การพัฒนาตำรับสบู่กึ่งเหลว

Development of Semisolid Soap

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บทคัดย่อ

การศึกษาค้นคว้าอิสระนี้มีวัตถุประสงค์เพื่อพัฒนาตำรับสบู่กึ่งเหลวจากน้ำมันมะพร้าวและน้ำมันปาล์ม โดยใช้ปฏิกิริยาสะปอนนิฟิเคชั่นกับด่างโซเดียมไฮดรอกไซด์และโพแทสเซียมไฮดรอกไซด์ จากการหาอัตราส่วนของด่างทั้งสอง พบว่าอัตราส่วนระหว่างโซเดียมไฮดรอกไซด์และโพแทสเซียมไฮดรอกไซด์ที่ 1:5 ส่วนโดยโมล เป็นอัตราส่วนที่ให้ความหนืดเหมาะสมที่สุด จากนั้นปรับคุณสมบัติของสบู่โดยการใช้น้ำมันละหุ่งน้ำมันมะกอกและน้ำมันรำข้าว พบว่าน้ำมันรำข้าวให้คุณสมบัติที่เหมาะสม จากการทดสอบความคงตัวโดยเก็บผลิตภัณฑ์ใน 2 สภาวะคือสภาวะอุณหภูมิห้อง (35°C) และสภาวะร้อนสลับเย็น คือจัดเก็บที่อุณหภูมิ 45°C สลับกับสภาวะที่อุณหภูมิ 10°C รวม 6 รอบใช้เวลารอบละ 24 ชั่วโมง พบว่าตำรับมีความคงตัวไม่มีการเปลี่ยนแปลงด้านกายภาพจากการประเมินความพึงพอใจในอาสาสมัคร 20 คนต่อภาพรวมของผลิตภัณฑ์ การชำระล้าง การล้างน้ำออก ความอ่อนโยน ความพึงพอใจโดยรวม ความชุ่มชื้น พบว่าอาสาสมัครมีความพึงพอใจกับสบู่กึ่งเหลวมาก โดยมีคะแนนเฉลี่ยที่ระดับ 7.75 – 8.22

คำสำคัญ: น้ำมันมะพร้าว/น้ำมันปาล์ม/น้ำมันละหุ่ง/น้ำมันมะกอก/น้ำมันรำข้าว/สบู่กึ่งเหลว/สะปอนนิฟิเคชั่น/ความพึงพอใจ

Abstract

This independent study aims to develop semisolid soap formulation from coconut oil and palm oil saponified with sodium hydroxide and potassium hydroxide. The most suitable ratio of sodium hydroxide and potassium hydroxide for making semisolid soap was 1:5 by mole. It gave the most suitable semisolid appearance for further development process. Moreover, the performance of soap was improved by varying castor oil, olive oil, and rice bran oil and the formula with rice bran oil gave the best quality. The results from stability tests, room temperature (35^{o}C) condition and accelerated condition with 6 cycles of heat-cool cycle which each cycle took 24 hours, showed that the soaps were stable and the appearances had not been altered. Furthermore, the result of satisfactory evaluation by 20 volunteers showed that they were satisfied with the soap considering the satisfaction levels of appearance, cleansing, easily washing, mildness, overall satisfaction, moisturizing, and foam level were at the average of 7.75-8.25.

Keywords: Coconut Oil/Palm Oil/Castor Oil/Olive Oil/Rice Bran Oil/Semisolid Soap/Saponification/Satisfaction Evaluation

Introduction

Soap has been used as skin cleansing in our daily lives. Apart from hard soap bar and liquid soap that we normally see in the market, there is another kind of soap which is semisolid soap. This new type of soap has been getting popularity among western soap makers. However, this soap type has not been produced in Thailand. Therefore, it was interesting to make semisolid soap to increase value of cleansing products as well as presenting alternative for purchasing skin cleansing product in Thailand market.

Objectives

1. To develop and formulate semisolid soap
2. To study stability of soap
3. To study volunteers' satisfaction towards the soap

Literature reviews

Soap is normally obtained from chemical reaction, saponification, of fatty acid with alkaline solution which has glycerin as by product (Rasami, 2010). There are many types of soap such as hard soap, superfatting soap, syndet soap, transparent soap, liquid soap and so on (Mangklarattanasri, 2009). Different types of soap are differentiated in either ingredients or production process which leads to various appearances and properties of the soaps. The main ingredients of soap making are as following (Hutapat, 2006).

Vegetable oils or animal fats are important because they determine character and efficiency of the outcome. For example, coconut oil, one of the most basic ingredients for soapmaking, will give hard bar soap with lots of fluffy lather. It is better to use other oils in the same formula as coconut oil to increase moisturizing property in the soap (Hutapat, 2006).

The alkaline that mostly used in soap making are sodium hydroxide (NaOH) for making hard bar soap and potassium hydroxide (KOH) in order to make soft or liquid soap (Hutapat, 2006).

Method

1. Preparation of semisolid soap
   1.1 Coconut oil and palm oil were selected as main ingredient in formula development.
   1.2 Saponification value was applied to calculate amount of alkaline for formulation.
   1.3 The ratio of NaOH:KOH was varied from 1:1, 1:2, 1:3, 1:4 to 1:5 by mole.

1.4 Other kinds of oils were added into formulas i.e. castor oil, olive oil, and rice bran oil to study property enhancement of the soap.

1.5 Other ingredients were added in order to increase quality of the soap which were citric acid, sodium laureth sulfate (SLES), stearic acid, and cocamide DEA.

1.6 All of the formulas were shown in Table 1.

Table 1 Semisolid Soap Formulation

Ingredients (gram)	1	2	3	4	5	6	7	8	9	10	11
Phase A											
Coconut oil	200	200	200	200	200	160	160	160	160	160	160
Palm oil	200	200	200	200	200	160	160	160	160	160	160
Castor oil	-	-	-	-	-	80	-	-	-	-	-
Olive oil	-	-	-	-	-	-	80	-	-	-	-
Rice Bran oil	-	-	-	-	-	-	-	80	20	20	20
Beeswax	-	-	-	-	-	-	-	-	60	-	-
Stearic Acid	-	-	-	-	-	-	-	-	-	60	30
Phase B											
Water	140	140	140	140	140	140	140	140	140	140	140
Phase C											
Citric Acid	-	-	-	-	-	-	-	-	13.6	13.6	13.6
SLES	-	-	-	-	-	-	-	-	20	20	30
Cocamide DEA	-	-	-	-	-	-	-	-	-	-	12.4

2. Stability test

The soap from selected formula was stored separately into 2 conditions; (1) room temperature (35^{o}C) condition and (2) accelerated condition with 6 cycles of heat-cool cycle which each cycle took 24 hours. Later, the soap would be put through assessments which were pH, weight, appearance and ability of the soap.

3. Satisfactory evaluation

The soap was given along with evaluation form to 20 volunteers. All volunteers were informed about the soap and amount of usage. The evaluation was divided into 2 parts; (1) volunteers' basic information and their soap experiences and (2) their satisfaction towards the semisolid soap which scored 0 – 10. The points from volunteers would be calculated for mean and standard deviation by Microsoft Excel version 2007.

Results and Discussion

1. Selection of NaOH:KOH ratio for making semisolid soap

In formula 1 – 5, there were the same amount of coconut oil, palm oil, and water but varied in ratio of NaOH:KOH. For the first formula, ratio of NaOH:KOH was 1:5 by mole which calculated to be 30.5 grams and 42.1 grams respectively. While following formulas would remain ratio of NaOH as 1, the KOH ratio was changed to 2, 3, 4, and 5 by mole in formula 2 – 5 respectively. As the result from formula 1 – 5, ratio of alkaline solution from formula 5 was the most suitable ratio for semisolid soap development due to its appearance and quality which shown in Table 2 and Figure 1. The soaps were measured pH in the process of diluting soap with water by using equal amount of both substances.

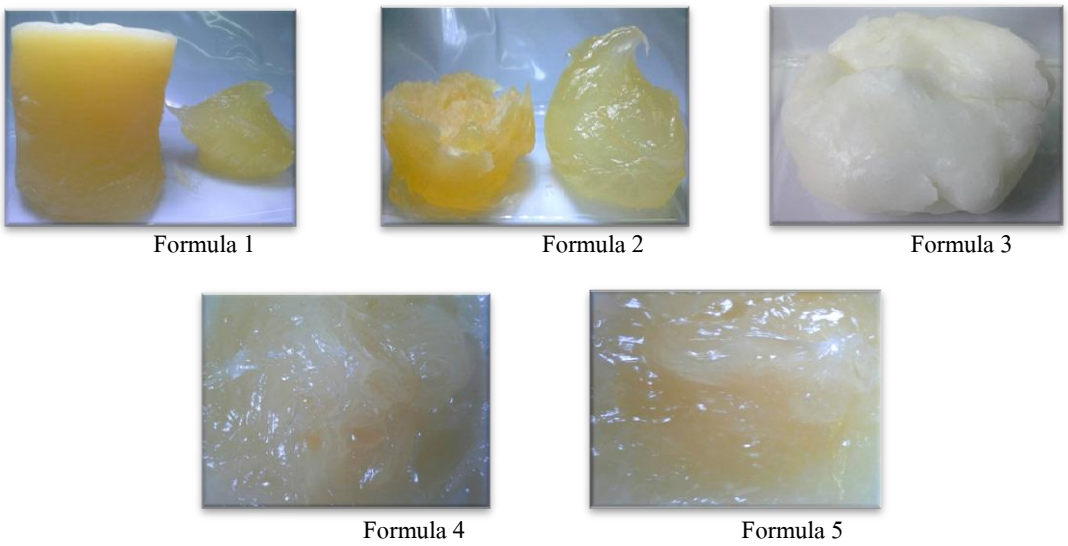

Figure 1 Appearances of Semisolid Soap Formula 1 – 5

Table 2 Appearances and Properties of Semisolid Soap Formula 1 – 5

Formula	Appearance	Viscosity	Color	Smell	pH
1	Hard soap at the top layers with soft soap at the bottom	++++	Yellow	Little rancid	10
2	Thin layer of hard soap at the top with soft soap at the lower part	+++	Yellow	Little rancid	10
3	Soap appeared similar to dough	+++++	White	Little rancid	10
4	Liquid with viscosity	++	Yellow	Little rancid	10
5	Liquid with viscosity	+	Yellow	Little rancid	10

+++++ means viscous dough; ++++ means glue paste viscosity

+++ means viscosity between glue paste and gel; ++ means viscous gel

+ means liquid soap viscosity

2. Addition of other kinds of oils to increase moisturizing property

Castor oil, olive oil, and rice bran oil were used to increase moisturizer in formula 6 – 8 respectively. These 3 formulas had the ratio of NaOH:KOH as 1:5 by mole which same as formula 5. The formula that gave the best result in appearance and quality among formula 6 – 8 was formula 8. It gave a little rancid smell and excellently increased moisturizing property which showed in Tables 3 and 4 and Figure 2.

Formula 6 Formula 7 Formula 8

Figure 2 Appearances of Formula 6 – 8

Table 3 Properties of Formula 6 – 8

Formula	Appearance	Viscosity	Color	Smell	pH
6	Viscous liquid	+++	Yellow	Very rancid	9.5
7	Viscous liquid	++	Yellow	Little rancid	9.5
8	Viscous liquid	++	Yellow	Little rancid	9.5

Table 4 Qualities of Formula 6 -8

Properties	Formula 6	Formula 7	Formula 8
Cleansing	4	4	4
Ease of foam forming	4	3	4
Level of foam	4	3	4
Moisturizing	4	5	5

3. Developing appearance of semisolid soap

Table 4 showed that the soap from formula 8 was more like liquid form. To develop the soap to become more semisolid and foam forming, more ingredients were added as shown in formula 9 – 11. According to their quality of saponification and ability as thickener, beeswax was added to formula 9 while stearic acid was used in formula 10. Moreover, sodium laureth sulfate (SLES) was used into 3 formulas to enhance foam in the soap. As the result displayed in Figure 3 that both beeswax and stearic acid were able to increase semisolid appearance of the soaps, formula 10 with stearic acid showed better quality in most of assessments. On the other hand, the soap from formula 10 had difficulty in application not only because of its viscosity but also its low level of foam during use. For this reason, formula 10 was continually improved by decreasing amount of stearic acid as well as adding amount of SLES and other foaming agent, cocamide DEA. These ingredients finally made the best formula in this independent study. The soap from

formula 11 gave excellent appearance with great properties which the result was shown in Tables 5, 6, and 7 and Figure 3.

Table 5 Properties of Formula 9 – 11

Formula	Appearance	Viscosity(cP)	Color	pH
9	Uniform semisolid	81800	White	9.7
10	Uniform semisolid	65100	White	9.8
11	Uniform semisolid	98100	White	9.8

Formula 9 Formula 10 Formula 11

Figure 3 Appearances of Formula 9 – 11

Table 6 Foam Assessment of Formula 9 – 11

Properties	Formula		
	9	**10**	**11**
Foam level (tap water)			
0 minute	13 cm	11.2 cm	13 cm
2 minutes	6.4 cm	11.2 cm	13 cm
Foam level (DI water)			
0 minute	11.2 cm	13 cm	13 cm
2 minutes	8 cm	13 cm	13 cm

Table 7 Qualities of Formula 9 – 11

Properties	Formula		
	9	**10**	**11**
Cleansing	2	5	5
Ease of foam forming	3	3	5
Foam fineness	4	4	4
Foam level	3	3	5
Ease of wash	3	4	5
Moisturizing	4	4	4

After that, the soap from this formula would be put through stability test, 2 containers of equal amount of soap was stored separately;(1) room temperature and (2) heat-cool cycle, with assessments and given to 20 volunteers for satisfaction evaluations.

4. Stability test

As a result of stability test, there was no difference of the soap after stored in different conditions such as appearance, smell, color, and so on as displayed in Table 8 and Figure 4. In other words, the semisolid soap was stable in various conditions and temperature had no effect on overall property of the soap.

Table 8 Stability Test of Formula 11

Properties	Initial	Room Condition ($35^{o}C$)	Heat-Cool Condition
pH	9.8	9.8	9.8
Appearance	Semisolid	Semisolid	Semisolid
Smell	Good	Unchanged	Unchanged
Color	White	White	White
Weight (gram)	100	100	100

Initial | After (Room Temperature) | After (Heat-Cool Condition)

Figure 4 Stability Test Results

5. Satisfaction evaluation

There were 20 volunteers which 80 percent of them were women and 20 percent were men. Most of volunteers' ages were in the range of 21 – 30 years old and 31- 40 years old which each range was calculated as 30 percent. Next, it was age between 41- 50 years old and 51 – 60 years old with percentage of 20 and 15, respectively. Lastly was 5 percent which was the range of age under 20.

The most popular soap that was used by volunteers in their daily lives was bar soap which was 55 percent. There were 20 percent of volunteers used liquid soap and 5 percent had been using both types of soap.

Table 9 Mean and standard deviation of satisfactory scores

Properties	Score
Appearance	8.25±1.48
Foam level	7.75±1.71
Cleansing	8.25±1.77
Ease of wash	8.10±2.29
Moisturizing	7.85±2.03
Mildness	8.10±2.05
Overall satisfaction	8.00±1.78

The result of the evaluation showed in Table 9 that volunteers were satisfied with semisolid soap with the level of 7.75-8.25 (scores 0 – 10). The satisfaction levels of appearance, cleansing, easily washing, mildness, overall satisfaction, moisturizing and foam level were 8.25, 8.25, 8.1, 8.1, 8, 7.85, and 7.75 respectively.

Considering scores from each volunteers showed in the appendix, by giving score of 6 and above showed volunteers' acceptance of the soap. On the other hand, by giving score 5 and under showed that the soap was unacceptable in volunteers' perspectives. The result of volunteers' acceptance was shown in Table 10 that almost of volunteers gave score of 6 and above in every aspects of evaluation. This meant the semisolid soap was accepted by volunteers with percentage of 75 to 95.

Table 10 Volunteers' acceptance of semisolid soap

Properties	Number of people	Percentage
Appearance	19	95
Foam level	18	90
Cleansing	19	95
Ease of wash	15	75
Moisturizing	16	80
Mildness	16	80
Overall satisfaction	16	80

Conclusion

Coconut oil and palm oil were used as main ingredients of semisolid soap in this study. The most suitable ratio of NaOH:KOH for formulating semisolid soap was 1:5 by mole. The formula with best result in enhancing moisture property was formula with addition of rice bran oil. However, the soap of this formula still looked liquid-like. In order to increase semisolid appearance to the soap, beeswax and stearic acid were used in formula 9 and 10, respectively. The soaps from both formulas were uniform with semisolid character but too high viscosity and low foam level. Therefore, SLES and cocamide DEA were used to increase foam level together with lowering amount of stearic acid to adjust character and develop quality. As a result, the last

formula is the best formula for making semisolid soap from this independent study. From studying stability test of the soap from the best formula (formula 11), the soap was stable in various conditions, different temperatures could not change overall appearance and qualities of the soap.

From the result of satisfactory evaluation by 20 volunteers showed that the mean of satisfaction scores which had scores more than 7 indicating that they were satisfies with the soap characteristics. The satisfactory levels of all aspects were at the average of 7.75-8.25. Furthermore, the total percentage of volunteers' acceptance was in range of 75 – 95.

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