure 4 indicates that melting point of the lipstick increases with the increase of wax and colorant composition. The higher amount of cutina wax and colorant gives the higher value of melting point. On the other hand, the melting point of the lipstick is reduced with the increases in oil and glycerin composition.

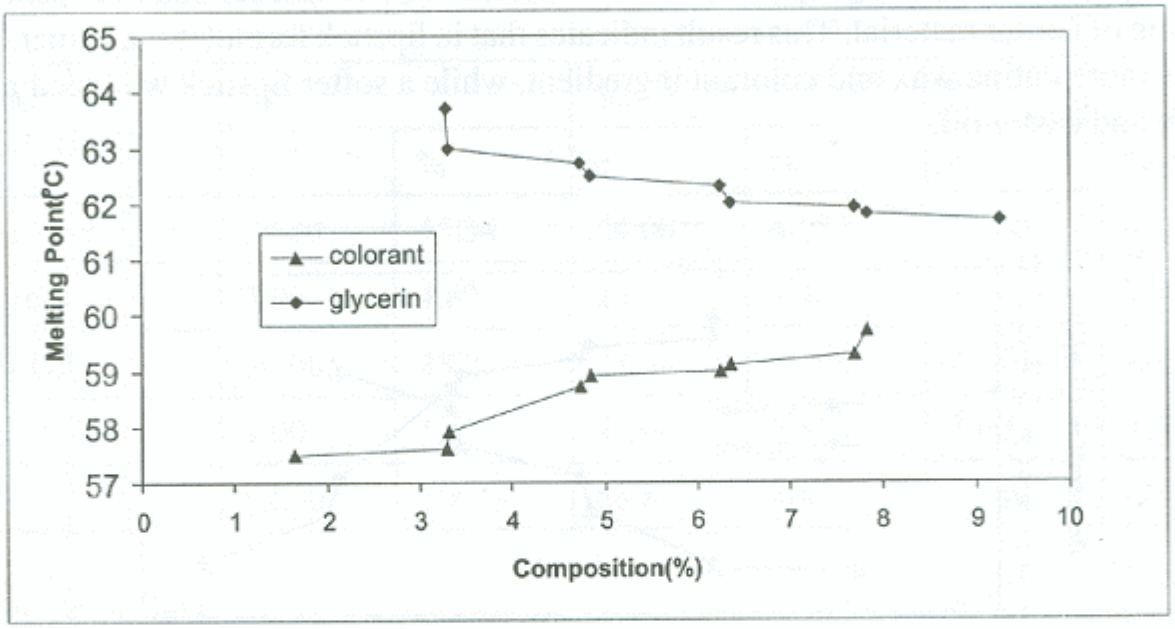

Figure 3. Effect of colorant and glycerin composition on the melting point of the lipsticks.

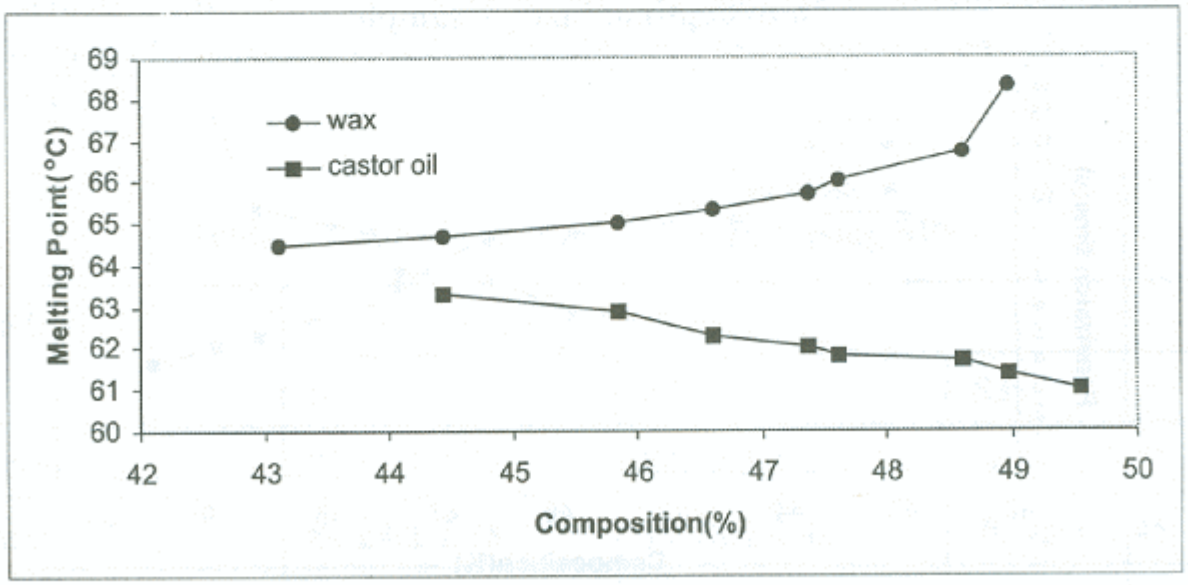

Figure 4. Effect of cutina wax and castor oil composition on melting point of the lipsticks.

Hardness

Figure 5 and Figure 6 show the penetration time as a function of cutina wax, castor oil, glycerin and colorant composition. The composition of cutina wax, castor oil, glycerin and coloring do have effect in lipstick formulation. The data show that the penetration time increases with increase of cutina wax and colorant composition. Meanwhile, an increase in oil and glycerin composition reduced the penetration time. A shorter penetration time indicates a soft sample, whereas a longer penetration time indicates a stronger resistance to penetration indicating of harder material. This result indicates that in lipstick formulation, firmer lipstick requires more cutina wax and colorant ingredient, while a softer lipstick will need more of glycerin and castor oil.

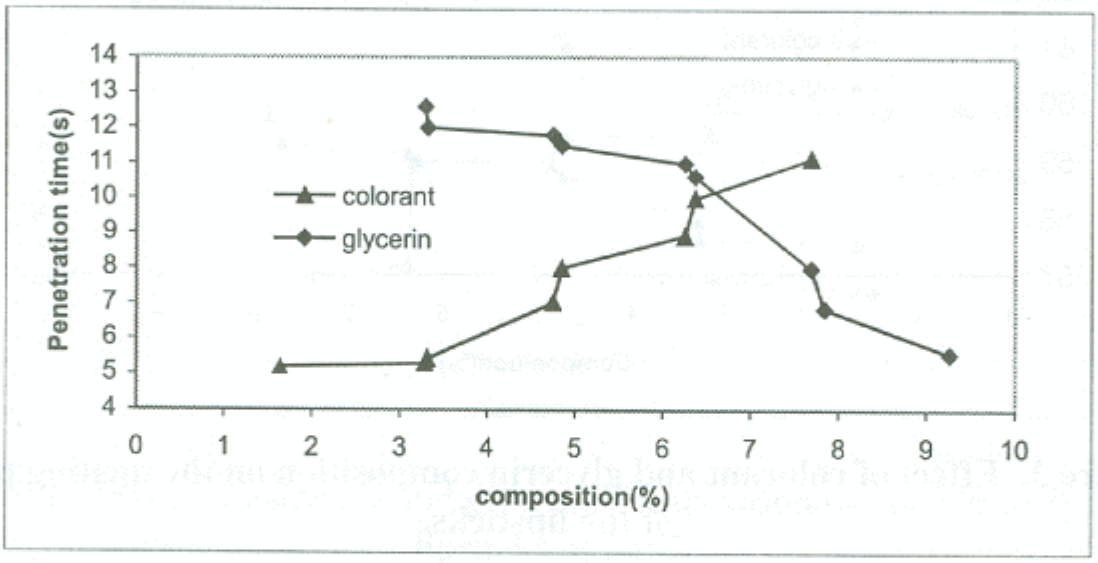

Figure 5. Effect of colorant and glycerin composition on the penetration time at 5mm depth of lipstick sample

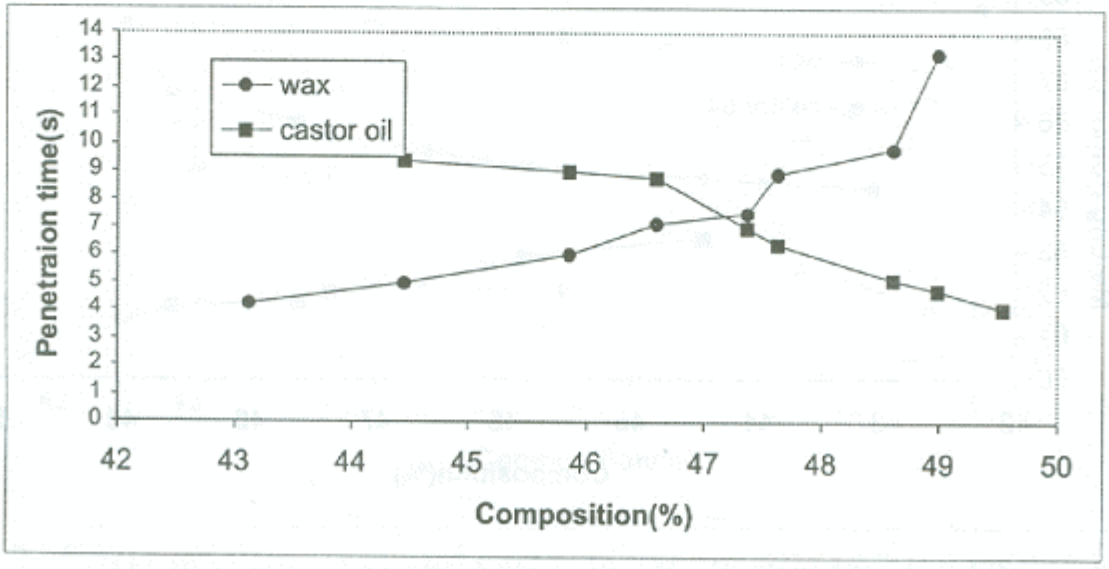

Figure 6. Effect of cutina wax and castor oil composition on the penetration time at 5mm depth of lipstick sample

Effect of Variation in Composition on Consumer Acceptance.

Ranking Test

Table 5 shows the best three formulations selected by respondents in Ranking test.

Table 5. Result of Ranking Test.

Sample/ Compositions	S1		S2		S3	
	g	%	g	%	g	%
Cutina Wax	28.20	45.34	24.00	40.82	30.00	46.58
Glycerin	3.00	4.82	2.00	3.40	5.00	7.76
Castor Oil	30.00	48.23	28.80	48.98	26.40	40.99
Colorant	1.00	1.61	4.00	6.80	3.00	4.66
Total	62.00	100.00	58.80	100.00	64.40	100.00

Hedonic Scale Test

Table 6 indicates that the respondents are slightly more inclined towards the color in S2 formulation than in the S1 and S3 formulation, which indicates preference to a firmer lipstick. However, the softness effect of the castor oil content and viscosity level in S1 is also preferable the softer S2 and S3 formulation. According to the overall acceptance, the most preferred formulation is SI, which obtained the highest mean value for overall acceptance.

Table 6. Result of Hedonic Scale Test using SPSS.

ATTRIBUTE	MEAN OF SAMPLE		
	S1	S2	S3
Colorant	81.56 ± 1.44	84.67 ± 1.28	60.27 ± 1.71
Oiliness	84.24 ± 1.38	71.78 ± 1.42	70.48 ± 1.45
Viscosity	81.47 ± 1.41	74.96 ± 1.45	70.07 ± 1.66
Overall acceptance	82.51 ± 1.22	78.40 ± 1.38	65.59 ± 1.53

CONCLUSION

Natural ingredient based lipstick formulations have been prepared and investigated. The effects of varying the amount of cutina wax, castor oil, glycerin and colorant compositions on the lipstick's physical properties have been studied. The result indicates that physical properties of the lipstick can be manipulated by changing the composition of cutina wax, castor oil, glycerin and colorant in the formulation. The viscosity, melting point and hardness of the lipstick are function of the cutina wax and coloring composition. The lipstick's viscosity, melting point and hardness increase with an increasing of the cutina wax and colorant content. The relative increase in glycerin and castor oil in the formulation reduced the viscosity, melting point and hardness of the lipstick. The consumer acceptance has also been investigated. The analyses revealed that the best lipstick formulation is S1.

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