

**DEVELOPMENT  
OF  
LOTION WITH POMEGRANATE EXTRACT**  
*(Punica granatum L.)*

**By**  
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4190

**A special project submitted to the Faculty of Biotechnology,  
Assumption University in part of fulfillment of the requirement of the  
degree of Bachelor of Science in Biotechnology  
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Title : Development of lotion with pomegranate extract (*Punica granatum L.*)  
By : Ms. Jaruwan Boondara  
Project Advisor : Dr. Aussama Soontrunnarudrungsri  
Level of study : Bachelor of Science  
Department : Food Technology  
Faculty : Biotechnology  
Academic year : 2014



Advisor



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## ABSTRACT

At the present, the people tend to care more about their health and their beauty than a part. The good appearance outside impacts the attitude of other people and it indicates your discipline to take care of yourself. A good appearance is the one factor that can be supported the people in several careers. Therefore, many skin care and cosmetic products are very popular. Nowadays, the rising number of consumers who concern about the ingredients contain in the skin care and cosmetics products, have to free from harmful ingredients, free from synthetic chemicals and using natural ingredient instead. Herbal lotions are prepared by using cosmetic associated with bioactive ingredients or pharmaceuticals such as botanical ingredients. Botanical ingredients influence the biological function of skin, provide nutrients, vitamin and antioxidant. The aim of this project is to develop lotion that contain herbal extracts for studying the effect of using different herbal in the lotion. The herbs used to study in this research, are composing of three types including pomegranate (*Punica granatum L.*), curcumins (*Curcuma longa.*) and pineapple fiber (*Ananas comosus*). According to the studying, the final formulation was consisted of 2% of Sodium polyacrylate, 3% of Dicaprylyl ether, 4% of Mineral oil 70, 5% of Propylene glycol, 0.6% of DMDM hydantion, 83.9% of deionize water, 0.2% of Sodium stearyl glutamate, 1% of Pomegranate Extract, and 0.3% of Perfume. Consumer test was conducted with 100 consumers at Assumption University and Sena, Ayutthaya province at Radbumroongsilp School. The product was tested with a target group of people who regularly use lotion. There are 90% accept the body lotion whereas 10% don't accept. 70% of consumers will buy this product if the product is available in market, 8% of consumers don't sure and 22% of consumers will not buy this product. Due to 250 ml of body lotion the preferable price from 100 consumers is around 100-200 baht (69%).



## ACKNOWLEDGMENT

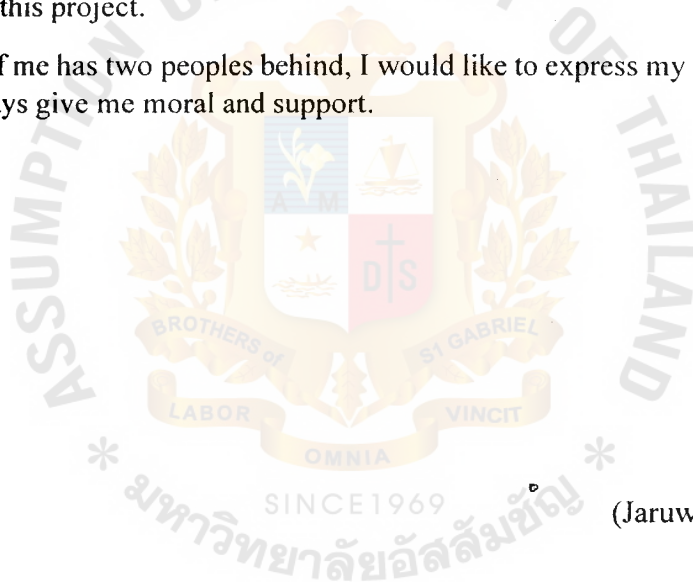
This project would not have been possible without the kind support and help of several people. I would like to extend my sincere thanks to all of them.

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(Jaruwan Boondara)

2014

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## Chapter 1

### Introduction

The beauty and cosmetic had presented since the ancient world until now, the concept of herbal cosmetics in generally, it refers to natural cosmetics, makes from natural materials ,contain one or more herbs in based ingredients, free from synthetic chemical and have less side effect to the skin. Moreover, it provides the body with nutrients and other useful vitamins, said by Raymond Reed founding member of U.S' Society of Cosmetics Chemist in 1961 and Dr.Albert kligman in the year 1984 gives the definition of herbal cosmetic that it is the substances that have both cosmetic and therapeutic benefit. Comparing the herbal cosmetics with the other beauty products, the herbal cosmetics are safer to use due to they are tested by dermatologists that they are hypo-allergenic, safe to use every day.

At the present, the increasing number of consumers who care more about ingredients in the product such as parabens, fragrance, mineral oil, synthetic chemical and etc. They prefer more natural ingredients and free from harmful chemicals. Natural cosmetics can apply all skin types by no side effects when compare with synthetic cosmetics that can irritate the skin, block the pores, make skin dry or oily. Moreover, some herbal cosmetics are not expensive, consumers are easy to afford, and an estimate of world health organization (WHO) indicates 80% of world population depend on natural products due to the less side effect and the rising of modern medicine cost. (Josni S L. and Pawar A H. Herbal Cosmetics and Cosmeceuticals, Natural product chemical & research, 2015). Herbal cosmetics are prepared by using cosmetic associated with bioactive ingredients or pharmaceuticals such as botanical ingredients. Botanical ingredients influence the biological function of skin, provide nutrients, vitamin and antioxidant (Kapoor, herbal cosmetics for skin and hair care, National botanical research institute, Luck now, India)

The herbs used to study in this research, were consisted of three types including pomegranate (*Punica granatum L.*), curcumins (*Curcuma longa.*) and pineapple fiber (*Ananas comosus*). Therefore, the aim of this project is to develop lotion that contains pomegranate extracts.

### Objectives

1. To formulate the appropriate based lotion.
2. To study effect of herbal extract obtained in lotion
3. To conduct the acceptance test for pomegranate lotion





## Chapter 2

### Literature Review

#### 1. Herbal cosmetics

##### 1.1 The definition of herbal cosmetics

Herbal cosmetics are formulate by using different cosmetic ingredients to developing base and adding one or more herbal ingredients to use as therapeutic benefits for enhancing health and beauty of skin' biological texture and function.

(Source: Josni S L. and Pawar A H. Herbal Cosmetics and Cosmeceuticals, Natural product chemical & research, 2015).

#### 2. Lotion

##### 2.1 The definition of lotion

The definition of lotion from Collin dictionary is a liquid preparation having a soothing, cleansing, or antiseptic action, applied to the skin, etc.

##### 2.2 Type of lotion

- **Bath lotion**

Bath lotion is used for applying to the whole body after take a shower or during the bath time. The purpose of using bath lotion is to replace the skin's essential oils and moisture that is removed during shower time and makes the skin softer.

- **Milk Bath**

Milk bath is the use during the bath time to nourish the skin, soaking in a while to sooth and soften the skin.

- **Body Lotion**

Body lotion is able to apply dairy to keep the smooth and healthy skin. The areas that have to more take care, is elbow, knees and both of feet, which can apply the extra body lotion.

- **Baby Lotion**

The baby lotion is used for baby and can be used in the people that have sensitive skin. This lotion is gentle and free from scent, alcohol and harsh chemical. This type of lotion has to be approved by dermatologists

- **Hand lotion**

This lotion is produced to prevent dehydration of specific area like hands, due to the hands are washed the most and the skin on hands are tended to dryness easily. The hand lotion help to rehydrate and nourish for the hands.

(Source: <http://www.wdxcyber.com/skin-lotion.html>)

## 2.3 composition of lotion

There are 5 main compositions of lotion including;

- **Aqueous phase**

Water is the main composition of lotion, it helps lotion to easily spread and absorb to skin. And water is used to dissolve the dry ingredients during development lotion.

- **Oily phase**

Oil is another main composition under the water, it helps to increase the skin's moisture by forming a gentle layer and sealing the moisture to stay on skin.

- **An emulsion**

This part is very important to keep the oil phase and aqueous phase together due to the water and oil is able to be easily separate.

- **Extracts/chemicals for specific purposes**

These can be the herbal extract like aloe Vera that is very popular to put in the lotion due to properties in moisturizing and soothing the skin. And others depend on the type of lotion and specific purpose.

- **Other ingredients**

There are several ingredients that commonly put into the lotion such as fragrances, glycerol, petroleum jelly, dyes, preservatives, proteins and stabilizing agents.

(Source: <http://idiva.com/news-style-beauty/types-of-lotion-for-skincare/10260>)

## 2.4 application of lotion

The classification of lotion are made due to their application that can classify into six categories.

- **Skin maintaining**

The purpose of these lotions are to keep the skin soft and looking healthy, to prevent the moisture loss due to the environment changing such as weather, temperature, pollution, and etc. these lotions can further classify to more suitable for consumer's skin type such as dry, normal, oily and sensitive skin

- **Damage repairing**

These lotions are used for specific purpose depend on the problem on skin. For example the skin that is very dry, the burn skin from sun damage, the highly sensitive skin.

- **Cellulite-reduction**

The aim of these lotions is to increase skin smoothness and decrease orange-peel skin by reducing the cellulite under skin.

- **Anti-wrinkle or anti-ageing**

These lotions are produced to help the mature skin. The retinol, vitamin E and other anti-oxidants are normally put in the lotion.



- **Anti-tan and fairness**

These lotions are used for specific purpose depend on the consumer's need, some consumer need to be the tan skin while normally they have fair skin, these lotion can fulfill the consumer's need by increasing the darkening pigment in to the lotion. It's help to change the color's skin within a short time.

- **Anti-stretch marks**

The purpose of these lotion is to reduce the stretch mark on the skin, it's very popular among pregnant women and it can divide into two type of lotion according to the stage including; the preventive stage and repair stage.

(Source: <http://idiva.com/news-style-beauty/types-of-lotion-for-skincare/10260>)

### 3. Pomegranate (*Punica granatum L.*)

A pomegranate is one type of fruit that is very popular around the world owing to the pomegranate is very high in nutrient and antioxidant. The original area of pomegranate is located in areas of Northern India, Pakistan, Iran and Afghanistan, though Peninsular Malaysia, Southeast Asia, California, Armenia, tropical Africa and others. This fruit has an orange-yellow, red or purple color on the peel outside and inside of this fruit is filled with pink arils with seed that are the juicy and sweet taste.

(Source: Gil, María Antioxidant Activity of Pomegranate Juice and Its Relationship with Phenolic Composition and Processing J. Agric. Food Chem. Journal of Agricultural and Food Chemistry)



**Figure 1: Pomegranate (*Punica granatum L.*)**

(Source: [http://www.healthydunia.com/article/995/29/benefits\\_of\\_pomegranate.html](http://www.healthydunia.com/article/995/29/benefits_of_pomegranate.html))



### 3.1 Pomegranate Fruit Parts and Constituents

**Table1:** Lists the principal constituents of the *Punica granatum* tree

Plant Component	Constituents
Pomegranate juice	Anthocyanin, glucose, ascorbic acid, ellagic acid, caffeic acid, catechin, EGCG, quercetin, rutin, numerous mineral, particularly iron, amino acids
Pomegranate seed oil	95-percent punica acid, ellagic acid, fatty acid (sterols)
Pomegranate pericarp (peel, rind)	Phenolic punicalagins; gallic acid and other fatty acids, catechin, EGCG, quercetin, rutin, and other flavonols, flavones, flavonones, anthocyanidins
Pomegranate leaves	Tannins (punicalin and punicafolin) and flavone glycosides, including luteolin and apigenin
Pomegranate flower	Gallic acid, ursolic acid, triterpenoids, including maslinic and Asiatic acid, other unidentified constituents
Pomegranate roots and bark	Ellagitannins, including punicalin and punicalagin, numerous, piperidine alkaloids

(Source: Jurenka Julie, MT. Therapeutic application of pomegranate (*Punica granatum* L.) alternative medicine review volume 13, number 2, 2008)

## 4.2 benefit of pomegranate

### 4.2.1 Beauty Benefits

- **Regenerate Cells**

Pomegranate has the property of regenerate cells by encouraging skin cell to regenerate, the tissue was repaired and leading to heal wound.

- **Protect from the Sun**

According to sun is the main cause of skin cancer, the skin is damaged by the sun every day produce the free radical damage, consuming the pomegranate can help to protect against radical damage due to the oil of pomegranate consist of antioxidant ellagic acid that can help to inhibit skin tumors that might become cancer in further.

- **Slow Aging**

Dark spot, age spots, fine lines and wrinkles is the characteristic that indicate the process of aging, the pomegranate is the fruit that can prevent or slow the process of aging owing to the highly anti-oxidant.

- **Produce Youthful Skin**

The skin was softer, firmer and youthful due to pomegranate can help in producing elastin and collagen.

- **Help with Dry Skin**

Due to pomegranate has a molecular structure that can penetrate into deep layer in the skin, the skincare production often use pomegranate as one composition in the lotion or skincare product.

- **Use for Oily or Combination Skin.**

Oily or combination skin type tend to occur the acne prone easily so, the pomegranates were used to sooth these outbreak and reduce the chance of occurring burns or scarring.

#### 4.2.2. Health Benefits

- **Eliminate Free Radicals.**

Pomegranate is the fruit that has high level of antioxidant as hydrolysable tannin or polyphenols that help to decreases the effect of free radical and can eliminate the radicals from the body.

- **Protect Cardiovascular Health**

The atherosclerosis is occurred due to the plaque block the arteries vessels, to minimize the atherosclerosis the plaque should be removed. The pomegranate juice can act as a blood thinner and help to remove the plaque from the arteries vessels, therefore; the pomegranate can reduce the chance of atherosclerosis. Moreover, the pomegranate can decreases the LDL cholesterol and increases HDL cholesterol that can minimize the chance to occur the cardiovascular problem

(Source: Aviram M. Pomegranate juice consumption reduces oxidative stress, atherogenic modifications to LDL, and platelet aggregation: studies in humans and in atherosclerotic apolipoprotein E-deficient mice 1, 2)

- **Fight Cancer**

Some type of cancers such as breast cancer, prostate cancer and skin cancer can prevent due to the antioxidant property of pomegranate.

- **Improve Bone Quality**

Pomegranates has the enzyme that can inhibit the damage of cartilage and furthermore, it can minimize the cartilage degeneration resulting in lower the risk of osteoarthritis.

- **Boost Digestive Condition**

Pomegranate juice can boot the digestive condition by stimulating the enzyme with anti-bacterial properties that improve the digestive condition and help to prevent



the chance to occur hemorrhoids, nausea, dysentery, intestinal parasites, piles and diarrhea.

- **Increase Appetite**

Pomegranate has effect on appetite by pomegranate juice can increase appetite in the children. Some children don't have a strong appetite so drinking pomegranate help them.

- **Cure Anemia**

Pomegranate contains high amount of iron that can increase the level of hemoglobin in circulatory system, aiding to correct anemia.

- **Reduce Inflammation**

Due to high level of vitamin C in pomegranate leading to the anti-inflammatory properties that will to reduce the asthma, sore throat, and cough and wheezing.

(Source: <http://www.med-health.net/Benefits-Of-Pomegranate.html>)

#### 4. **Pineapple (*Ananas comosus*)**

Pineapple (*Ananas comosus*) is the fruit originate in the central and south of America and in several tropical and subtropical countries including Hawaii, India, China, Kenya, South Africa, Malaysia, Philippines and Thailand. It has been used as a medicinal plant due to it contains bromelain that was known since 1876 (Peckoldt et al., In: Taussig, 1988). Bromelain had found in the stem of pineapple plant that has important properties for example malignant cell growth. Thrombus formation, control diarrhea.

(Source: Cohen, 1964; Taussig and Batkin, 1988; Kelly, 1996; Maurer, 2001).



Figure2- Pineapple (*Ananas comosus*)

Source: [https://www.google.co.th/search?espv=2&biw=1366&bih=667&tbm=isch&sa=1&q=pineapple&oq=pineapple&gs\\_l=img.3](https://www.google.co.th/search?espv=2&biw=1366&bih=667&tbm=isch&sa=1&q=pineapple&oq=pineapple&gs_l=img.3).



## 5. Turmeric (*Curcuma longa* L.)

Turmeric is one type of spice derived from the rhizomes of *Curcuma longa* which is a member of the ginger family. Turmeric was used in several ways such as spice and pigment. In India, turmeric has been used for making curry and medicinal purpose for centuries. The important chemical compound of turmeric is Curcuminoid, which contain polyphenolic compounds that given yellow color in turmeric and curcumin is the important chemical in curcuminoid.

(Source: Josni S L. and Pawar A H. Herbal Cosmetics and Cosmeceuticals, Natural product chemical & research, 2015)



**Figure3- the curcumin powder**

(Source: [https://www.google.co.th/search?q=curcumin&espv=2&source=lnms&tbm=isch&sa=X&ved=0CAcQ\\_AUoAWoVChMInc62tOqswIVWHOOCh0\\_tQ0J&biw=1366&bih=667#imgre=I-pJpTD4HhxFqM%3A](https://www.google.co.th/search?q=curcumin&espv=2&source=lnms&tbm=isch&sa=X&ved=0CAcQ_AUoAWoVChMInc62tOqswIVWHOOCh0_tQ0J&biw=1366&bih=667#imgre=I-pJpTD4HhxFqM%3A))

### 5.1 Uses of turmeric in therapeutic benefit

There are several therapeutic benefits of turmeric include; antiseptic, analgesic, anti-inflammatory, antioxidant, antimalarial, insect-repellent.

### 5.2 Benefit of curcumin

Curcumin is yellow substance which is an important constituent in turmeric, More recently, evidence that curcumin may have anti-inflammatory and anticancer activities has renewed scientific interest in its potential to prevent and treat disease.

(Source: Jurenka J. Anti-inflammatory Properties of Curcumin, a Major Constituent of *Curcuma longa*: A Review of Preclinical and Clinical Research, Alternative Medicine Review Volume 14, 2009)

## 6. Fragrance

Fragrance is a special odor that human make it up by using natural material or synthesize from chemical compound. In all culture the odor can considering as a powerful thing to affect the emotion of human. In the last few decades, a growing scientific literature has documented various emotional effects of odors, the odor can influent the mood by pleasant odors tend to induce positive mood in contrast unpleasant odors tend to induce negative mood

(Source: Schiffman, Miller, et al. 1995; Schiffman, Sattely-Miller, et al. 1995; Re'tiveau et al. 2004)



## Chapter 3

## Materials and Methods

## Materials

## 1. Raw Materials

(Hong Huat company)

- 1.1 Sodium polyacrylate
- 1.2 Dicaprylyl ether
- 1.3 Mineral oil 70
- 1.4 Propylene glycol
- 1.5 DMDM hydantion
- 1.6 Deionize water
- 1.7 Sodium stearyl

## 1.8 Extract herbs

(Tipco®)

- Pomegranate (*Punica granatum L.*)
- Pineapple fiber (*Ananas comosus*)
- Curcumin (*Curcuma longa L.*)

## 1.9 Perfume

- Sweet floral scent (<http://www.zippysoap.com/>)
- Fruity scent
- Pomegranate scent

## 2. Equipment

## 2.1 Equipment for lotion

- Digital Balance
- Stirring rod
- Kitchenware

## 2.2 Equipment for sensory evaluation

- Lotion sample
- Spoon
- Baby wipe
- Questionnaires



## Materials and Method

### Method

#### 1. To formulate the appropriate based lotion

##### 1.1 Screen the basic formulation of based lotion

The based lotion was developed by using Hong Huat formula to screen for the further development.

**Table2:** The Hong Huat formula for developing lotion

Phase	Ingredients	Percentage (%)
1	Sodium polyacrylate	0.8
	Dicaprylyl ether	3
	Mineral oil 70	4
	Propylene glycol	4
2	DMDM hydantion	0.6
	Deionize water	87.1
	Sodium stearyl glutamate	0.2
3	Perfume	0.3
	<b>Total</b>	<b>100</b>

Source: <http://honghuatshop.blogspot.com/2010/10/diy-skin-lotion-cream.html>

The base lotion was evaluated by sensory evaluation using 9-point hedonic scale test and intensity test (appendix A1) with 30 panelists. Then, using mean and standard deviation to interpreted data. After got the data, considering which attributed that got the lowest score point in 9-hedonic scale for further improving.

##### 1.2 Adjust the viscosity of lotion by varying Sodium polyacrylate.

The base lotion was adjusted by varying sodium polyacrylate substitute as 1%, 2% and 3%. Characteristics of each samples were determined and recorded by preliminary laboratory and the suitable characteristic was chosen for further development.

##### 1.3 Select the optimum percentage of Propylene glycon for based lotion

Based lotions were prepared by varying the different percentage of propylene glycol and using Randomized Complete Block Design (RCBD). The Propylene glycol was varied into different percentages including 4%, 5%, and 6 % of total weight of based lotion.

Three samples were prepared to evaluate by sensory evaluation using 9-point hedonic scale test (appendix A2) with 30 panelists. And using ANOVA to analyze data

1.4 Adjust the based lotion

The most appropriated lotion was selected for sensory evaluation using 9-point hedonic scale test and just about right scale (appendixA3). Then, using mean and standard deviation to interpreted data and find the percentage of each attributes. Moreover, the JAR scale was use to apply in weighted penalty in order to specify the importance of each attributes.

2. To study effect of herbal extract and perfume obtained in lotion
- Herbal lotions formula

**Table3:** Show weight in gram and percentage of each ingredient of herbal lotion

Phase	Ingredients	Weight in gram(g)	Percentage (%)
1	Sodium polyacrylate	5	2
	Dicaprylyl ether	7.5	3
	Mineral oil 70	10	4
	Propylene glycol	12.5	5
2	DMDM hydantion	1.5	0.6
	Deionize water	209.75	83.9
	Sodium stearoyl glutamate	0.5	0.2
	Herbal Extracts	2.5	1
3	Perfume	0.75	0.3
	Total	250	100

Process of making herbal lotion

Process of making lotion was divided into three phrases. First phrase, was consisted of sodium polyacrylate, dicaprylyl ether, mineral oil 70 and propylene glycol. Second phrases, was consisted of DMDM hydantion, deionize water, herbal extracts and sodium stearoyl glutamate and third phase was perfume. Combined the ingredients in each phrases and mixed ingredients together until the mixture was completely combined. Then, combined the three phrases together, stirred the mixture until the texture of lotion was completely combined. Last step was adding the perfume and stir the lotion to make sure that the perfume was complete extended into the lotion.



## 2.1 Screening the different herbal using in developing herbal lotion

Three different types of herbal power were used including; pomegranate (*Punica granatum L.*), pineapple fiber (*Ananas comosus*) and curcumin powder (*Curcuma longa L.*) from Tipco® to screen the effect of using the herbal in lotion by preliminary laboratory and chose the most appropriate appearance for further step.

## 2.2 To select the most preference and suitable scents for lotion

- Select the most preference suitable scents

Three different scents were chosen include; sweet floral, pomegranate and fruity scents. The sensory evaluation was conducted by using 9-point hedonic scale test with 30 panelists. Then using RCBD experimental design and select the most appropriate scent and preference for making lotion.

- Determine the quality of lotion and relationship between samples and market brands

The three sample was determined the quality by sensory evaluation using ranking and the relationship between three samples and market brand was determined by matching from sensory perceiving of 30 panelists.

## **3. Conduct Consumer Acceptance for pomegranate lotion**

### 3.1 consumer test

The consumer test was conducted in Thailand with 100 consumers and the test was taken place at Assumption University and Sena, Ayutthaya province at Radbumroongsilp School. The serving samples including the sample 2.5 g. obtain in the container, spoon, tissue wipe and questionnaire.

The questionnaire was consisted of three main parts including consumer behavior, consumer acceptances and demographic information.

## CHAPTER 4

### Result and discussion

#### Experiment 1: Development of base lotion

##### 1.1 Screen the basic formulation of base lotion

The base lotion was developed by using Hong Huat formula to screen the overall appearance of lotion for further development. The characteristics of lotion was observed and recorded by preliminary laboratory. Furthermore, the sensory evaluation was conducted by using 9-point hedonic scale and intensity test with 30 panelists. And using average (mean) and standard deviation (SD) to interpreted data shown in table.



**Figure4- The base lotion making from Hong Huat formular**

##### **The characteristics of lotion developing for Hong Huat formula**

- Lotion had low viscosity.
- The texture of lotion was liquidly.
- The lotion obtained white color.
- The absorption of lotion was low.
- The lotion was easily spread.

It was found that, the lotion that was developed by using Hong Huat formula obtained the low viscosity, the liquidly texture, white color, and low absorption and easily spread, due to the viscosity of lotion was low and the texture was too liquidly.

Then, sensory evaluation was conducted by using 9- point hedonic scales and intensity using 15 point hedonic scale with 30 panelists. After that the data was interpreted by using mean and standard deviation shown in table below.



**Table4:** Average (mean) and standard deviation (SD) of liking score (9-point hedonic scale) on based lotion and intensity (15-point hedonic scale).

Attribute	Average score (mean)	Standard deviation(SD)	Intensity
Overall liking	6.3	1.5	-
Viscosity	5.5	1.8	9.4
Ease of spread	6.1	1.9	8.2
Ease of absorb	4.8	1.8	6.7
Stickiness	5.8	1.9	8.6
Moisturizing	6.7	1.5	8.4
Skin smoothness	6.3	1.9	8.0

According to table4, there were two attributes that got the low score of 9-point hedonic scale and 15-point hedonic scale included viscosity and ease of absorb. Therefore, the two attributes were selected for improvement in further step.

1.2 Adjust the viscosity of lotion by varying Sodium polyacrylate.

The base lotion was adjusted by varying sodium polyacrylate substitute as 1%, 2% and 3% of total weight of lotion. Characteristics of each samples were determined and recorded by preliminary laboratory.

**Table5:** Characteristic of different percentage of Sodium polyacrylate in lotion.

Percentage of Sodium polyacrylate (%)	Characteristic of lotion
1	<ul style="list-style-type: none"><li>- Lotion had low viscosity.</li><li>- The texture of lotion was too liquidly.</li><li>- The lotion obtained white color.</li><li>- The absorption of lotion was low.</li><li>- The lotion was easily spread.</li></ul>
2	<ul style="list-style-type: none"><li>- Lotion had medium viscosity.</li><li>- The texture of lotion was not too liquidly and too sticky.</li><li>- The lotion obtained white color.</li><li>- The absorption of lotion was low.</li><li>- The lotion was easily spread.</li></ul>
3	<ul style="list-style-type: none"><li>- Lotion had high viscosity.</li><li>- The texture of lotion was too sticky.</li><li>- The lotion obtained white color.</li><li>- The absorption of lotion was low.</li><li>- The lotion was easily spread.</li></ul>

According to the table5, the 2% of Sodium polyacrylate was selected to developing in next step owing to its characteristics was the most appropriated appearance when compare with 3% and 4%. Due to lotion that obtain 2% of Sodium polyacrylate had medium viscosity, the texture of lotion was not too liquidly and too sticky and the lotion was easily spread.

1.3 Select the optimum percentage of Propylene glycol for based lotion

The lotion was prepared and the sensory evaluation was conducted with 30 panelists using 9- point hedonic scales on overall liking, viscosity, ease of absorb, ease of spread, stickiness, moisturizing and skin smoothness. RCBD experimental design was used by varying the propylene glycol substitute as 4%, 5% and 6% of total weight of lotion shown in table below.

**Table6:** Average (mean) and standard deviation (SD) of liking score (9-point Hedonic scale) of based lotion by varying propylene glycol

	4% of propylene glycol	5% of propylene glycol	6% of propylene glycol	Pr > F
Overall liking	6.8 ± 1.2	6.7 ± 1.3	6.9 ± 1.0	0.8 <sup>n.s</sup>
Viscosity	6.1 ± 1.4	6.3 ± 1.6	6.4 ± 1.3	0.6 <sup>n.s</sup>
Ease of spread	6.6 ± 1.2	6.4 ± 1.4	6.8 ± 1.2	1 <sup>n.s</sup>
Ease of absorb	6.5 ± 1.4	6.5 ± 1.5	6.5 ± 1.3	0.4 <sup>n.s</sup>
Stickiness	7.0 ± 1.2	6.4 ± 1.7	6.8 ± 1.8	0.3 <sup>n.s</sup>
Moisturizing	7.1 ± 1.1	6.9 ± 1.3	7.0 ± 1.2	0.7 <sup>n.s</sup>
Skin smoothness	6.9 ± 1.0	6.6 ± 1.3	6.6 ± 1.4	0.5 <sup>n.s</sup>

Note: P-value in this experiment is equal 0.05 or 95% confidence level

If Pr > F value is more than 0.05, then null hypothesis is accepted as there as there is no significant difference between the samples.

If Pr > F value is less than 0.05, then null hypothesis is accepted as there as there is significant difference between the samples.

According to the result, there are no significant difference among 4%, 5% and 6% of propylene glycol. The 5% of propylene glycol was chosen due to the overall characteristic of the lotion is the most suitable.

1.4 Adjust the based lotion

The most appropriated lotion was selected for sensory evaluation using 9-point hedonic scale test and just about right scale (appendixA3). Then, using mean and standard deviation to interpreted data and find the percentage of each attributes. Moreover, the JAR scale was use to apply in weighted penalty in order to specify the importance of each attributes.

**Table7:** Average (mean) and standard deviation (SD) of liking score (9-point Hedonic scale) of based lotion

Attributes	Average score (mean)	Standard deviation(SD)
Overall liking	7.0	1.1
Viscosity	6.6	1.3
Ease of spread	6.7	1.2
Ease of absorb	5.9	1.5
Stickiness	6.4	1.3
Moisturizing	6.9	1.2
Skin smoothness	6.9	1.0

According to the table7, it was found that the average of overall liking of based lotion was 6.97 and standard deviation was 1.10 and the other attributes got average score around 6. It showed that the score was improved when compare with the previous score of sensory evaluation means that the based lotion was more acceptant among the panelists.

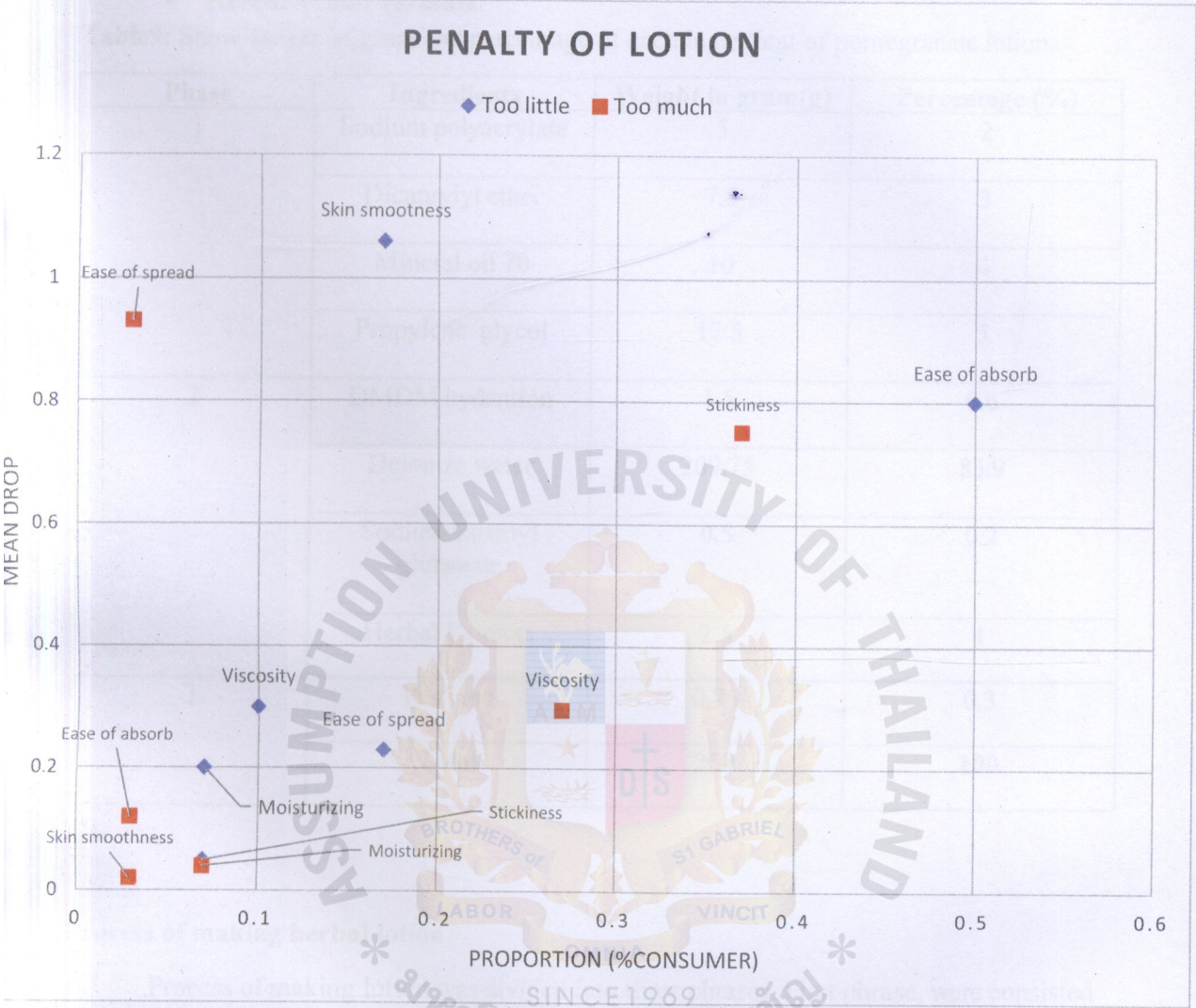
**Table8:** Percentage of each attribute on Just About Right test (JAR test)

Attributes	Just about right test (%)				
	Much too little	Somewhat too little	Just right	Somewhat too much	Much too much
Viscosity	0	10	63.3	26.7	0
Ease of spread	0	16.7	80	3.3	0
Ease of absorb	3.3	46.7	46.7	3.3	0
Stickiness	0	6.7	56.7	36.7	0
Moisturizing	0	6.7	86.7	6.7	0
Skin smoothness	0	16.7	80	3.3	0

Due to the table8, it was found that almost attribute got the highest percentage in just right except, he ease of absorb that got the equal percentage in somewhat too little and just right.



Weighted Penalty Score



**Figure5- The finding of Weighted Penalty score from JAR result**

Due to the Figure, It was found that the attribute that most affected consumer in high proportion was ease of absorb (50%) with a mean drop of -0.8 If the ease of absorb was too little. In the other hand if the ease of absorb was too high, it is less affect in low proportion (3%) with a mean drop of -0.12. The second attributes that affected consumer in high proportion was stickiness (37%) with a mean drop of -0.75 if there are too much stickiness in lotion. The highest mean drop was -1.06 in skin smoothness but in low proportion (17%) It weak impact of percentage of consumer when compare with ease of absorption attribute. Then, the viscosity affected consumer in 27% of consumer with mean drop of -0.3if there are too much viscosity while affected consumer less proportion (10%) when it was less viscosity. The least effect in proportion of consumer was consisted of 3 attributes include ease of absorb and skin smoothness with mean drop of -0.12 and 0.02 respectively. Therefore, the important attributes that had to consider were too little ease of absorb, too much of stickiness and too little of skin smoothness.

Experiment 2: To study effect of herbal extract and perfume obtained in lotion

• Herbal lotions formula

Table9: Show weight in gram and percentage of each ingredient of pomegranate lotion

Phase	Ingredients	Weight in gram(g)	Percentage (%)
1	Sodium polyacrylate	5	2
	Dicaprylyl ether	7.5	3
	Mineral oil 70	10	4
	Propylene glycol	12.5	5
2	DMDM hydantion	1.5	0.6
	Deionize water	209.75	83.9
	Sodium stearoyl glutamate	0.5	0.2
	Herbal Extracts	2.5	1
3	Perfume	0.75	0.3
	Total	250	100

Process of making herbal lotion

Process of making lotion was divided into three phrases. First phrase, were consisted of sodium polyacrylate, dicaprylyl ether, mineral oil 70 and propylene glycol. Second phrases, were consisted of DMDM hydantion, deionize water, herbal extracts and sodium stearoyl glutamate and third phase was perfume. Combined the ingredients in each phrases and mixed ingredients together until the mixture was completely combined. Then, combined the three phrases together, stirred the mixture until the texture of lotion was completely combined. Last step was adding the perfume and stir the lotion to make sure that the perfume was complete extended into the lotion.

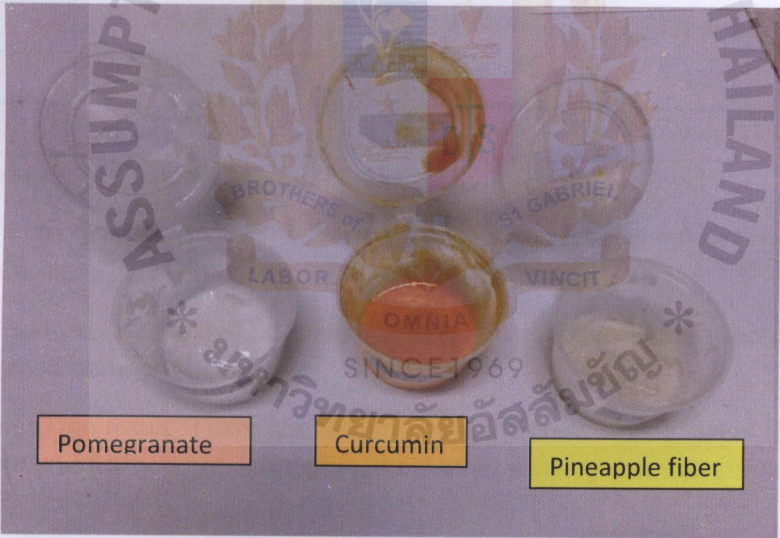
2.1 Screening the different herbal using in developing herbal lotions

Three different types of herbal power were used including; pomegranate (*Punica granatum L.*), pineapple fiber (*Ananas comosus*) and curcumin powder (*Curcuma longa L.*) from Tipco® to screen the effect of using the herbal in lotion by preliminary laboratory. The most appropriated appearance was chosen to develop in further step.



**Table10:** The characteristics of each different types of herbal lotions.

Herbal Extract Powder	Characteristics
Pomegranate ( <i>Punica granatum L.</i> )	<ul style="list-style-type: none"><li>- Lotion obtained white colour</li><li>- Lotion had medium viscosity.</li><li>- The texture of lotion was not too liquidly and too sticky.</li><li>- Lotion obtained weak the pomegranate odor</li></ul>
Curcumin ( <i>Curcuma longa.</i> )	<ul style="list-style-type: none"><li>- Lotion obtained yellow color</li><li>- Lotion had low viscosity.</li><li>- The texture of lotion was too liquidly.</li><li>- Lotion obtain too strong curcumin odor</li></ul>
Pineapple fiber ( <i>Ananas comosus</i> )	<ul style="list-style-type: none"><li>- Lotion obtain pale yellow color</li><li>- Lotion had high viscosity.</li><li>- The texture of lotion was not too liquidly and too sticky.</li><li>- Lotion had small particles in lotion</li></ul>



**Figure6- Characteristics of each herbal lotions**

From the table, it was founded that the lotion obtained pomegranate powder was the most appropriate characteristics among three different herbal lotions. Therefore, the pomegranate powder was selected for further development.

2.2 Select the most preference and suitable scents for pomegranate lotion

- Select the most preference and suitable scents

Three different scents were chosen include; sweet floral, pomegranate and fruity scents. The sensory evaluation was conducted by using 9-point hedonic scale test with 30 panelists. The data was interpreted by using RCBD experimental design to select the most appropriate scent and preference for making lotion.

**Table11:** Average (mean) and standard deviation (SD) of liking score (9-point Hedonic scale) of pomegranate lotion by varying scent

Attributes	Sweet floral Scent	Pomegranate Scent	Fruity Scents	Pr > F
Overall liking	7.1 ± 1.4	7.4 ± 0.8	6.9 ± 1.1	0.2 <sup>n.s</sup>
Viscosity	6.9 ± 1.2	7.0 ± 1.1	7.2 ± 0.9	0.6 <sup>n.s</sup>
Ease of spread	7.2 ± 1.4	7.4 ± 1.1	6.9 ± 1.3	0.3 <sup>n.s</sup>
Ease of absorb	6.8 ± 1.4	7.1 ± 1.2	6.7 ± 1.8	0.4 <sup>n.s</sup>
Stickiness	7.0 ± 1.3	7.2 ± 0.9	7.1 ± 1.3	0.7 <sup>n.s</sup>
Moisturizing	7.3 ± 1.1	7.3 ± 1.2	7.4 ± 1.1	0.9 <sup>n.s</sup>
Skin smoothness	7.5 ± 1.0	7.3 ± 1.2	7.5 ± 1.1	0.6 <sup>n.s</sup>

**Note: P-value in this experiment is equal 0.05 or 95% confidence level**

If Pr > F value is more than 0.05, then null hypothesis is accepted as there as there is no significant difference between the samples.

If Pr > F value is less than 0.05, then null hypothesis is accepted as there as there is significant difference between the samples.

According to the result, There are no significant different among sweet floral scent, pomegranate scent and fruity scent. Therefore, the further sensory test was conducted.



**Table12:** The percentage of most preference scent and most suitable scent in pomegranate lotion.

sample code	Percentage (%)	
	Scent like the most	suitable for pomegranate lotion
A=297	36.7	23.3
B=342	36.7	56.7
C=781	26.7	20.0
total	100	100

Note: A= sweet floral scent, B= pomegranate scent, C= fruity scent

According to the table, the most preference scent in consumer was consisted of 2 samples that were sample A and B, sweet floral scent and pomegranate scent respectively. And the most suitable for pomegranate lotion was sample B, pomegranate scent. So, the pomegranate scent was chosen as the scent for development pomegranate lotion.

**- Determine the quality of lotion and relationship between samples and market brands**

The three samples were determined the quality by sensory evaluation using ranking and the relationship between three samples and market brand was determined by matching from sensory perceiving of 30 panelists using Friedman test to interpreted the result.

According to calculation (appendix5) Tcal is less than  $X^2$ , there are not significant difference between treatments, there are not different in the quality in the lotion ( $p > 0.05$ ). Therefore, the pomegranate scent was chosen as the scent of pomegranate lotion due to its scent had the highest percentage of suitable for pomegranate lotion in table

**Table13:** the Percentage of relationship between samples and market brands.

Scents	Percentage (%)					
	Nivea	Vaseline	Jergens	Mistine	Soap& glory	Johnson Baby
Sweet floral	13.3	6.7	20	6.7	3.3	50
Pomegranate	6.7	16.7	13.3	13.3	36.7	13.3
Fruity	26.7	26.7	13.3	16.7	10	6.7

Due to table, the sweet floral scent was matched with Johnson brand, Pomegranate scent was matched with soap& glory brand and fruity scent was match with Nivea and Vaseline brand. The relationship of sample and market lotion was determined using sensory perceived by 30 panelists and the most attribute that affect the decision of consumer is scent of sample.

### Experiment3: Conduct Consumer Acceptance for pomegranate lotion

The consumer test was conducted on 100 consumers. Most of consumers are regularly use the lotion. The questionnaire consisted of three parts including consumer's behavior, product acceptance, and demographic information.

#### Part 1: Consumer's behavior

The First part is consumer's behavior, this part involves brand that consumers regularly use, the frequency of using lotion, place that consumers normally buy the lotion, the properties of lotion that consumer expect, the interesting of herbal lotion and factors that affect the decision of consumer on purchasing the body lotion.

**Table14: Percentage of consumer's behavior on consumer test**

Consumer's behavior	Percentage (%)
<b>1. Consumer use and don't use lotion</b>	
• Use	93
• Don't use	7
<b>Total</b>	<b>100</b>
<b>2. Brand of lotions that consumer regularly use</b>	
• Citra	4.3
• Vaseline	27.96
• Nivea	17.2
• Jergens	19.35
• Johnson	7.53
• Mistine	2.15
• Oriental princess	16.13
• Others	5.38
<b>Total</b>	<b>100</b>
<b>3. Frequency to use lotion</b>	
• Daily	65.59
• 3-4 per week	22.58
• 1-2 per week	10.75
• Occasionally	1.08
<b>Total</b>	<b>100</b>
<b>4. Place that buy lotion</b>	
• Supermarket	59.14
• Hypermarket	11.83
• Convenient store	4.3
• Drug store(Boot & Watson)	24.73
<b>Total</b>	<b>100</b>

<b>5. Most expected properties of lotion</b>	
• Moisturizing	22.58
• Whitening	1.08
• Anti-aging	0
• Protection UV	0
• All combine	19.35
• Moisturizing and whitening	23.66
• Moisturizing and protect UV	7.53
• Whitening and anti-aging	2
• Whitening and protect UV	2.15
• Moisturizing and whitening and protection UV	19.35
• Moisturizing and whitening and anti-aging	1.08
• Moisturizing and protection UV and anti-aging	1.08
<b>Total</b>	<b>100</b>
<b>6. Herbal lotion interesting</b>	
• Interesting	93.55
• Not interesting	6.45
<b>Total</b>	<b>100</b>

According to the data (table 1), based on the data of 100 consumers 97% of consumers has use body lotion before whereas 3% of consumer that never use body lotion. Three most preferable brands are Vaseline (27.96%), Jergens (19.35%), and Nivea (17.2%) respectively while the least preferable brand is Mistine (2.15%). The most frequency of using body lotion is daily use (65.59%). The most preferable place to buy the body lotion is supermarket and the most expected properties of body lotion is moisturizing and whitening.

There are several factors that are very important due to it can affect decision of consumers on purchasing the product. For this research, there are seven factors include scent, color, ingredients, quality, packaging, price and brand.



Table15: Factors that affecting decision on purchasing the lotion body

Factor	Percentage (%)				
	Most important	Very important	Important	Slightly important	Not important
Scent	29.0	37.6	29.0	4.3	0
Color	10.8	22.6	33.3	23.7	6.5
Ingredients	41.9	35.5	21.5	1.1	0
Quality	64.5	30.1	4.3	1.1	0
Packaging	9.7	32.3	31.2	26.9	0
Price	23.7	39.8	34.4	2.2	0
Brand	16.1	32.3	31.2	17.2	3.2

According to the table2, the most important factors are ingredients (41.94%) and quality (64.52%) respectively. Follow by scent (37.63%), packaging (32.26%), price (39.78%) and brand (32.26%). And the least important factors is color (33.33%)

Part 2: Product Acceptance

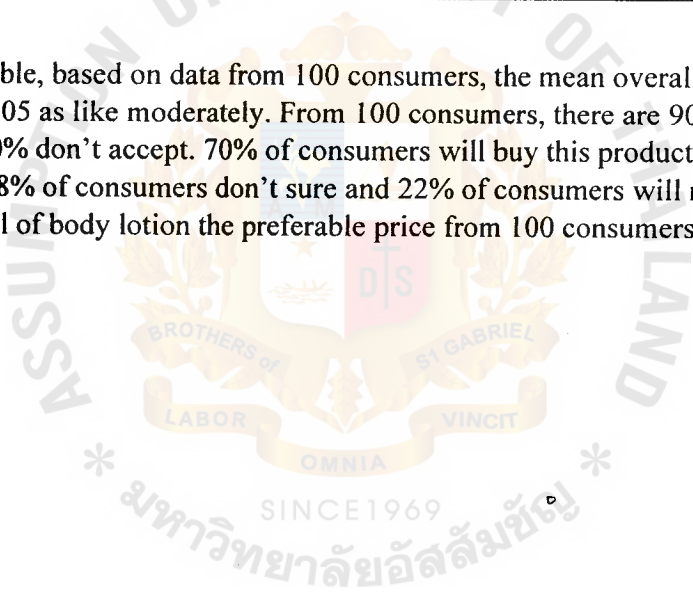
The second part is product acceptance. The pomegranate lotion was judge by 100 consumers by using 9 hedonic liking score as “dislike extremely to like extremely” and the questionnaire asked about the product acceptance and price of product.

Table16: Percentage for product acceptance on consumer test.

Product Acceptance	Mean ± SD
1. Liking score	
Before use	
• Overall liking	7.3 ± 1.1
• Viscosity	6.9 ± 1.5
• Scent	7.1 ± 1.5
During use	
• Ease of spread	7.5± 1.2
• Ease of absorb	7.2± 1.4
After use	
• Stickiness	7.0 ± 1.4
• Moisturizing	7.3 ± 1.1
• Skin smoothness	7.2 ± 1.1
• Scent	7.3 ± 1.3

2. Product acceptance	Percentage (%)
• Yes	90
• No	10
Total	100
3. If product available in market	
• Will buy	70
• Not sure	8
• Will not buy	22
Total	100
4. Price of product sample (250 ml)	
• Below 100	15
• 100 - 200 baht	69
• 201 - 300 baht	16
• 301- 400 bath	0
• Above 400 bath	0
Total	100

According to table, based on data from 100 consumers, the mean overall liking of the body lotion is  $7.28 \pm 1.05$  as like moderately. From 100 consumers, there are 90% accept the body lotion whereas 10% don't accept. 70% of consumers will buy this product if the product is available in market, 8% of consumers don't sure and 22% of consumers will not buy this product. Due to 250 ml of body lotion the preferable price from 100 consumers is around 100-200 baht (69%).



Part3: Demographic Information

Table17: Consumer demographics' information

Demographic information	Percentage (%)
1. Gender	
• Male	20
• Female	80
Total	100
2. Age	
• below 15 years	0
• 16-20 years	13
• 21 – 25 years	34
• 26-30 years	5
• 31-35 years	6
• over 35 years	42
Total	100
3. Education	
• High school or lower	0
• Diploma	6
• Bachelor's degree	90
• Master's degree	4
• Doctorate	0
Total	100
4. Occupation	
• Student	45
• Employee	52
• Business-owner	1
• Freelance	2
• Government officer	0
Total	100



<b>5. Income monthly</b>	
• Below 5,000 baht	16
• 5,000- 10,000 baht	19
• 10,001 – 15,000 baht	21
• 15,001 – 20,000 baht	20
• 20,001 – 25,000 baht	17
• more than 25,000 baht	5
<b>Total</b>	<b>100</b>
<b>6. Nationality</b>	
• Thai	96
• Non Thai	4
<b>Total</b>	<b>100</b>

From the table, shown the percentage of demographic information from 100 consumers. It was found that ratio of male and female was around 1:4. The majority age of consumer was over 35 year old and minority age is around 21-25 years old. 90% of consumers had the education level in bachelor degree. More than 50% of consumers were employee and the income around 15,001 – 20,000 baht (22%). Most of consumers were Thai nationality (96%).

## Chapter 5

### Conclusion

The different herbal extracts powder were used to develop the herbal lotions to study the characteristic of it. There were consisted of three different types of herb using in development herbal lotion including; pomegranate (*Punica granatum L.*), curcumins (*Curcuma longa.*) and pineapple fiber (*Ananas comosus*). The pomegranate was selected for further development due to the overall characteristics of pomegranate lotion was the most appropriated when compared with curcumins lotion and pineapple fiber lotion. The ingredients of based lotion and process of developing lotion was based on the Hong Huat formula, the formula was adjusted by preliminary lab and using sensory evaluation as based data to select the most preference characteristics of lotion in development. The herbal extracted powder came from the Tipco®. To develop the lotion, there were consisted of several methods, beginning with screening the formulation of based lotion, adjusted the viscosity of lotion by varying Sodium polyacrylate, Select the optimum percentage of Propylene glycon for based lotion, screening the different herbal using in developing herbal lotion, Select the most preference and suitable scents for pomegranate lotion, determine the quality of lotion and relationship between samples and market brands. And the last step was to conduct the consumer test with 100 consumers.

According to the study, the final formulation was consisted of 2% of Sodium polyacrylate, 3% of Dicaprylyl ether, 4% of Mineral oil 70, 5% of Propylene glycol, 0.6% of DMDM hydantion, 83.9% of deionize water, 0.2% of Sodium stearyl glutamate, 1% of Pomegranate Extract, and 0.3% of Perfume. From the penalty, It was found that the attribute that most effected consumer in high proportion was ease of absorb (50%) If the ease of absorb was too little. The second attributes that affected consumer in high proportion was stickiness (37%) if there are too much stickiness in lotion. RCBD experimental design was used to select the most appropriate scent and preference for making lotion. There are no significantly different among three scents. The pomegranate scent was chosen as a scent for developing pomegranate lotion due to it was gotten the highest percentage in preference and suitable for developing pomegranate lotion.

Consumer test was conducted with 100 consumers at Assumption University and Sena, Ayutthaya province at Radbumroongsilp School. The product was tested with a target group of people who regularly use lotion. There are 90% accept the body lotion whereas 10% don't accept. 70% of consumers will buy this product if the product is available in market, 8% of consumers don't sure and 22% of consumers will not buy this product. Due to 250 ml of body lotion the preferable price from 100 consumers is around 100-200 baht (69%).

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Appendix: Part A1 (Sensory evaluation 1- 9point hedonic scale and intensity)

No.	Overall liking	viscosity	Intensity	Ease of spread	Intensity	Ease of absorb	Intensity	Stickiness	Moisturizing	Intensity	Skin smoothness	Intensity
1	8	9	14	9	15	7	9	9	4	15	3	5
2	7	8	8	8	14	4	6	6	6	10	6	9
3	4	3	10	2	8	4	6	5	6	13	2	8
4	8	8	12	7	6	8	6	7	8	7	7	7
5	8	7	9	6	12	3	5	8	9	4	7	13
6	4	4	8	3	12	4	6	4	8	7	7	8
7	7	7	5	7	8	4	7	7	8	6	5	5
8	5	6	11	7	9	4	6	5	5	9	3	12
9	7	5	9	7	7	4	10	7	7	8	7	8
10	7	7	13	8	7	8	13	4	9	15	8	8
11	2	3	8	2	5	2	5	1	4	8	1	8
12	8	7	7	6	12	6	5	7	8	10	8	11
13	6	5	8	7	9	4	8	4	7	5	8	7
14	8	7	6	8	7	8	4	7	8	7	7	7
15	6	4	10	8	11	3	3	5	5	13	9	12
16	5	4	5	7	8	3	2	5	8	8	7	10
17	5	4	8	7	5	3	5	1	6	7	6	7
18	6	5	9	4	7	4	6	7	5	7	6	7
19	7	4	15	7	6	5	6	5	6	10	8	7
20	6	3	12	4	5	4	10	5	7	2	6	8
21	4	2	7	2	8	7	7	7	7	7	6	7
22	6	7	10	4	7	3	1	7	8	12	5	10
23	5	4	12	7	5	2	8	7	6	11	6	7
24	7	6	8	6	4	7	6	7	6	5	8	5
25	7	6	8	5	7	7	3	6	4	11	7	10
26	8	8	10	6	10	6	10	8	9	10	8	10
27	8	7	12	8	7	8	4	8	8	8	8	13
28	7	4	8	8	10	4	10	6	8	11	8	10
29	6	3	10	6	7	4	12	3	6	6	7	7
30	6	7	10	7	7	4	12	6	6	6	4	7
Average	6.27	5.47	9.40	6.10	8.17	4.80	6.70	5.80	6.73	8.60	6.27	8.43
SD	1.51	1.89	2.46	1.97	2.76	1.88	3.00	1.92	1.51	3.14	1.96	2.22

Appendix: Part A2  
Sensory evaluation 2

9-point Hedonic scale for the variation of propylene glycol

Code sample

542: 4% Propylene glycol

327: 5% Propylene glycol

975: 6% Propylene glycol

sample code 975							
No.	Overall liking	Viscosity	Ease of spread	Ease of absorb	Stickiness	Moisturizing	Skin smoothness
1	7	4	6	6	8	8	5
2	7	7	8	5	7	7	8
3	6	7	4	8	8	7	5
4	4	4	3	2	1	3	3
5	7	7	8	7	8	7	7
6	5	4	7	5	4	7	7
7	6	5	6	7	5	6	5
8	8	5	8	8	8	8	8
9	7	7	7	7	8	6	5
10	7	7	7	7	7	6	6
11	7	6	8	4	7	8	7
12	7	5	7	7	8	7	7
13	6	6	6	7	8	7	7
14	8	4	6	6	8	6	7
15	8	6	7	8	7	8	8
16	7	7	7	7	7	7	7
17	8	7	7	6	7	8	6
18	6	7	6	6	7	6	8
19	8	7	7	8	8	8	7
20	8	8	8	7	9	8	6
21	6	7	7	7	6	7	7
22	9	8	9	8	7	8	8
23	8	8	7	7	8	8	8
24	7	7	7	7	7	4	3
25	7	7	7	7	8	8	7
26	6	8	8	6	8	8	8
27	7	8	7	8	7	7	8
28	7	6	6	5	2	8	8
29	6	7	6	6	5	7	5
30	7	7	7	7	7	8	7
mean	6.90	6.43	6.80	6.53	6.83	7.03	6.60
S.D	1.03	1.28	1.19	1.33	1.80	1.22	1.43



sample code 327							
No.	Overall liking	Viscosity	Ease of spread	Ease of absorb	Stickiness	Moisturizing	Skin smoothness
1	8	6	7	8	8	8	8
2	8	8	7	6	8	8	7
3	7	8	5	7	7	8	6
4	6	5	5	5	6	5	5
5	8	8	8	8	8	8	9
6	4	5	6	4	4	6	5
7	8	5	6	6	5	8	7
8	7	8	8	7	5	7	7
9	7	7	7	7	7	6	5
10	7	6	8	6	6	6	5
11	6	5	7	4	5	8	7
12	7	2	5	6	6	6	4
13	7	5	6	8	8	6	6
14	6	8	7	7	4	5	6
15	7	6	6	4	7	8	8
16	8	7	8	8	8	8	8
17	5	8	5	4	5	8	6
18	6	7	7	7	6	6	6
19	5	4	6	8	7	4	5
20	4	3	3	4	2	7	6
21	7	8	6	7	8	8	7
22	8	7	6	8	8	8	7
23	6	6	6	6	7	6	6
24	8	5	7	7	8	8	8
25	8	7	8	7	8	7	7
26	8	8	8	8	8	8	8
27	7	7	7	8	7	8	8
28	4	6	3	5	2	5	6
29	7	6	7	8	7	5	8
30	8	8	8	8	7	8	8
mean	6.73	6.30	6.43	6.53	6.40	6.90	6.63
S.D	1.28	1.60	1.36	1.46	1.73	1.27	1.25

sample code 542							
No.	Overall liking	Viscosity	Ease of spread	Ease of absorb	Stickiness	Moisturizing	Skin smoothness
1	9	9	9	9	9	9	9
2	6	5	6	7	6	6	6
3	5	5	4	6	5	7	6
4	7	6	7	6	8	7	6
5	7	6	6	7	6	7	7
6	7	7	7	7	8	7	7
7	7	6	6	5	7	6	6
8	8	5	8	8	8	8	8
9	7	7	7	7	7	6	5
10	6	5	5	6	6	6	6
11	7	7	8	5	7	8	7
12	8	4	6	6	7	8	7
13	8	5	5	6	8	8	7
14	6	4	5	6	7	6	7
15	9	7	8	9	8	9	9
16	7	6	7	7	8	6	7
17	6	6	7	7	8	7	6
18	7	6	8	6	6	8	6
19	7	7	7	8	8	8	7
20	7	6	7	7	7	6	7
21	6	6	6	6	6	6	6
22	8	7	7	8	8	9	7
23	8	8	6	6	8	6	8
24	5	7	7	7	7	6	7
25	6	5	6	7	6	7	7
26	7	8	8	4	7	8	8
27	5	5	8	4	7	8	8
28	7	8	5	8	7	6	5
29	4	3	5	3	3	6	7
30	8	7	8	8	7	8	8
mean	6.83	6.10	6.63	6.53	7.00	7.10	6.90
S.D	1.18	1.35	1.22	1.41	1.17	1.06	0.99

conclusion							
No.	Overall liking	Viscosity	Ease of spread	Ease of absorb	Stickiness	Moisturizing	Skin smoothness
975	6.90	6.43	6.80	6.53	6.83	7.03	6.60
327	6.73	6.30	6.43	6.53	6.40	6.90	6.63
542	6.83	6.10	6.63	6.53	7.00	7.10	6.90

Appendix: Part A3

Sensory evaluation 3

- 9- Point hedonic scale

No.	Overall liking	viscosity	Ease of spread	Ease of absorb	Stickiness	Moisturizing	Skin smoothness
1	6	6	6	4	5	5	6
2	4	3	6	1	4	6	7
3	7	8	8	5	7	4	6
4	7	7	7	6	7	8	8
5	8	8	8	7	8	7	7
6	7	6	7	7	7	7	7
7	7	7	7	4	7	7	8
8	6	4	4	4	7	5	5
9	7	8	6	6	6	7	7
10	8	7	7	6	8	8	7
11	7	7	7	7	6	8	7
12	5	6	7	5	5	5	5
13	7	7	7	6	7	8	8
14	7	8	9	6	7	8	6
15	8	7	7	6	8	7	8
16	5	5	5	5	4	5	5
17	7	7	7	6	6	7	7
18	7	6	7	5	6	8	8
19	6	6	6	7	5	7	6
20	6	4	4	8	4	7	6
21	8	6	7	6	8	6	8
22	8	7	7	7	4	8	8
23	8	8	7	8	8	7	6
24	9	8	8	8	7	7	7
25	8	8	8	8	8	8	8
26	6	6	7	4	6	6	7
27	7	7	4	6	6	8	7
28	8	7	7	7	7	9	7
29	7	7	7	6	6	7	8
30	8	6	7	7	7	7	7
Average	6.97	6.57	6.70	5.93	6.37	6.90	6.90
SD	1.10	1.28	1.18	1.53	1.30	1.18	0.96



Just About Right Test: 30 panelists

Attributes	Viscosity	Ease of spread	Ease of absorb	Stickiness	Moisturizing	Skin smoothness
Much too little	-	-	I	-	-	-
Somewhat too little	III	IIII	IIII II III	II	II	IIII
Just right	IIII IIII IIII III	IIII IIII IIII IIII III	IIII IIII III	IIII IIII II II	IIII IIII IIII IIII IIII I	IIII IIII IIII IIII III
Somewhat too much	IIII III	I	I	IIII IIII I	II	I
Much too much	-	-	-	-	-	-
Total	30	30	30	30	30	30

• Total percentage of each attribute on just about right test: 30 panelists

Attributes	Just about right test (%)				
	Much too little	Somewhat too little	Just right	Somewhat too much	Much too much
Viscosity	-	3	19	8	-
Percentage	0	10	63.33	26.67	0

Attributes	Just about right test (%)				
	Much too little	Somewhat too little	Just right	Somewhat too much	Much too much
Ease of spread	-	5	24	1	-
Percentage	0	16.67	80	3.33	0

Attributes	Just about right test (%)				
	Much too little	Somewhat too little	Just right	Somewhat too much	Much too much
Ease of absorb	1	14	14	1	-
Percentage	3.33	46.67	46.67	3.33	0

Attributes	Just about right test (%)				
	Much too little	Somewhat too little	Just right	Somewhat too much	Much too much
Stickiness	-	2	17	11	-
Percentage	0	6.67	56.67	36.67	0

Attributes	Just about right test (%)				
	Much too little	Somewhat too little	Just right	Somewhat too much	Much too much
Moisturizing	-	2	26	2	-
Percentage	0	6.67	86.67	6.67	0

Attributes	Just about right test (%)				
	Much too little	Somewhat too little	Just right	Somewhat too much	Much too much
Skin smoothness	-	5	24	1	-
Percentage	0	16.67	80	3.33	0

• Penalty calculation

	Viscosity		
	Too little	JAR	Too much
Proportion	0.1	0.63	0.27
Group Mean	4.67	7.16	5.88
Grand Mean	6.57		

Too little        = (4.67 - 6.57) = -1.9

Normalized     = ((-1.9) x 0.1) / 0.63 = -0.3

Too much       = (5.88 - 6.57) = -0.69

Normalized     = ((-0.69) x 0.27) / 0.63 = -0.296

	Ease of spread		
	Too hard	JAR	Too easy
Proportion	0.17	0.8	0.03
Group Mean	5.4	6.79	4
Grand Mean	6.47		

Too little        = (5.4 - 6.47) = -1.07

Normalized     = ((-1.07) x 0.17) / 0.8 = -0.23

Too much       = (4 - 6.47) = -2.47

Normalized     = ((-2.47x 0.03) / 0.8 = -0.93

	Ease of absorb		
	Too hard	JAR	Too easy
Proportion	0.5	0.47	0.03
Group Mean	5.2	6.86	4
Grand Mean	5.94		

Too little        = (5.2 - 5.94) = -0.74

Normalized     = ((-0.74) x 0.5) / 0.47 = -0.8

Too much = (4 - 5.94) = -1.94

Normalized = ((-1.94) x 0.03) / 0.47 = -0.12

	Stickiness		
	Too little	JAR	Too much
Proportion	0.07	0.57	0.37
Group Mean	6	7.12	5.27
Grand Mean	6.43		

Too little = (6 - 6.43) = -0.43

Normalized = ((-0.43) x 0.07) / 0.57 = -0.05

Too much = (5.27 - 6.43) = -1.16

Normalized = ((-1.16) x 0.37) / 0.57 = -0.75

	Moisturizing		
	Too little	JAR	Too much
Proportion	0.07	0.87	0.07
Group Mean	4.5	7.12	6.5
Grand Mean	6.96		

Too little = (4.5 - 6.96) = -2.46

Normalized = ((-2.46) x 0.07) / 0.87 = -0.2

Too much = (6.5 - 6.96) = -0.46

Normalized = ((-0.46) x 0.07) / 0.87 = -0.04

	Skin smoothness		
	Too little	JAR	Too much
Proportion	0.17	0.5	0.03
Group Mean	5.8	7.21	5
Grand Mean	4.74		

Too little = (5.8 - 4.74) = 1.06

Normalized = (1.06 x 0.17) / 0.5 = 0.36

Too much = (5 - 4.74) = 0.26

Normalized = (0.26 x 0.03) / 0.5 = 0.02



Appendix: Part A4

Sensory evaluation 4

sample code 297 (Sweet floral scent)									
No.	Overall liking	Viscosity	Scent before use	Ease of spread	Ease of absorb	Stickiness	Moisturizing	Skin smoothness	Scent after use
1	7	7	8	7	6	6	7	7	7
2	9	8	7	9	9	9	9	8	6
3	8	7	9	7	7	7	8	8	7
4	7	8	7	8	6	6	7	7	7
5	4	3	4	5	4	5	6	5	6
6	7	4	5	6	7	3	8	5	4
7	5	5	4	6	7	5	6	6	5
8	7	8	8	8	7	8	8	8	7
9	6	6	5	7	5	6	7	5	6
10	7	7	7	7	7	6	7	7	7
11	7	7	5	8	6	6	7	7	5
12	5	7	5	6	5	4	5	4	5
13	8	8	8	7	6	6	7	6	8
14	7	8	7	7	7	8	7	7	7
15	4	5	4	8	7	8	6	6	4
16	7	6	5	6	7	7	6	5	6
17	7	6	8	7	8	9	9	9	8
18	7	8	6	7	7	7	8	8	6
19	8	6	9	6	7	6	7	6	9
20	7	6	8	7	3	5	7	7	7
21	8	9	5	8	7	8	8	8	6
22	8	6	9	7	7	9	7	7	7
23	7	5	6	7	7	5	6	6	5
24	8	9	5	8	8	9	8	7	5
25	7	8	7	8	7	8	9	8	7
26	8	7	9	7	7	7	8	7	8
27	8	7	8	7	8	8	7	8	6
28	8	8	9	9	5	7	8	8	9
29	8	7	8	8	8	8	8	8	8
30	7	7	7	7	8	7	8	7	5
mean	7.03	6.77	6.73	7.17	6.67	6.77	7.30	6.83	6.43
S.D	1.19	1.41	1.68	0.91	1.27	1.55	0.99	1.21	1.33



- sample code 781 (lemony scent)

sample code 342(pomegranate scent)

No.	Overall liking	Viscosity	Scent before use	Ease of spread	Ease of absorb	Stickiness	Moisturizing	Skin smoothness	Scent after use
1	6	6	6	8	7	8	7	7	5
2	8	8	8	7	8	9	7	9	8
3	8	8	8	7	8	7	7	8	9
4	6	7	9	8	6	7	7	7	8
5	6	4	5	5	6	5	4	5	6
6	6	2	3	5	6	5	8	6	4
7	5	4	4	6	6	4	5	5	4
8	9	8	7	8	7	8	6	8	9
9	5	6	8	7	5	6	5	5	6
10	6	7	6	7	8	7	6	7	6
11	7	7	7	7	8	5	6	7	8
12	7	4	7	6	7	6	6	6	8
13	8	8	8	7	6	6	7	6	8
14	8	7	8	7	8	8	8	8	9
15	8	7	8	7	5	8	7	7	5
16	9	8	9	8	9	6	6	6	8
17	6	4	3	8	4	4	8	8	7
18	8	7	8	7	8	7	8	8	8
19	6	6	7	7	6	6	6	6	7
20	7	4	5	3	3	5	8	8	8
21	7	7	7	7	5	5	6	6	8
22	8	8	8	7	7	6	7	7	7
23	6	4	3	6	7	5	6	6	3
24	7	9	7	9	7	9	8	6	7
25	9	8	8	8	8	9	9	9	6
26	8	8	8	8	8	8	7	7	8
27	7	8	6	8	8	8	8	7	8
28	7	8	6	6	5	8	7	7	6
29	7	7	7	7	6	8	6	6	6
30	7	7	6	7	8	7	8	7	4
Mean	7.07	6.53	6.67	6.93	6.67	6.67	6.80	6.83	6.80
S.D	1.11	1.76	1.71	1.17	1.42	1.49	1.13	1.09	1.65

sample 297: sweet floral scent

sample 342: pomegranate scent

sample 781: fruity scent

Overall liking	Viscosity	Scent before use	Ease of spread	Ease of absorb	Stickiness	Moisturizing	Skin smoothness	Scent after use
7.07	6.77	6.73	7.17	6.67	6.77	7.30	6.83	6.43
7.07	6.33	6.67	6.93	6.67	6.67	6.80	6.83	6.8
7.07	6.93	6.70	6.87	6.10	6.73	7.20	6.93	6.43



sample code 781(fruity scent)

No.	Overall liking	Viscosity	Scent before use	Ease of spread	Ease of absorb	Stickiness	Moisturizing	Skin smoothness	Scent after use
1	8	8	6	7	7	7	7	8	6
2	6	5	7	6	4	7	7	4	5
3	7	7	7	7	7	6	7	7	7
4	7	7	6	8	6	7	7	7	8
5	6	6	5	4	3	4	6	6	5
6	8	4	3	4	4	5	8	6	5
7	7	5	7	6	6	5	7	7	7
8	8	8	8	7	7	8	7	7	8
9	7	6	4	7	6	8	7	8	8
10	7	7	8	7	7	7	6	7	7
11	8	7	8	7	7	7	6	7	7
12	5	5	6	7	5	4	5	5	5
13	9	8	9	7	6	7	7	7	9
14	7	8	7	8	7	8	7	7	7
15	8	7	8	8	7	8	7	7	6
16	8	8	8	8	6	8	8	7	6
17	8	9	8	9	9	9	9	9	7
18	9	8	8	8	8	8	9	8	8
19	9	8	8	9	9	8	8	8	8
20	5	4	3	3	3	4	8	8	4
21	6	7	7	8	7	6	7	6	5
22	7	8	8	6	7	6	7	7	7
23	5	4	3	6	7	5	6	6	3
24	8	9	8	9	6	9	8	6	8
25	7	8	6	8	7	6	7	6	5
26	7	8	8	7	6	6	7	7	7
27	8	7	8	6	3	8	9	8	8
28	8	8	9	6	4	9	9	9	9
29	4	7	4	7	6	8	8	7	4
30	5	7	6	6	6	4	5	6	4
Mean	7.07	6.93	6.70	6.87	6.10	6.73	7.20	6.93	6.43
S.D	1.31	1.44	1.78	1.43	1.58	1.57	1.06	1.08	1.61

### Conclusion

Note 297: sweet floral scent

342: pomegranate scent

781: fruity scent

No.	Overall liking	Viscosity	Scent before use	Ease of spread	Ease of absorb	Stickiness	Moisturizing	Skin smoothness	Scent after use
297	7.03	6.77	6.73	7.17	6.67	6.77	7.30	6.83	6.43
342	7.07	6.53	6.67	6.93	6.67	6.67	6.80	6.83	6.8
781	7.07	6.93	6.70	6.87	6.10	6.73	7.20	6.93	6.43

Appendix: Part A5

Sensory evaluation 5

Part2: Rank the quality of lotion from high to low

- using Friedman test

1=the most quality

3= the least quality

judge no.	176	294	952
1	2	3	1
2	3	1	2
3	1	3	2
4	3	2	1
5	1	3	2
6	3	1	2
7	2	1	3
8	1	2	3
9	3	1	2
10	3	2	1
11	1	3	2
12	1	2	3
13	1	2	3
14	1	2	3
15	1	2	3
16	1	3	2
17	3	1	2
18	2	1	3
19	3	1	2
20	1	3	2
21	2	3	1
22	2	1	3
23	2	1	3
24	3	1	2
25	2	3	1
26	3	2	1
27	3	2	1
28	2	3	1
29	1	3	2
30	1	2	3
Rank sum	58	60	62

\*\*Remark: Lower sum is the most quality



### Sample code

- 176 = floral-sweet scent
- 294 = pomegranate scent
- 952 = fruity scent

### Calculation

Test statistic (T):

$$T = \frac{12}{bk(k+1)} \left( \sum_{j=1}^k R_j^2 \right) - 3b(k+1)$$

b= the number of panelists

k= the number of sample

x= the rank sum of sample

df= k-1

$\alpha = 0.05$

$$T = \frac{12}{30(3)(4)} (58^2 + 60^2 + 62^2) - 3(30)(4) = 0.2667$$

$$X^2 = 5.99$$

$$T_{cal} < X^2$$

### Conclusion

There are not significant difference between treatments, there are not different in the quality in the lotion ( $\alpha = 0.05$ )

## Appendix: Part B1

## SAS Analysis

- Sensory evaluation2: RCBD experiment design code

```
title'Randomized Complete Block';
```

```
data RCB;
```

```
input lotion treatment$ov viscos spread absorp skick moist smooth@@;
```

```
datalines;
```

1	A	9	9	9	9	9	9
1	B	8	6	7	8	8	8
1	C	7	4	6	6	8	5
2	A	6	5	6	7	6	6
2	B	8	8	7	6	8	7
2	C	7	7	8	5	7	8
3	A	5	5	4	6	5	6
3	B	7	8	5	7	7	6
3	C	6	7	4	8	8	5
4	A	7	6	7	6	8	6
4	B	6	5	5	5	6	5
4	C	4	4	3	2	1	3
5	A	7	6	6	7	6	7
5	B	8	8	8	8	8	9
5	C	7	7	8	7	8	7
6	A	7	7	7	7	8	7
6	B	4	5	6	4	4	6
6	C	5	4	7	5	4	7
7	A	7	6	6	5	7	6
7	B	8	5	6	6	5	8
7	C	6	5	6	7	5	6
8	A	8	5	8	8	8	8
8	B	7	8	8	7	5	7
8	C	8	5	8	8	8	8

9 A	7	7	7	7	7	6	5
9 B	7	7	7	7	7	6	5
9 C	7	7	7	7	8	6	5
10 A	6	5	5	6	6	6	6
10 B	7	6	8	6	6	6	5
10 C	7	7	7	7	7	6	6
11 A	7	7	8	5	7	8	7
11 B	6	5	7	4	5	8	7
11 C	7	6	8	4	7	8	7
12 A	8	4	6	6	7	8	7
12 B	7	2	5	6	6	6	4
12 C	7	5	7	7	8	7	7
13 A	8	5	5	6	8	8	7
13 B	7	5	6	8	8	6	6
13 C	6	6	6	7	8	7	7
14 A	6	4	5	6	7	6	7
14 B	6	8	7	7	4	5	6
14 C	8	4	6	6	8	6	7
15 A	9	7	8	9	8	9	9
15 B	7	6	6	4	7	8	8
15 C	8	6	7	8	7	8	8
16 A	7	6	7	7	8	6	7
16 B	8	7	8	8	8	8	8
16 C	7	7	7	7	7	7	7
17 A	6	6	7	7	8	7	6
17 B	5	8	5	4	5	8	6
17 C	8	7	7	6	7	8	6
18 A	7	6	8	6	6	8	6
18 B	6	7	7	7	6	6	6
18 C	6	7	6	6	7	6	8
19 A	7	7	7	8	8	8	7
19 B	5	4	6	8	7	4	5

19 C	8	7	7	8	8	8	7
20 A	7	6	7	7	7	6	7
20 B	4	3	3	4	2	7	6
20 C	8	8	8	7	9	8	6
21 A	6	6	6	6	6	6	6
21 B	7	8	6	7	8	8	7
21 C	6	7	7	7	6	7	7
22 A	8	7	7	8	8	9	7
22 B	8	7	6	8	8	8	7
22 C	9	8	9	8	7	8	8
23 A	8	8	6	6	8	6	8
23 B	6	6	6	6	7	6	6
23 C	8	8	7	7	8	8	8
24 A	5	7	7	7	7	6	7
24 B	8	5	7	7	8	8	8
24 C	7	7	7	7	7	4	3
25 A	6	5	6	7	6	7	7
25 B	8	7	8	7	8	7	7
25 C	7	7	7	7	8	8	7
26 A	7	8	8	4	7	8	8
26 B	8	8	8	8	8	8	8
26 C	6	8	8	6	8	8	8
27 A	5	5	8	4	7	8	8
27 B	7	7	7	8	7	8	8
27 C	7	8	7	8	7	7	8
28 A	7	8	5	8	7	6	5
28 B	4	6	3	5	2	5	6
28 C	7	6	6	5	2	8	8
29 A	4	3	5	3	3	6	7
29 B	7	6	7	8	7	5	8
29 C	6	7	6	6	5	7	5
30 A	8	7	8	8	7	8	8



30	B	8	8	8	8	7	8	8
30	C	7	7	7	7	7	8	7

;

proc anova data=RCB;

Class lotion Treatment;

model ov viscos spread absorp skick moist smooth=lotion treatment;

means treatment;

run;



Randomized Complete Block

The ANOVA Procedure

Class Level Information

Class	Levels	Values
lotion	30	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
treatment	3	A B C

Number of Observations Read 90

Number of Observations Used 90



Randomized Complete Block

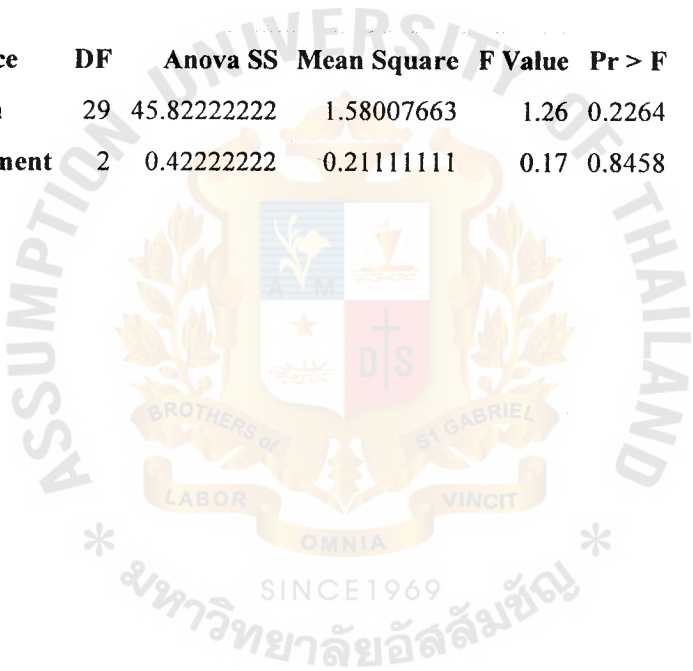
The ANOVA Procedure

Dependent Variable: ov

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	31	46.2444444	1.4917563	1.19	0.2819
Error	58	72.9111111	1.2570881		
Corrected Total	89	119.1555556			

R-Square	Coeff Var	Root MSE	ov Mean
0.388101	16.43452	1.121199	6.822222

Source	DF	Anova SS	Mean Square	F Value	Pr > F
lotion	29	45.8222222	1.58007663	1.26	0.2264
treatment	2	0.4222222	0.21111111	0.17	0.8458



Randomized Complete Block

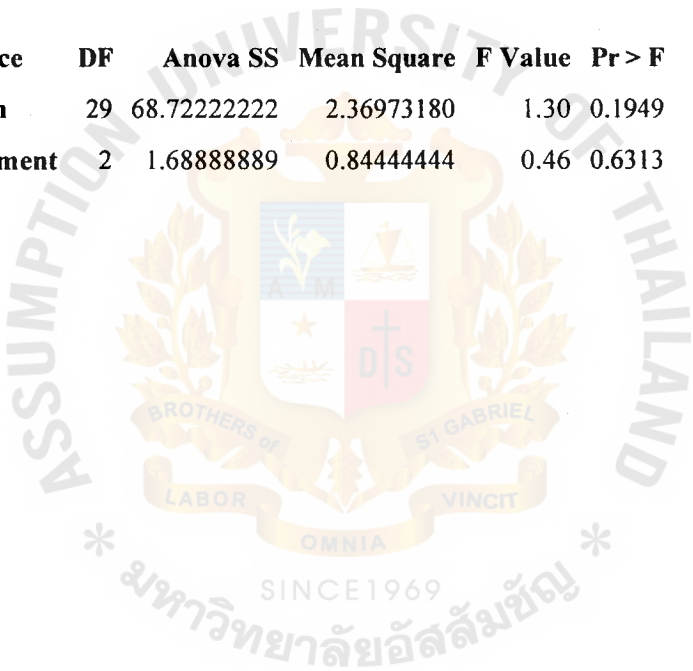
The ANOVA Procedure

Dependent Variable: viscos

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	31	70.4111111	2.2713262	1.25	0.2307
Error	58	105.6444444	1.8214559		
Corrected Total	89	176.0555556			

R-Square	Coeff Var	Root MSE	viscos Mean
0.399937	21.49826	1.349613	6.277778

Source	DF	Anova SS	Mean Square	F Value	Pr > F
lotion	29	68.72222222	2.36973180	1.30	0.1949
treatment	2	1.68888889	0.84444444	0.46	0.6313





Randomized Complete Block

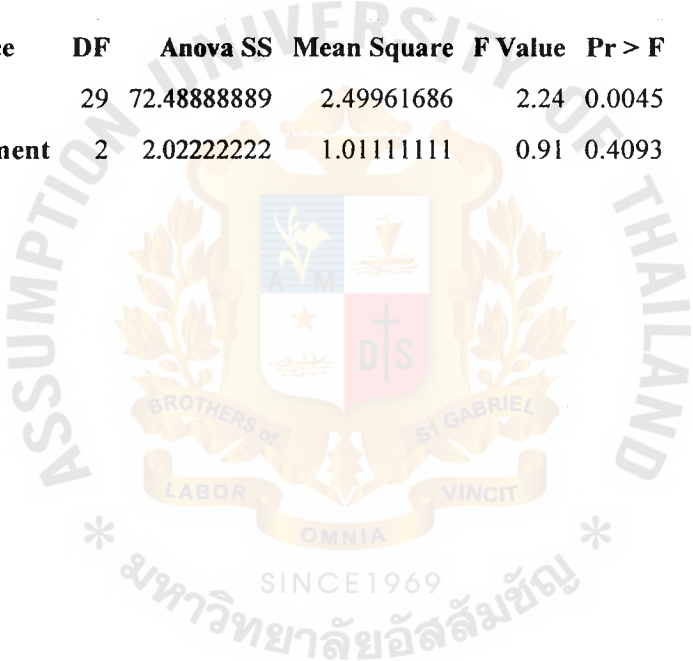
The ANOVA Procedure

Dependent Variable: spread

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	31	74.5111111	2.4035842	2.16	0.0057
Error	58	64.6444444	1.1145594		
Corrected Total	89	139.1555556			

R-Square	Coeff Var	Root MSE	spread Mean
0.535452	15.94219	1.055727	6.622222

Source	DF	Anova SS	Mean Square	F Value	Pr > F
lotion	29	72.4888889	2.49961686	2.24	0.0045
treatment	2	2.02222222	1.01111111	0.91	0.4093



Randomized Complete Block

The ANOVA Procedure

Dependent Variable: absorp

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	31	75.0666667	2.4215054	1.47	0.1008
Error	58	95.3333333	1.6436782		
Corrected Total	89	170.4000000			

R-Square	Coeff Var	Root MSE	absorp Mean
0.440532	19.62337	1.282060	6.533333

Source	DF	Anova SS	Mean Square	F Value	Pr > F
lotion	29	75.0666667	2.58850575	1.57	0.0708
treatment	2	0.00000000	0.00000000	0.00	1.0000



Randomized Complete Block

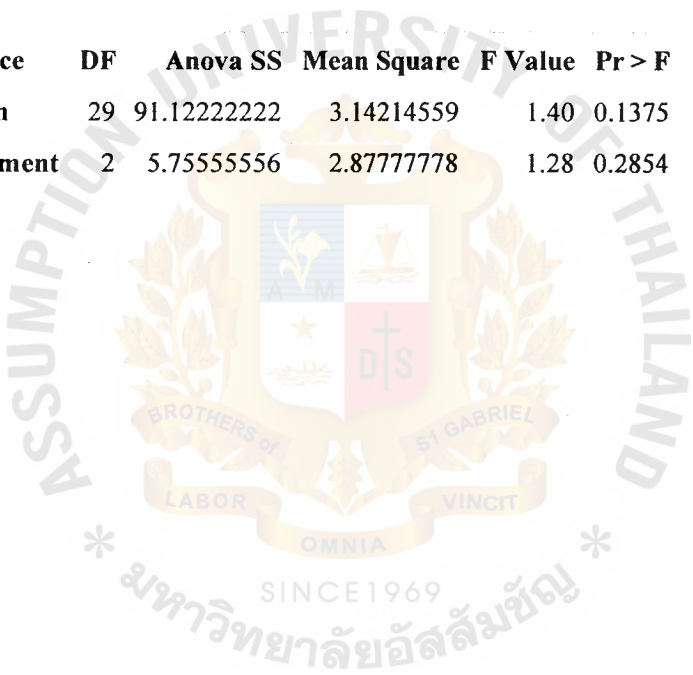
The ANOVA Procedure

Dependent Variable: skick

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	31	96.8777778	3.1250896	1.39	0.1375
Error	58	130.2444444	2.2455939		
Corrected Total	89	227.1222222			

R-Square	Coeff Var	Root MSE	skick Mean
0.426545	22.21874	1.498531	6.744444

Source	DF	Anova SS	Mean Square	F Value	Pr > F
lotion	29	91.12222222	3.14214559	1.40	0.1375
treatment	2	5.75555556	2.87777778	1.28	0.2854



Randomized Complete Block

The ANOVA Procedure

Dependent Variable: moist

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	31	62.9444444	2.0304659	1.96	0.0134
Error	58	60.0444444	1.0352490		
Corrected Total	89	122.9888889			

R-Square	Coeff Var	Root MSE	moist Mean
0.511790	14.51228	1.017472	7.011111

Source	DF	Anova SS	Mean Square	F Value	Pr > F
lotion	29	62.3222222	2.14904215	2.08	0.0091
treatment	2	0.6222222	0.31111111	0.30	0.7416

Level of treatment	N	ov		Viscos		spread		absorp		skick		moist		smooth	
		Mean	Std Dev	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev
A	3	6.83	1.17	6.10	1.34	6.63	1.21	6.53	1.40	7.00	1.17	7.10	1.06	6.90	0.99
	0	333	688	000	805	333	721	333	769	000	444	000	187	000	481
		333	465	000	096	333	370	333	641	000	044	000	862	000	414
B	3	6.73	1.28	6.30	1.60	6.43	1.35	6.53	1.45	6.40	1.73	6.90	1.26	6.63	1.24
	0	333	474	000	064	333	655	333	586	000	404	000	899	333	522
		333	694	000	642	333	073	333	408	000	053	000	363	333	075
C	3	6.90	1.02	6.43	1.27	6.80	1.18	6.53	1.33	6.83	1.80	7.03	1.21	6.60	1.42
	0	000	889	333	801	000	612	333	218	333	197	333	721	000	876
		000	294	333	930	000	670	333	341	333	848	333	370	000	846



Appendix: Part C1

Sensory Evaluate Sheet

Questionnaire of sensory analysis

No.....

Name.....

Date.....

Part 1: Questionnaire to study about the liking of body lotion

**Instruction:** Before the test, please wipe your hands and arms with baby wipe and dry it with tissue paper. Take 1 spoon of the sample and pour on your arm. Apply all of the lotion on your arm then evaluate sample follow the attribute (before, during, and after usage) by 9 point hedonic scale. After that, evaluate the intensity of the lotion by using 15 point hedonic scale

- 1 = Dislike extremely
- 4 = Dislike slightly
- 7 = Like moderately
- 2 = Dislike very much
- 5 = neither like nor dislike
- 8 = Like very much
- 3 = Dislike moderately
- 6 = Like slightly
- 9 = Like extremely

Intensity rating: 0- 15

- 0 = none
- 15 = extremely high

Attribute	Liking	Intensity
Overall liking :		
Before usage:		
Viscosity		
During usage:		
Ease of spread		
Ease of absorb		
After using :		
Stickiness		
Moisturizing		
Skin smoothness		

Questionnaire of sensory analysis

No.....

Date.....

**Part 1: Questionnaire to study about the liking of body lotion**

**Instruction:** Before the test, please wipe your hands and arms with baby wipe and dry it with tissue paper. Take 1 spoon of the sample and pour on your arm. Apply all of the lotion on your arm, circular motion in different area then evaluate sample follow the attribute (before, during, and after usage) by 9 point hedonic scale.

- 1 = Dislike extremely
- 4 = Dislike slightly
- 7 = Like moderately
- 2 = Dislike very much
- 5 = neither like nor dislike
- 8 = Like very much
- 3 = Dislike moderately
- 6 = Like slightly
- 9 = Like extremely

Sample code	691	274	495
Overall liking			
<u>Before usage</u>			
Viscosity			
<u>During usage</u>			
Ease of spread			
Ease of absorb			
<u>After using</u>			
Stickiness			
Moisturizing			
Skin smoothness			

Sensory Analysis of Pomegranate Extract Lotion

Please test the samples and score them based on the following preference test of 9-point hedonic score

The 9-point hedonic score of preference test

- 9 = Like extremely (ชอบมากที่สุด)
- 8 = Like very much (ชอบมาก)
- 7 = Like moderately (ชอบปานกลาง)
- 6 = Like slightly (ชอบเล็กน้อย)
- 5 = Neither like nor Dislike (เฉย)
- 4 = Dislike slightly (ไม่ชอบเล็กน้อย)
- 3 = Dislike moderately (ไม่ชอบปานกลาง)
- 2 = Dislike very much (ไม่ชอบมาก)
- 1 = Dislike extremely (ไม่ชอบมากที่สุด)

Attribute

Overall Liking (ความชอบโดยรวม) \_\_\_\_\_

Just About Right Scale

Before usage (ก่อนใช้)

Viscosity (ความหนืด) \_\_\_\_\_

- ☐ Much too little
- ☐ Somewhat too little
- ☐ Just right
- ☐ Somewhat too much
- ☐ Much too much

During usage (ระหว่างใช้)

Ease of spread (ความง่ายในการกระจายครีม) \_\_\_\_\_

- ☐ Much too little
- ☐ Somewhat too little
- ☐ Just right
- ☐ Somewhat too much
- ☐ Much too much

Ease of absorb (ความง่ายในการซึม) \_\_\_\_\_

- ☐ Much too little
- ☐ Somewhat too little
- ☐ Just right
- ☐ Somewhat too much
- ☐ Much too much

**After usage (หลังใช้)**

**Stickiness (ความเหนียว)** \_\_\_\_\_

☐                      ☐                      ☐                      ☐                      ☐

Much too little   Somewhat too little   Just right   Somewhat too much   Much too much

**Moisturizing (ความชุ่มชื้น)** \_\_\_\_\_

☐                      ☐                      ☐                      ☐                      ☐

Much too little   Somewhat too little   Just right   Somewhat too much   Much too much

**Skin smoothness (ความนุ่ม)** \_\_\_\_\_

☐                      ☐                      ☐                      ☐                      ☐

Much too little   Somewhat too little   Just right   Somewhat too much   Much too much

**Recommendation**

.....

.....

.....

THANK YOU



Questionnaire of sensory analysis

Part 1: Questionnaire to study about the liking of body lotion

**Instruction:** Before the test, please wipe your hands and arms with baby wipe and dry it with tissue paper. Take 1 spoon of the sample and pour on your arm. Apply all of the lotion on your arm, circular motion in different area then evaluate sample follow the attribute (before, during, and after usage) by 9 point hedonic scale.

- 1 = Dislike extremely
- 4 = Dislike slightly
- 7 = Like moderately
- 2 = Dislike very much
- 5 = neither like nor dislike
- 8 = Like very much
- 3 = Dislike moderately
- 6 = Like slightly
- 9 = Like extremely

Sample code .....

Overall liking \_\_\_\_\_

Before usage

Viscosity (ความหนืด) \_\_\_\_\_

Scent (กลิ่นก่อนใช้) \_\_\_\_\_

During usage

Ease of spread \_\_\_\_\_

(ความง่ายในการกระจายครีม)

Ease of absorb \_\_\_\_\_

(ความง่ายในการซึมเข้าผิว)

After using

Stickiness (ความเหนียว) \_\_\_\_\_

Moisturizing (ความชุ่มชื้น) \_\_\_\_\_

Skin smoothness (ความนุ่ม) \_\_\_\_\_

Scent (กลิ่นที่ผิว) \_\_\_\_\_

Questionnaire of sensory analysis

Part 1: Questionnaire to study about the liking of body lotion

**Instruction:** Before the test, please wipe your hands and arms with baby wipe and dry it with tissue paper. Take 1 spoon of the sample and pour on your arm. Apply all of the lotion on your arm, circular motion in different area then evaluate sample follow the attribute (before, during, and after usage) by 9 point hedonic scale.

- 1 = Dislike extremely
- 2 = Dislike very much
- 3 = Dislike moderately
- 4 = Dislike slightly
- 5 = neither like nor dislike
- 6 = Like slightly
- 7 = Like moderately
- 8 = Like very much
- 9 = Like extremely

Sample code .....  
.....

Overall liking \_\_\_\_\_

Before usage

Viscosity (ความหนืด) \_\_\_\_\_

Scent (กลิ่นก่อนใช้) \_\_\_\_\_

During usage

Ease of spread \_\_\_\_\_

(ความง่ายในการกระจายครีม)

Ease of absorb \_\_\_\_\_

(ความง่ายในการซึมเข้าผิว)

After using

Stickiness (ความเหนียว) \_\_\_\_\_

Moisturizing (ความชุ่มชื้น) \_\_\_\_\_

Skin smoothness (ความนุ่ม) \_\_\_\_\_

Scent (กลิ่นที่ผิว) \_\_\_\_\_

Choose sample code, which scent do you like the most? .....

In your opinion, which lotion is suitable to use in the pomegranate lotion? .....

Part2:

1. Please rank the sample from quality of lotion you perceive by writing the sample code into the table below.

The most quality	Medium quality	The least quality

2. Please √ in ( ) to match the sample with the brand by one sample with one brand  
Sample code \_\_\_\_\_



Other brand (pleases specify).....

Sample code \_\_\_\_\_



Other brand (pleases specify).....

Sample code \_\_\_\_\_



Other brand (pleases specify).....

Consumer Test Questionnaires

Product concept:

Pomegranate lotion is the skin care product that put the pomegranate extract to increase the properties of lotion. Pomegranate has powerful antioxidant and high in vitamin C. There are several beauties benefit such as helping the dry skin, slowing aging, regeneration the cell and boosting the natural SPF.

Instruction: Please √ in ( ) that comply with your opinior

Part 1: Consumer’s behavior

1. Have you ever use the lotion? (If no skip to part2)
- ( ) yes

( ) No
2. What brand of body lotion you regularly use? (choose only 1 brands)
- ( ) Citra

( ) Jergens

( ) Cute press

( ) Other

( ) Vaseline

( ) Johnson& Johnson

( ) Oriental princess

( ) Nivea

( ) Mistine

( ) soap and glory
3. How often that you use body lotion?
- ( ) every day

( ) 3-4 per week

( ) 1-2 per week

( ) Other
4. Where do you buy body lotion?
- ( ) Supermarket

( ) Boot

( ) Hypermarket

( ) 7-11

( ) Watson

( ) Other
5. What is the most expected properties of using the lotion? ( can answer more than 1)
- ( ) Moisturizing

( ) Protection skin from UV light

( ) Other

( ) Whitening

( ) Anti-aging
6. If there is an herbal lotion available, would you be interested?
- ( ) Yes

( ) No
7. Please √ in ( ) about the factor affecting on purchasing “ body lotion”

Factor	Level of importance				
	Most important	Very important	Important	Slightly important	Not important
Scent (กลิ่น)					
Color (สี)					
Ingredients (ส่วนประกอบ)					
Quality (คุณภาพ)					
Packaging (บรรจุภัณฑ์)					
Price(ราคา)					
Brand(ยี่ห้อ)					
Others					



Part 2: Product Acceptance

Instruction: Before the test, please wipe your hands and arms with baby wipe and dry it with tissue paper. Take 1 spoon of the sample and pour on your arm. Apply all of the lotion on your arm, circular motion in different area then evaluate sample follow the attribute (before, during, and after usage) by 9 point hedonic scale.

- 1 = Dislike extremely
- 4 = Dislike slightly
- 7 = Like moderately
- 2 = Dislike very much
- 5 = neither like nor dislike
- 8 = Like very much
- 3 = Dislike moderately
- 6 = Like slightly
- 9 = Like extremely

Sample code .....

Overall liking (ความชอบโดยรวม) \_\_\_\_\_

Before usage

Viscosity (ความหนืด) \_\_\_\_\_

Scent (กลิ่นก่อนใช้) \_\_\_\_\_

During usage

Ease of spread \_\_\_\_\_

(ความง่ายในการกระจายครีม)

Ease of absorb \_\_\_\_\_

(ความง่ายในการซึมเข้าผิว)

After using

Stickiness (ความเหนียว) \_\_\_\_\_

Moisturizing (ความชุ่มชื้น) \_\_\_\_\_

Skin smoothness (ความนุ่ม) \_\_\_\_\_

Scent (กลิ่นที่ผิว) \_\_\_\_\_

1. Do you accept this Product? ( ) Yes ( ) No Please give the reason  
Because:

.....

2. If this product is launched in market, will you buy this product?

( ) will buy

because.....

( ) will not buy

because.....

( ) Not sure

because.....

3. What should be the suitable price of this body lotion of this showing package?

( ) Less than 100 Baht

( ) 100 - 200 Baht

( ) 201- 300 Baht

( ) 301 – 400 Baht

( ) more than 400 Baht

### Part 3: Demographic information

1. Gender

( ) Male

( ) Female

2. Age

( ) below 15 years

( ) 16-20 years

( ) 21 – 25 years

( ) 26-30 years

( ) 31-35 years

( ) over 35 years

3. Education

( ) High school

or lower

( ) Diploma

( ) Bachelor's degree

( ) Master's degree

( ) Doctorate

4. Occupation

( ) Student

( ) Employee

( ) Business-owner

( ) Freelance

( ) Government officer

( ) Housewife/house

Other (please specific) .....

5. Income monthly

( ) Below 5,000 baht

( ) 5,000- 10,000 baht

( ) 10,001 – 15,000 baht

( ) 15,001 – 20,000 baht

( ) 20,001 – 25,000 baht

( ) more than 25,000 baht

6. Nationality

( ) Thai

( ) Non Thai (please

specific).....