

Development of Coconut Oil Skincare Body Cream with Plub-plung  
(*Crinum Lily*) and Ratee (*Cestrum Nocturnum*) Fragrance

By

Ms. Monthida Janphirom

ID. 4512477

A special project submitted to the faculty of Biotechnology, Assumption  
University in part fulfillment of the requirements of the degree of Bachelor of  
Science in Biotechnology

2006

**Development of Coconut Oil Skincare Body Cream with Plub-plung  
(*Crinum Lily*) and Ratee (*Cestrum Nocturnum*) Fragrance**

**By**

**Ms.Monthida**

**Janphirom**



**A special project submitted to the faculty of Biotechnology, Assumption  
University in part fulfillment of the requirements of the degree of Bachelor of  
Science in Biotechnology**



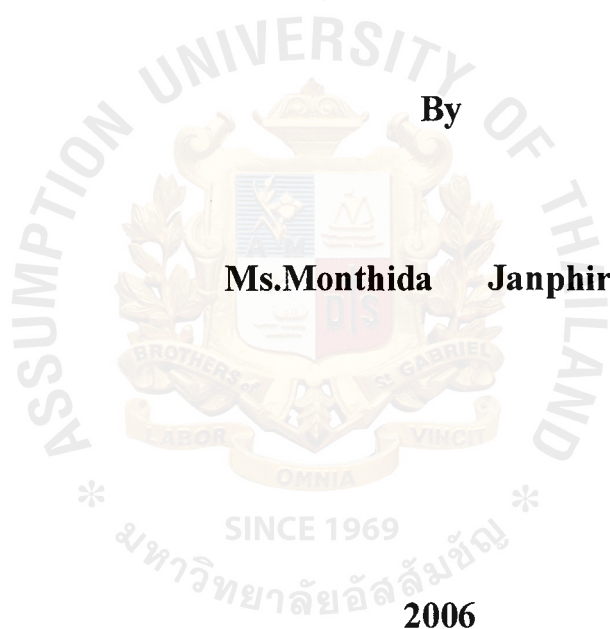
## **Special Project**

### **Development of Coconut Oil Skincare Body Cream with Plub-plung (*Crinum Lily*) and Ratee (*Cestrum Nocturnum*) Fragrance**

**By**

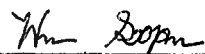
**Ms.Monthida**

**Janphirom**



**2006**

**Title:** Development of Coconut Oil Skincare Body Cream  
with Plub-plung (*Crinum Lily*) and Ratee  
(*Cestrum Nocturnum*) Fragrance  
**By:** Ms.Monthida Janphirom  
**Project Advisor:** Ms.Wanniya Sopagdee  
**Level of study:** Bachelor of Science  
**Department:** Food Technology  
**Faculty:** Biotechnology  
**Academic year:** 2006



---

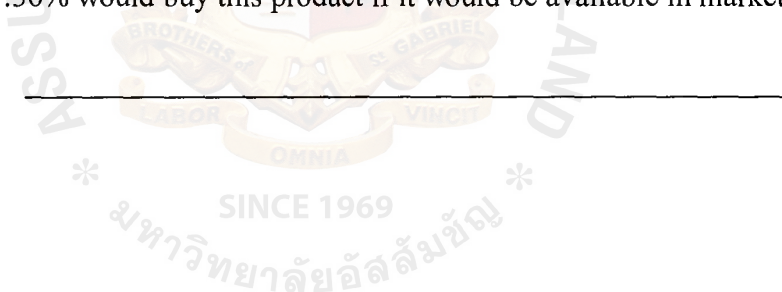
(Ms.Wanniya S.)  
Advisor

  
All right reserved by Faculty of Biotechnology  
Assumption University

## **Development of Coconut Oil Skincare Body Cream with Plub-plung (*Crinum Lily*) and Ratee (*Cestrum Nocturnum*) Fragrance**

### **Abstract**

The aim of this research was to develop skincare body cream containing coconut oil as a main ingredient associated with Thai flower fragrance for consumers who concern about Thai flower aroma and their body skins. The basic formula to produce skincare body cream was followed by Somerset company (1998). Four treatments were produced by using 2x2 factorial design in RCBD to study the effect of coconut oil and aloe vera extract of skincare body cream on sensory evaluation. The percentage of coconut oil and aloe vera extract used in each treatment were; treatment 1: 20% and 2%, treatment 2: 20% and 5%, treatment 3: 40% and 2%, treatment 4: 40% and 5%, respectively. The results showed that there was no effect between coconut oil and aloe vera extract on sensory evaluation. However, treatment 2 was chosen as the best formula because it obtained the highest score of liking in almost attributes. For the step of selection of Thai flower fragrance, four varieties of Thai flower fragrance such as Plub-plung, Peeb, Jampa, and Ratee were ranked by 30 panelists according to their preference. But there was non significant difference among them ( $P>0.05$ ). Then 2 types of fragrance which gained the most preferred (Plub-plung) and second most preferred score (Ratee) were chosen to conduct paired preference test. Eventually, Plub-plung fragrance was selected for adding in cream. The final formulation of skincare body cream consisted of 25% coconut oil, 5% aloe vera extract, 20% sweet almond oil, 12% polysorbate tween 60, 5.5% cetyl alcohol, 27% hot distilled water, 0.3% xanthan gum, 2.5% sorbitol, 1% vitamin E, 0.2% grape seed oil, 1% Plub-plung fragrance and 0.5% Ratee fragrance. From the consumer acceptance test, the average overall liking score was 7.53, like moderately. Moreover, 95.56% of consumers accepted the product and 61.36% would buy this product if it would be available in market.



## Acknowledgement

Firstly, I would like to express my profound gratitude to my advisor, A. Wanniya S. for her kindness, suggestion, motivation, valuable guidance and time to make this project possible.

I would like to thank Ms. Ling Zhi from Singapore Polytechnic for her helpful to do my laboratory, and gather the information in the step of consumer acceptance test. Furthermore, I would like to thank Ms. Soontharin S. and Ms. Srivalee T. for kindly helping me to decorate my presentation and conduct consumer acceptance test.

I would like to very special thank to other committee members, A. ROUNGDAO K. and A. PORNPEN P. for their time and comments during my presentation and I would also like to thank Metrohm Siam Ltd company for supporting viscosity measurement.

In addition, I would like to thank all of my panelists who dedicated their time for me to test the products and everybody who gave me for the ideas and suggestion.

Lastly, the very important persons in my life, my parents who have supported me through the years in Assumption University. I owe them everything that I am today. Also thank to my best friends that never leave me alone.

Ms. Monthida J.  
May, 2006

**Table of content**

<b>Content</b>	<b>Page</b>
List of tables	i
List of figure	iii
Introduction	1
Aim and Objectives	2
Literature review	3
Materials and Methods	15
Result and Discussion	21
Conclusion	45
Reference	46
Appendix A	48
Appendix B	50
Appendix C	63
Appendix D	72
Appendix E	82

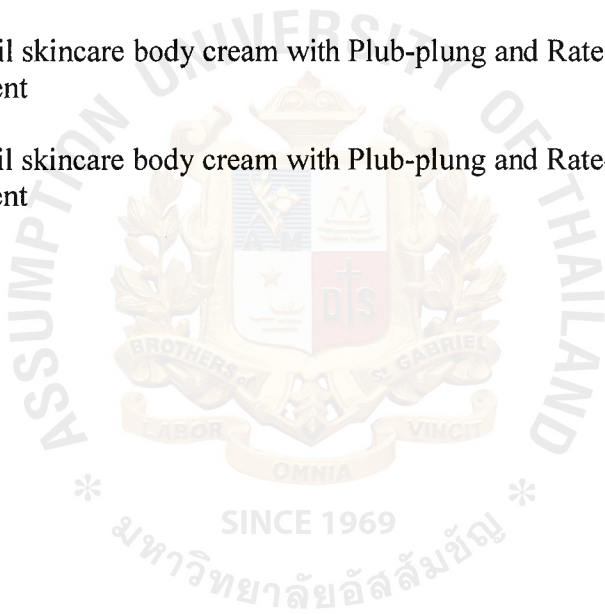
## List of tables

Table	Page
1 Treatment used in studying the effect of coconut oil and aloe vera extract	19
2 Comparison between 4 formulas of coconut oil and aloe vera extract skincare body cream	22
3 Comparison between 4 types of Thai flower fragrance in skincare body cream	24
4 Formula of coconut oil skincare cream with Thai flower fragrance at the first development	25
5 Liking score (9- Point Hedonic Scaling Test) of first development of coconut oil skincare body cream with Thai flower fragrance	26
6 Just right scale analysis of first development of coconut oil skincare body cream with Thai flower fragrance	27
7 Formula of coconut oil skincare body cream with Thai flower fragrance at the second development	29
8 Liking score (9-Point Hedonic Scaling Test) of second development of coconut oil skincare body cream with Thai flower fragrance	30
9 Just right scale analysis of second development of coconut oil skincare body cream with Thai flower fragrance	31
10 Formula of coconut oil skincare body cream with Thai flower fragrance at the third development	33
11 Liking score (9-Point Hedonic Scaling Test) of third development of coconut oil skincare body cream with Thai flower fragrance	34
12 Just right scale analysis of third development of coconut oil skincare body cream with Thai flower fragrance	35
13 Color value of coconut oil skincare body cream with Plub-plung and Ratee fragrance	36
14 Viscosity value of coconut oil skincare body cream with Plub-plung and Ratee fragrance at 25°C	37
15 pH value of coconut oil skincare body cream with Plub-plung and Ratee fragrance	37



<b>Table</b>	<b>Page</b>
16 Demographic data of consumers	39
17 Consumer buying behavior	40
18 Factors affecting the buying decision on skincare body cream	42
19 Coconut oil skincare body cream with Plub-plung and Ratee fragrance evaluation	43
<b>Appendix table</b>	<b>Page</b>
1 Multiple comparisons of overall liking of coconut oil and aloe vera extract skincare body cream	73
2 Multiple comparison of color of coconut oil and aloe vera extract skincare body cream	74
3 Multiple comparisons of stickiness during testing of coconut oil and aloe vera extract skincare body cream	75
4 Multiple comparisons of absorbency during testing of coconut oil and aloe vera extract skincare body cream	76
5 Multiple comparisons of gloss on the skin after testing of coconut oil and aloe vera extract skincare body cream	77
6 Multiple comparisons of moist after testing of coconut oil and aloe vera extract skincare body cream	78
7 Multiple comparisons of stickiness after testing of coconut oil and aloe vera extract skincare body cream	79
8 Multiple comparisons of viscosity during testing of coconut oil and aloe vera extract skincare body cream	80
9 Pair-preference test between Plub-plung and Ratee fragrance	81
10 Pair-preference test between 1.5% and 3.0% fragrance concentration of Plub-plung fragrance	81

List of figures	
Figure	Page
1 Coconut Plam	10
2 Coconut fruit	11
3 <i>Crinum Lily</i>	13
4 <i>Cestrum Nocturnum</i> (Ratee)	14
5 Skincare body cream production	18
6 Coconut oil skincare body cream with Plub-plung and Ratee fragrance at the first development	28
7 Coconut oil skincare body cream with Plub-plung and Ratee fragrance at the second development	32
8 Coconut oil skincare body cream with Plub-plung and Ratee fragrance at the third development	36



## Introduction

The basic chemicals and additives used in the manufacture of cosmetics are governed by prevailing fashions in the market, which in turn are influenced by the expectation of consumers. This can be seen by rising or falling sales quantities in the individual market segment. Quality and safety are prerequisites, but the market is opened to further optimization. Not only value for money will gain in the importance of the cosmetics branch, but also the additional use. Nowadays, people concern about their health and skins which results in an increase in skincare body products. The types of skincare product that in trend at present is clearly skin moisturizing with 40%, followed by skin aging with 20%, regeneration with 18% and 15% each for protection and aura/freshness. Skincare products that made from natural ingredients become more popular at the moment and these ingredients are available to find easily in Thailand (Bernd Brackmann, Trends in Cosmetic Care Products, 2005).

Coconut oil is considered as very healthy oil. Consumption of virgin coconut oil (unhydrogenated) is claimed to cause increased metabolism and an improved immune system. In India, coconut oil is used as oil for styling hair. It is also excellent as a skin moisturizer and virgin coconut oil is as effective and safe as mineral oil when used as a moisturizer, with absence of adverse reactions (Wikipedia, the free encyclopedia, 2003). Due to the plenty of coconut oil with low cost in Thailand, coconut oil was used as the main ingredient of skincare body cream. When Thai flowers were extracted in form of essential oil or fragrance. They can be for adding value in skincare body cream. It can help for supporting economic and expanding the unique of Thai traditional product.

Due to less skincare body cream with flower fragrance available in the market of Thailand. Therefore, it will be an alternative choice to sell innovative type of skincare body cream for target consumers who desire to use natural skincare body cream associated with Thai flower fragrance. Furthermore, in the development of coconut oil skincare body cream with Plub-plung and Ratee fragrance, almost ingredients were produced in Thailand in order to save cost and both introduce and promote Thai traditional product to people around the world.

### **Aim**

To develop skincare body cream containing coconut oil as a main ingredient with Thai flower fragrance for consumers who concern about Thai flower aroma and their body skins.

### **Objectives**

1. To brainstorm and screen the ideas for new natural skincare body cream.
2. To study the effect of coconut oil and aloe vera extract in skincare body cream on sensory evaluation.
3. To formulate suitable coconut oil skincare body cream with Thai flower fragrance.
4. To determine the final product quality of coconut oil skincare body cream with Thai flower fragrance.
5. To conduct consumer acceptance test for coconut oil skincare body cream with Thai flower fragrance.





## Literature review

### 1. Cream

Creams are usually about 2/3 oil phase (oils, butters, waxes) and 1/3 water phase (all water soluble ingredients). These ratios can be adjusted according to producer needs. The producers will need about 5-10% if using an emulsifying wax or 15-20% if the producers are using polysorbate 20. Water based preservatives should be stirred into the water phase and oil based preservatives should be stirred into the oil phase. The smaller phase should be added very slowly to the larger phase with constant mixing. The cream will change consistency somewhat as it cools.

#### 1.1 Thickeners

Thickeners are used very often in various cosmetic products. They enhance the consistency, volume and viscosity of cosmetic products, thereby providing more stability and better performance. While some thickeners have also emulsifying or gelling properties, the majority of thickeners have the ability to retain water on the skin and act therefore as moisturizers. Thickeners can be completely natural like waxes but also synthetic or semi-synthetic. They are derived from various sources and consist of very different molecular structures including polysaccharides, alcohols or waxes.

##### 1.1.1 Cetyl Alcohol (All- purpose thickener with moisturizing effect)

Description: 1- hexadecanol, hexadecyl or palmityl alcohol, synthetic (occurs also naturally in whale oil as palmitic acid ester), purity > 95%, composed of fatty alcohols. White flakes, no or faint odor, soluble in water and alcohol.

Properties: Non- gelling thickener, co-emulsifier if concentration > 5%, viscosity and consistency enhance (also in waterless products like lipsticks), emollient, moisturizer (attracts moisture), foam booster.

Applications: Lotions, creams, hair shampoos, hair conditioners, body washes, and make up product.

Combination: Typically combined with polysorbate 60.

##### 1.1.2 Xanthan gum (Natural thickener and viscosity enhancer)

Description: Corn sugar gum, excretion product from bacteria (*xanthomas campestris*), purity >98%, composed of pure natural polysaccharide (sugar) constituted of glucose, mannose and glucuronic acid, white powder, and odorless. Soluble in water (use warm water to avoid lumps).

Properties: Non-gelling thickener (but binds water), viscosity, volume and foam enhancer, emulsion stabilizer, lubricant, and suspending agent.

Utilizations: Dissolve in warm water, usual final concentration of 0.5-2.0%

Applications: Lotions, creams, hair shampoos, hair conditioners, body washes, and make up product.

Combinations: Typically combined with Surfactants or Emulsifiers.

### **1.1.3 Sorbitol (moisturizing thickener and texturizer)**

Description: D-glucose, D-sorbitol, hexahydric alcohol, natural polyhydric alcohol derived from a sugar solution (dextrose) from wheat, consists of the alcohols D-glucitol and D-mannitol, resistant to acids and alkalis, stable at temperature up to 180°C (356°F). White, crystalline powder, slightly sweet odor. Soluble in water or alcohols.

Properties: Excellent plasticizing and thickening effects providing viscosity and texture, stabilizes gels and provides good clarity, effective moisturizing properties (avoids moisture loss), good smoothing and conditioning effects.

Utilization: Can be added to formulas as is usually at concentration of 5-50%

Applications: Creams, lotions, gels, pastes, protecting creams, ointments, make up and sun care as well as personal care products.

Combinations: Typically combined with Surfactants or Emulsifiers.

## **1.2 Humectants (Moisturizers)**

Humectants are important cosmetic ingredient allowing to prevent loss of moisture thereby retaining the skin's natural moisture. Some compounds also have the ability to actively attract moisture. Humectants are key ingredient in most skincare products. There is a large variety of very different compounds providing moisturizing effects including proteins, acids, polysaccharides, and various small molecules (e.g. glycerine, sorbitol, urea, aloe vera etc.)

### **1.2.1 Aloe vera (Natural moisturizer with regenerating properties)**

Description: Pure natural gel derived from the hollow interior of the leaves of the aloe vera plant (aloe barbadensis miller), consists of > 75 ingredients including amino acids, enzymes, hormones, minerals, saponins, sterols, sugar (starch), lectins and vitamins, pH:3.5-4.7, water-soluble, clear liquid, faint herbal odor and water-soluble.

Properties: Moisturizer, regenerating and healing agent (penetrates skin stimulating the immune system and increasing blood circulation), anti-inflammatory effects and anti-aging effects (increase collagen synthesis and skin elasticity).

Utilization: Use 5-100% of final concentration.

Applications: All skincare products for dry skin, soothing cream and lotion, sun care and after sun products, shampoos as well as conditioners for dry hair.

Combinations: Typically combined with Surfactants or Emulsifiers.

### 1.2.2 Vitamin E (dl- alpha- tocopheryl acetate)

Description: Synonyms : dl-alpha (all-rac-alpha) tocopheryl acetate, 95.7 synthetic, purity > 98%, provides antioxidant activity only on the skin (tissue esterases will cleave off acetate to form active vitamin E), pH 6-8. Activity 1000 IU per 1 g solution (about 1 ml). Clear viscous yellow liquid, faint odor, soluble in alcohol and oil, and water insoluble.

Properties: Potent antioxidant (protects from damages by reactive oxygen radicals and UV rays), increases SPF, moisturizing and antiaging effect (improves skin surface relief), soothing and anti-inflammatory properties, promotes epithelisation and enzyme activity (faster wound healing).

Utilization: Use 1-10% of final concentration.

Applications: All kinds of skincare products, sun care and make up products.

Combinations: Typically combined with Sunscreens, Lacto-ceramide and Coenzyme Q 10.

## 1.3 Stabilizers and Solvents

### 1.3.1 Preservative and Antioxidant

Description: Ethylenediaminetetraacetic acid tetrasodium salt, Chelating agent able to bind metal ions (e.g. sodium, calcium, magnesium, zinc and many more). Widely used in the food and cosmetic industry for various purposes. Off-white powder, and no odor. Easily soluble in cold water.

Properties: Effective preservative (enhances efficacy of other antibacterial agents), emulsion and foam stabilizer (has detergent properties and stabilizes other surfactants), antioxidant/enhances effects of natural antioxidants as e.g. vitamin C and E, improves efficacy of other preservatives by stabilizing the pH value.

Utilization: Typical concentration 0.1-1.3% (but up to 2% possible).

Applications: To preserve or stabilize all kinds of cosmetic products.

Combinations: Typically combined with Paraben-DU, Grapefruit Seed Extract, Potassium Sorbate, Vitamins, and BHT (Butylated Hydroxyl Toluene).

## 1.4 Emollients (Softeners)

Emollients are natural or also synthetic products mainly consisting of fatty components including oil, fats, butters, waxes and silicones. Besides their effective refitting properties, they have also many important protective and nourishing properties and are therefore widely used in basically all personal care products. In addition, emollients improve the softness, smoothness, and skin feeling of personal care products. Many emollients are also often used as basic components in various make up products.

### 1.4.1 Almond oil (Natural emollient with nourishing properties)

Description: Amygdalae oleum dulcium, sweet almond oil, natural oil pressed from the seeds of the sweet almond tree, contains 62-86% oleic acids and other valuable fatty acids, rich in beta-sitosterol, squalene and vitamin E. Insoluble in water, hardly soluble in alcohol, pale yellow liquid, and nutty odor.

Properties: Excellent emollient (leaves the skin soft, smooth and conditioned), good nourishing and revitalizing effect (penetrates well the skin), moisturizer and lubricant, heals injured and chapped skin.

Utilizations: Can be used as is, usual final concentration 1-100%. Can be used as massage oil.

Applications: Creams, lotions, protecting and healing creams, ointments, bath oils, make up and sun care products, personal and baby care product.

Combinations: Typically combined with natural waxes, natural butters, polysorbate 60, sorbitan stearate, and SL-polyglyceryl laurate.

### 1.4.2 Grapeseed oil (Natural emollient with astringent properties)

Description: Natural oil pressed from the seeds of grapes (*Vitis vinifera*), contains 60-76% linoleic acid, 12-25% oleic acid, 6-9% palmitic acid and 3-6% stearic acid, rich in various vitamins including vitamin A, D and E, pale yellow to greenish liquid, faint odor. Soluble in alcohol, and water-insoluble.

Properties: excellent non-greasy emollient with good skin absorption (leaves the skin soft and smooth) mild astringent effect (tightens and tones the skin), useful for acne, oily and improve skin.

Utilizations: Concentration in personal care products range from 1-100% (can be used pure as massage oil).



Applications: Creams, lotions, protecting and healing creams, ointments, bath oils, make up and sun care products

Combinations: Typically combined with natural waxes, natural butters, polysorbate 60, sorbitan stearate.

## 1.5 Emulsifiers

Emulsifiers are used in creams and lotions to mix water with oil. Since water and oil do not mix but stay separated, an additional agent (emulsifier) is necessary to form a homogenous mixture keeping water and oil together. There are 2 types of emulsifiers. Oil-in-water (o/w) emulsifiers keep oil drops packed in water, while water-in-oil (w/o) emulsifiers keep water drops packed in oil. W/O emulsifiers are used for a fatty feel (e.g. night and sun protection creams). O/W emulsifiers are used more in moisturizing products (e.g. body lotions, day creams)

### 1.5.1 Cream Maker P60 (Polysorbate 60)

Description: Tween 60, polyoxyethylene (20) sorbitan monostearate, synthetic, consists of sorbitol, ethylene oxide and stearic acid (stearic acid is derived from vegetable oil), purity >95%, food-grade. Yellow-brownish viscous liquid, no or weak odor. Soluble in water and alcohol, insoluble in oils, HLB value : 14.9 (gives oil- in-water emulsions).

Properties: Non-ionic, multi-purpose emulsifier (enables water and oil to mix, effect increased when combined with cetyl alcohol or sorbitan stearate), dispersing agent, thickener antistat, solubilizer and stabilizer of essential oils can be used in food.

Utilizations: Warm to melt before use.

Application: Creams, lotions, skin cleansers, make up products requiring emulsification.

Combinations: Typically combined with emollients, natural oils or natural butter.

## 1.6 Fragrance

Fragrances are all oils of the highest quality available and are produced and designed especially for personal care and cosmetic products. Most oils are a blend of natural oils and specific aroma chemicals which make it possible at all to create stable fragrances. The fragrances can be used in a wide variety of products, from bath salts and skin lotion, to face creams, body sprays, shampoos, and aromatic moisturizers. All fragrances are strictly undiluted, full-strength oil that have not been cut with solvents. This allows using much less oils in product while still achieving the fragrance effect of the scent you like.

Typically, a face cream may contain 0.01% fragrance by weight while a soap bar and body cream might range from 0.5-3.0% fragrance. With each of oils strongly recommend do through testing with the fragrance at different concentrations to find what works best in products (<http://www.thailabonline.com/aromaproductlist.htm>).

## **1.7 Preservatives**

Cosmetic products become easily contaminated by microbes. Containing water, oils, peptides, and carbohydrates cosmetics are a very good medium for growth of microbes. All these factors contribute to the fact that cosmetic products need very good preservation to prevent microbial growth and spoiling of the cosmetic product and also infection of the skin. Preservatives are active ingredients able to prevent the growth bacteria, fungi and viruses. All preservatives have potent antimicrobial properties preventing personal care and make up products effectively from spoiling and prolonging substantially the shelf life. Some of these agents also have stabilizing effects able to preserve the function of various active ingredients including antioxidants (vitamins), emulsifiers and surfactants. The addition of such kind of stabilizers makes sure that creams, lotions and other complex cosmetic products do not separate. (<http://www.youthingstrategies.com/qualities.htm>)

## **1.8 Specification of body cream**

### **1.8.1 Physical properties**

Viscosity: The body cream must have good spreading properties. It must not be too thick or too watery. It should be easily absorbed by the skin so that the essential nutrients can fully absorb.

Melting point: The body cream should be stable under storage temperature. All of its properties should not change under storage temperature e.g. there should not be a change in state.

Color: The color of the body cream is preferred to be light e.g. white, off white or light pink. It should not stain the clothing of the user.

Scent: After the development of the cream, fragrance may be added to increase the selling factor of the product.

Texture: The texture should be smooth and soft. It should not be too sticky or too oily.

### 1.8.2 Chemical properties

pH: The skin's natural pH is 5.5. Once the pH of skin exceeds 6.5, bacterial invasion increases dramatically, a loss of normal skin integrity and a variety of various skin diseases and disorders results.

Reactivity: Chemicals used in the body cream should not react with the storage container. Otherwise, harmful by products may be form and the skin will be irritated as a result.

### 1.8.3 Microbiological properties

Microbial stability is defined as the resistance of a material to the growth of microorganisms should not occur in the body cream during its shelf- life and in the period of consumer use. Microorganisms will grow whenever conditions such as temperature, moisture, pH and nutrients are presence or favorable. Emulsion type of formulations is a good media for growth of bacteria and fungi (moulds and yeasts). Hence, preservation is essential to prevent spoilage of the product and to ensure 100% safety of the consumer during its period of use. Spoilage caused by growth of microorganisms cannot be detected by naked eyes. Microbiological contamination can be detected by performing sampling and growing on enriched culture media. Pathogenic organisms present in the body cream may give rise to disease when general resistance is lowered by illness.

In this development, herbal extracts are to be used and there is a possibility of such raw materials to be heavily contaminated. It is important that the supplier pack these materials properly in protective containers. To test for the type of microbes present in the cream, it is possible to use plating media such as Tryptone Soya Agar (TSA) for gram positive microorganism such as *Staphylococcus albus* and Mac Conkey agar No.2 for *Escherichia coil* (Gram negative). Sabouraud agar and melt extract agar is suitable for mould and yeast, respectively.

### 1.8.4 Sensory Evaluation

Sensory Evaluation includes testing of the selected formulation on the skin. Panelists are used to give their opinion for each attribute of the body cream based on individual opinion. Sensory evaluation test should include attributes before use, the color and scent of the cream, attribute during use including spreading ability and absorbency, attributes after use including stickiness, gloss and moist.

## 2. Coconut Palm (*Cocos nucifera*)

Scientific name: *Cocos nucifera*

Family: *Arecaceae*

Genus: *Cocos*



**Figure 1: Coconut Palm**

### 2.1 Origins and cultivation

The origin of this plant is the subject of controversy with some authorities claiming it is native to Southeast Asia, while others claim its origin is in Northwestern South America. Fossil records from New Zealand indicate that small, coconut-like plants grew there as far back 15 million years ago. Picture of coconut palm was shown in figure 1.

The coconut palm thrives on sandy soils and is highly tolerant of salinity and prefers areas with abundant sunlight and regular rainfall (750 to 2,000 mm annually), which makes colonizing shorelines of the tropics relatively straightforward. Coconuts also need high humidity (70–80%+) for optimum growth, which is why they are rarely seen in areas with low humidity (e.g. the Mediterranean), even where temperatures are high enough. They are very hard to establish and grow in dry climates.

### 2.2 Fruit

A coconut is a simple dry fruit known as a fibrous drupe (not a true nut). The husk (monocarp) is composed of fibers called coir and there is an inner "stone" (the endocarp). This hard endocarp (the coconut as sold in the shops of non-tropical countries) has three germination pores that are clearly visible on the outside surface once the husk is removed. It is through one of these that the radical emerges when the embryo germinates. Adhering inside wall of endocarp is the test with a thick aluminous endosperm, the coconut meat, the white and fleshy edible part of the seed (Bruce Fife's book *The Healing Miracles of Coconut Oil*, 2001).





**Figure 2: Coconut fruit**

When the coconut is still green, the endosperm inside is thin and tender, a favorite snack. But the main reason to pick the nut at that stage is to drink its juice; a big nut contains up to one liter of refreshing drink. Coconut fruit was shown in figure 2.

To open a coconut, remove the outer husk (if not purchased already removed) and piece two of the three eyes of the fruit (one for the juice to come out of, one to enable air to go in); drain the juice from the fruit. Since coconuts have a naturally-forming fracture point, they can be opened by taking a heavy knife, such as a meat cleaver, and striking the coconut with the flat edge of the knife using a flat-bladed screwdriver and a hammer (which is easier, and may be safer than using a cleaver). After inserting the screwdriver slightly, twist it to crack the shell. The coconut should then be turned, and this process repeated until there is a continuous crack in the shell around the entire fruit. Afterwards, the fruit can be separated at this fracture point. ([http://en.wikipedia.org/wiki/Cestrum\\_nocturnum](http://en.wikipedia.org/wiki/Cestrum_nocturnum))

### **.2.3 Coconut oil for your skin**

The ideal lotion is one that is made from oil that not only softens the skin, but protects it against damage, promotes healing and gives it a more youthful, healthy appearance. Coconut oil fits that description. Pure virgin coconut oil is the best natural ingredient for skin lotion available. It prevents destructive free-radical formation and provides protection against them. It can help to keep the skin from developing liver spots, and other blemishes caused by aging and over exposure to sunlight. It helps to keep connective tissues strong and supple so that the skin doesn't sag and wrinkle. The oil is absorbed into the skin and into the cell structure of the connective tissues, limiting the damage excessive sun exposure can cause.

Coconut oil will not only bring temporary relief to the skin, but it will aid in healing and repairing. It will have lasting benefits, unlike most lotions. It can help bring back a youthful appearance. The coconut oil will aid in removing the outer layer of dead skin cells, making the skin smoother. The skin will become more evenly textured with a healthy "shine". While doing this, the coconut oil will penetrate into the deeper layers of the skin and strengthen the underlying tissues (<http://en.wikipedia.org/wiki/Coconut>).

## **2.4 The protective environment of the skin and how coconut oil helps**

Antiseptic fatty acids in coconut oil help to prevent fungal and bacterial infections in the skin when it is consumed and to some extent, when it is applied directly to the skin. The only way to gain entry into the body other than through the natural openings, such as the nose and mouth, is by penetrating the skin. When the skin's defenses break down, infections can result. Acne, ringworm, herpes, boils, athlete's foot, and warts are just some of the infectious conditions that can affect the skin and body ([http://en.wikipedia.org/wiki/Coconut\\_oil](http://en.wikipedia.org/wiki/Coconut_oil)).

The biggest chemical barrier to infectious organisms is the acid layer on the skin. Healthy skin has pH of about 5, making it slightly acidic. Our sweat (containing uric and lactic acids) and body oils promote this acidic environment. For this reason, sweat and oil do us good. Harmless bacteria can tolerate the acid and live on the skin, but troublesome bacteria can't thrive and their numbers are few.

The oil that our bodies produce is called sebum. Sebum is secreted by oil glands (sebaceous glands) located at the root of every hair as well as other places. This oil is very important to skin health. It softens and lubricates the skin and hair and prevents the skin from drying and cracking. Sebum also contains medium chain fatty acids, in the form of medium chain triglycerides that can be released to fight harmful germs ([http://www.coconut-connections.com/skin\\_care.htm](http://www.coconut-connections.com/skin_care.htm)).

Our skin is home to many tiny organisms, most of which are harmless; some are beneficial. At least one variety of bacterium is essential to the healthy environment on our skin. It feeds on the sebum, breaking down the triglycerides into free fatty acids. The bacteria actually feed on the glycerol part of the triglyceride. This leaves fatty acids which are now "freed" from the glycerol unit that held them together. Medium chain fatty acids which are bound to the glycerol unit as they are in coconut oil have no antimicrobial properties. However, when they are broken apart into free fatty acids, they become powerful antimicrobials.

So these bacteria convert the medium chain triglycerides (in the sebum or on the skin) into free fatty acids that can kill disease-causing bacteria, viruses, and fungi. The combination of the slightly acid pH and medium chain fatty acids provides a protective chemical layer on the skin that prevents infection from disease-causing organisms. Due primarily to the action of bacteria, the oil on the surface of your skin and hair is composed of between 40 and 60 percent free fatty acids. The medium chain fatty acids in the sebum provide the protective layer on the skin that kills harmful germs. Coconut oil is nature's richest source of medium chain fatty acids (<http://www.coconut-oil-uk.com/Virgin-Coconut-Oil.html>).

When coconut oil is put on the skin it doesn't have any immediate antimicrobial action. However, when bacteria which are always present on the skin turn these triglycerides into free fatty acids, just as it does with sebum, the result is an increase in the number of antimicrobial fatty acids on the skin and protection from infection. The free fatty acids also help to contribute to the acid environment on the skin which repels disease causing germs.

When bathing or showering, soap washes the protective layer of oil and acid off our skin. Often afterwards the skin becomes tight and dry. Adding moisturizers help the skin feel better, but it does



not replace the acid or the protective medium chain fatty acid layers that was removed. Skin is vulnerable to infection at this time. Many germs survive washing by hiding in cracks and folds of the skin. Before long skin is again teaming with microorganisms, both good and bad. Until sweat and oils return to reestablish the body's chemical barrier, skin is vulnerable to infection. If a cut or cracked skin present, this can allow streptococcus, staphylococcus and other harmful germs entry into the body. By using coconut oil cream, lotion or just pure coconut oil can quickly help reestablish the skin's natural antimicrobial and acid barrier. Many people use coconut oil on their skins after every bath (<http://www.coconut-info.com/>).

### 3. *Crinum Lily* (Plub-plung)

Scientific name: *Crinum spp.*

Pronunciation: **KRYE- num species**

Common name: *Crinum Lily*

Family: *Amaryllidaceae*



**Figure 3: *Crinum Lily***

*Crinum Lily* grows on sandy seashores or in the back mangrove. A very large lily, it grows from an underground bulb. The lower leaves form a stout pseudo-stem from which the leaves emerge in a rosette ([http://www.naturia.per.sg/buloh/plants/crinum\\_lily.htm](http://www.naturia.per.sg/buloh/plants/crinum_lily.htm)). The leaves can grow up to 2m long. The flowers are delightfully scented (figure: 3). The fruit is a globe which turns shiny white when ripe then splits open to reveal irregularly shaped seeds. The plant is poisonous (<http://www.pharmacare.com.au/invite/#>).

#### 4. Lady of night (Ratee)

Scientific name: *Cestrum Nocturnum*

Family: *Solanaceae*

Common name: **Night Jessamine**

Other name: **Lady of the Night**



**Figure 4: *Cestrum Nocturnum* (Ratee)**

*Cestrum nocturnum*, has the strongest fragrance out of all the fragrant plants present. In the evening the fragrance becomes almost intoxicating. It is a common misconception that this bush is fragrant only at night. It is true that the fragrance is stronger in the evening but it still smells a light scent all day long. The characteristic of Lady of night was shown in figure 4. (<http://www.positivehealth.com/permit/Articles/Regular/mcintyre81.htm>)



## Materials and Methods

### 1. Chemical reagents

1. Sweet Almond Oil (Honghuat Co., Ltd)
2. Coconut Oil (Honghuat Co., Ltd)
3. Aloe Vera Extract (Honghuat Co., Ltd)
4. Polysorbate Tween 60 (Honghuat Co., Ltd)
5. Sorbital 70% solution USP (Honghuat Co., Ltd)
6. Cetyl Alcohol (Honghuat Co., Ltd)
7. Xanthan Gum (Degussa Texturant Thailand Co., Ltd)
8. Vitamin E Acetate (Honghuat Co., Ltd)
9. Grape seed oil (Honghuat Co., Ltd)
10. Ratee Fragrance (Honghuat Co., Ltd)
11. Peeb Fragrance (Honghuat Co., Ltd)
12. Plub-plung Fragrance (Honghuat Co., Ltd)
13. Jampa Fragrance (Honghuat Co., Ltd)
14. Distilled water

### 2. Media

1. Tryptone (Becton Dickinson and Company Sparks, USA)
2. Yeast Extract (Scharlau Chemie S.A., Barcelona, Spain, EU)
3. Glucose (Utopian Co., Ltd, Thailand)
4. Agar (Mathar Group Trading, Thailand)
5. Peptone (Merck, Germany)
6. PDA (HiMedia Laboratories Limited, Mumbai, India)
7. LSTB (HiMedia Laboratories Limited, Mumbai, India)
8. Lactose (Merck, Germany)
9. Oxgall (Merck, Germany)
10. Brilliant Green (Merck, Germany)
11. Dipotassium Hydrogen Phosphate (May & Baker Ltd, England)
12. Potassium Dihydrogen Phosphate (May & Baker Ltd, England)
13. NaCl (Montedison Group, Germany)
14. Bile salt (Difco Laboratories, Detroit, USA)
15. Bacto Peptone (Difco Laboratories, Detroit, USA)
16. Eosin (Montedison Group, Germany)
17. Baird-Parker's agar (HiMedia Laboratories Limited, Mumbai, India)
18. HgCl (Merck, Darmstadt, Germany)

### **3. Equipment and apparatus**

#### **3.1 Skincare body cream production**

- 3.1.1 Water bath
- 3.1.2 Homogenizer mixer (Model Moulinex Supermix 180 Stand, Hakemaker Mayer Thailand, France)
- 3.1.3 Analytical Balance (Model no. AP2105, Jebsen & Jessen Thailand, Ltd)
- 3.1.4 Thermometer
- 3.1.5 Beaker
- 3.1.6 Stringing rod
- 3.1.7 Bottle
- 3.1.8 Spoon
- 3.1.9 Dropper

#### **3.2 Physical properties**

- 1. Viscometer (Model Physica MCR301, Anton Paar, Ltd)
- 2. Munsell Book (volume 1)

#### **3.3 Microbiological properties**

- 1. Laminar flow (Model H2, Dwyer Mark 2, “Clean”)
- 2. Incubator (Model EB280, Jouan)
- 3. Autoclave (Model HA 300 M2, Hirayama )
- 4. 95%Ethyl alcohol
- 5. Hood
- 6. Petri dish
- 7. Beaker
- 8. Micropipette
- 9. Plastic bag 8”x10”

#### **3.4 Determination of chemical property**

- 1. pH meter (Model HI 98127- HI 98128 Waterproof pH & temperature meters, NANNA Instruments, Italy)

## **Methods**

### **1. Focus group discussion of new natural skincare body cream**

Two groups of target consumers were used for conducting focus group discussion. Each group contained 12 respondents. They were asked the ideas about the desired product attributes of skincare body cream, ingredients to be used, aroma of Thai flower, and the benefits of natural ingredients that consumers want, the suitable weight, price, and packaging design. (Focus group discussion questions were shown in appendix A).

### **2. Study the effect of coconut oil and aloe vera extract in skincare body cream on sensory evaluation**

**Basic formula of skincare body cream (Somerset Company, 1998)**

**Formula: Body cream with vitamin E and aloe vera for normal skin, o/w type (8 oz, 228 ml).**

#### **Phase A**

1. Sweet Almond Oil (51%)
2. Polysorbate Tween 60 (12%)
3. Cetyl Alcohol (8.5%)

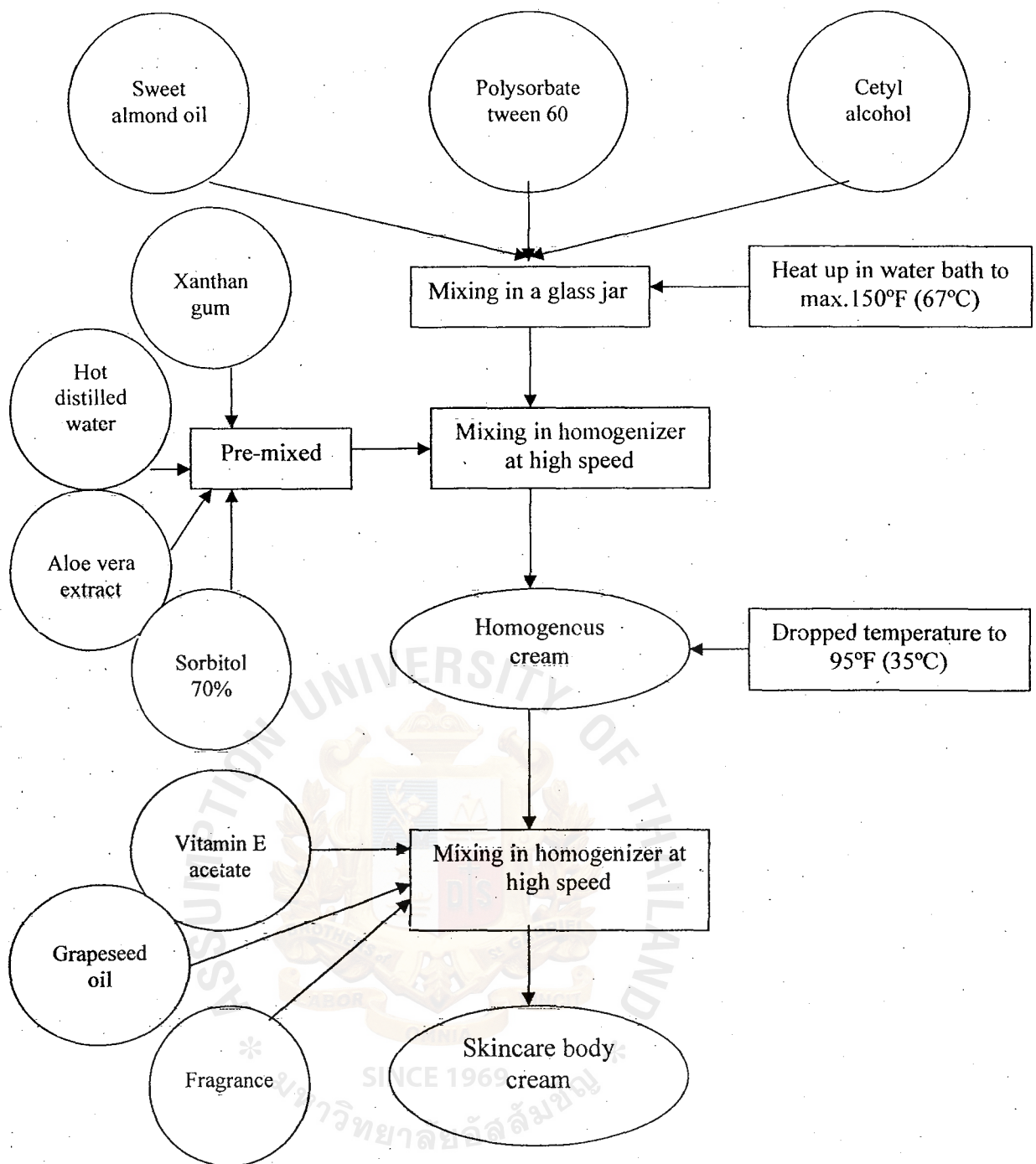
#### **Phase B**

1. Hot Distilled Water (22%)
2. Xanthan Gum (0.3%)
3. Aloe Vera Extract (2.2%)
4. Sorbitol 70% (2%)

#### **Phase C**

1. Vitamin E Acetate (1%)
2. Grapeseed Oil (0.7%)
3. Fragrance and Essential Oils

Phase A was added into a heat resistant glass jar and it was heated up in a hot water bath to maximum 150°F (67°C). Phase B was pre-mixed by sprinkling the xanthan gum into the water and mixing on high speed. Phase B was added into phase A and stirred thoroughly until it became homogenous cream. After the temperature had dropped to about 95°F (35°C), then the ingredients of phase C were added and stirred them again. (Figure 5)



**Figure 5:** Skincare body cream production

Used factorial design 2x2 in RCBD by studying the effect of coconut oil and aloe vera extract, coconut oil was varied at 20% and 40% whereas aloe vera extract was varied at 2% and 5%. All treatments used presented in table 1.

Table 1: Treatments used in studying the effect of coconut oil and aloe vera extract

Treatment	Coconut oil (%)	Aloe vera extract (%)
1	20	2
2	20	5
3	40	2
4	40	5

The attributes of four treatments were evaluated by thirty panelists. Each panelist tested all samples during use and after use. The results were analyzed by using Scheffe test ( $\alpha = 0.05$ ). A questionnaire used in this study was shown appendix B, questionnaire 1.

### **3. Selection of Thai flower fragrance in skincare body cream**

Coconut oil skincare body cream was varied in four kinds of Thai fragrance, which obtained from focus group discussion step by using Randomized Complete Block Design (RCBD). Thai flower fragrance were Jampa, Ratee, Plub-plung, and Peeb. Each of them was added in skincare body cream at 1%. Preference ranking of Thai flower fragrance was evaluated by thirty panelists. (Appendix B, Questionnaire 2). A sample which had significantly highest score of the most preferred was selected for the further development ( $\alpha=0.05$ ). If the results of each Thai flower fragrance were non significant difference ( $P>0.05$ ), therefore the most preferred and the second most preferred fragrance were chosen for using in paired preference test (Appendix B, Questionnaire 3) in order to acquire the most preferred fragrance. After that, skincare body cream were selected the percentage of Thai flower fragrance by using paired preference test between 1.5% and 3.0%.

### **4. Development of coconut oil skincare body cream with Thai flower fragrance**

After obtaining the best formula and the most preferred Thai flower fragrance from the previous step, then the last formula was developed until gaining satisfactory results. 9-point hedonic scaling test and just right scale (Appendix B, Questionnaire 4) were used by thirty panelists. Once obtaining the final formulation, the results were confirmed by using only 9-point hedonic scaling test with thirty panelists.

### **5. Determination of final product quality**

The final product was examined in 3 aspects such as physical, microbiological and chemical properties. Determinations of physical and chemical properties were conducted triply whereas microbiological properties were conducted in duplicate. (Appendix C)



### **5.1 Physical properties**

- Color (Hue Value/ Chroma)
- Viscosity

### **5.2 Microbiological properties**

- Total Plate Count (Mesophilic and Psychotrophs) (A.O.A.C., 2000)
- Yeast and Mold (A.O.A.C., 2000)
- Coliform (A.O.A.C., 2000)
- *Escherichia coli* (A.O.A.C., 2000)
- *Staphylococcus aureus* (A.O.A.C., 2000)

### **5.3 Chemical property**

- pH (A.O.A.C., 2000)

## **6. Consumer acceptance test for coconut oil skincare body cream with Thai flower fragrance**

Consumer acceptance test for coconut oil skincare body cream with Thai flower fragrance (Plub-plung and Ratee) was conducted at Assumption University (Hua Mark campus), Ramkamhang road, and Param 9 road by using 100 target consumers who worked or studied or stayed in an air-conditioned atmosphere or had dry skin. Samples were taken by using convenience sampling method. Consumers were asked the questions related to demographic data, consumer buying behavior, product evaluation including product acceptability, price, package/container, buying place as well as weight of product by using questionnaire (Appendix B, Questionnaire 5).

### **7. Place**

Assumption University (Hua Mark campus)

### **8. Period of research**

Started from February – May, 2006

## Result and Discussion

### **1. Focus group discussion of new natural skincare body cream**

Two groups of target consumers were conducted the focus group discussion for 20 questions. Each group consisted of 12 respondents and the questions used in focus group discussion were shown in appendix A.

The results showed that the brands of skincare body cream that the target consumer currently using were Nivea (55%), Vaseline (25%) and Jergen (20%). The reasons for them to choose these brands were not allergic for their skins, not too much sticky and not have strong smell.

The major reasons for target consumers using skincare body cream were; they had dry skins or wanted to increase moisture to their skins because most of them worked or studied in air-conditioned room all day which made their skins dry. Normally, the target consumers also used skincare body cream 2 times per day (in the morning and at night) around 64%, 20% used only at night and 16% used skincare body cream only in the morning.

The main factors affecting buying decision on skincare body cream were price, quality and ingredients, absorbency, aroma, color as well as brand of the product. 90% of consumers liked cream that had white color including not too sticky and somewhat quick for absorbency. Another 10% liked light color such as light yellow or light pink color.

The desired characteristics of skincare body cream that respondents needed were quickly absorbed but increase moisture to their skins, Furthermore, skincare body cream must consist of some ingredients that can promote an efficiency to repair their skins such as vitamin C but not allergic to their skins. The types of aroma that target consumers preferred to add in skincare body cream were flower aroma 80%, fruit aroma 10% and 10% of fresh aroma. Moreover, 80% of the target consumers were interested in skincare body cream that had ingredients extracted from natural ingredient in Thailand such as coconut oil, honey, aloe vera, turmeric and cucumber because almost of them had possessed knowledge of the function of these natural ingredient to their skins.

Thai flower fragrance that the target consumer preferred in skincare body cream were Peeb, Plub- plung, Ratee, Jumba and Jasmine. The most of consumers really wanted to test skincare body cream comprised of Thai flower aroma.

The desirable type of package for skincare body cream should be easy to open like original package (85%) and 15% of target consumers wanted to use pumping package. The size of the package that respondents of target consumers preferred should contain about 200-300 ml with the price of 250-500 baht.

The majority of the respondents also knew about the function/quality of natural ingredients in the aspect of cosmetic function because most of natural ingredients have been beneficial for Thai woman skins for a long time. However, consumers did not find natural ingredients in form of skincare body cream with Thai flower aroma. The target consumers were quite interested in alternative natural ingredient and desired to test this product if available in the market.

## **2. Study the effect of coconut oil and aloe vera extract on sensory evaluation of skincare body cream**

Four formulations of coconut oil and aloe vera extract skincare body cream were produced by using the basic formula from Somerset company (1998). The results of liking score (9- Point Hedonic Scaling Test) of coconut oil and aloe vera extract skincare body cream in each attribute was shown as below table.

Table 2: Comparison between 4 formulas of coconut oil and aloe vera extract skincare body cream.

Attribute	Formulas	Mean±S.D.
Overall <sup>NS</sup>	20% coconut oil and 2% aloe vera extract	6.17±1.14
	20% coconut oil and 5% aloe vera extract	6.37±1.03
	40% coconut oil and 2% aloe vera extract	6.00±1.15
	40% coconut oil and 5% aloe vera extract	5.87±1.23
Color <sup>NS</sup>	20% coconut oil and 2% aloe vera extract	6.43±1.35
	20% coconut oil and 5% aloe vera extract	6.73±1.10
	40% coconut oil and 2% aloe vera extract	6.50±1.32
	40% coconut oil and 5% aloe vera extract	6.77±1.24
Stickiness during use <sup>NS</sup>	20% coconut oil and 2% aloe vera extract	5.80±1.31
	20% coconut oil and 5% aloe vera extract	6.13±1.12
	40% coconut oil and 2% aloe vera extract	5.73±1.42
	40% coconut oil and 5% aloe vera extract	5.67±1.34
Absorbency <sup>NS</sup>	20% coconut oil and 2% aloe vera extract	5.57±1.24
	20% coconut oil and 5% aloe vera extract	5.83±1.01
	40% coconut oil and 2% aloe vera extract	5.50±1.18
	40% coconut oil and 5% aloe vera extract	5.30±1.03

Table 2: Comparison between 4 formulas of coconut oil and aloe vera extract skincare body cream.  
(cont.)

Attribute	Formulas	Mean±S.D.
Stickiness after use <sup>NS</sup>	20% coconut oil and 2% aloe vera extract	5.77±1.08
	20% coconut oil and 5% aloe vera extract	6.03±1.01
	40% coconut oil and 2% aloe vera extract	5.70±1.21
	40% coconut oil and 5% aloe vera extract	5.53±1.11
Viscosity <sup>NS</sup>	20% coconut oil and 2% aloe vera extract	6.17±1.11
	20% coconut oil and 5% aloe vera extract	6.53±0.09
	40% coconut oil and 2% aloe vera extract	5.87±1.32
	40% coconut oil and 5% aloe vera extract	6.07±1.22
Gloss on skin <sup>NS</sup>	20% coconut oil and 2% aloe vera extract	5.77±1.09
	20% coconut oil and 5% aloe vera extract	5.83±0.08
	40% coconut oil and 2% aloe vera extract	5.90±0.09
	40% coconut oil and 5% aloe vera extract	5.57±1.23
Moist <sup>NS</sup>	20% coconut oil and 2% aloe vera extract	6.37±1.12
	20% coconut oil and 5% aloe vera extract	6.27±0.07
	40% coconut oil and 2% aloe vera extract	6.33±0.09
	40% coconut oil and 5% aloe vera extract	6.17±1.01

Form the table 2, there were non significant difference between levels of coconut oil and aloe vera extract in skincare body cream on sensory evaluation ( $P>0.05$ ) as well as there was no interaction between coconut oil and aloe vera extract on sensory evaluation ( $P>0.05$ ). Therefore, there was no effect of coconut oil and aloe vera extract on sensory evaluation.

When comparing between 4 formulas, it was found that there was non significant difference among formulas ( $P>0.05$ ) in each sensory attribute. However, the formula consisted of 20% coconut oil and 5% aloe vera extract was chosen for the further step because it obtained the highest score of liking in almost attributes such as overall liking, stickiness during use, absorbency, stickiness after use and viscosity.

### **3. Selection of Thai flower fragrance in skincare body cream**

Four types of Thai flower fragrance such as Jampa, Plub-plung, Peeb, and Ratee from focus group discussion were used in this step. Each treatment was added with one type of Thai flower fragrance at 1% concentration. Four varieties of Thai flower fragrance were ranked according to preference by means of preference ranking. The results were presented in table 3.

Table 3: Comparison between 4 types of Thai flower fragrance in skincare body cream

Treatments	Fragrance	Mean±S.D.
1	Ratee	2.23±1.01 <sup>ns</sup>
2	Jampa	2.68±0.09 <sup>ns</sup>
3	Plub-plung	2.40±1.21 <sup>ns</sup>
4	Peeb	2.50±1.11 <sup>ns</sup>

The data was analyzed by using Friedman's test (Appendix E). From table 3, there was non significant difference between four varieties of Thai flower fragrance ( $P>0.05$ ). Nevertheless, Plub-plung and Ratee were acceptable at the most preferred and second most preferred fragrance, respectively.

Thus Pub-plung and Ratee fragrance were chosen in paired preference test in order to obtain the most preferred Thai flower fragrance. From analysis the data (Appendix D , table 27 ), it was found that there was significantly different between Plub-plung and Ratee fragrance ( $P<0.05$ ) by coconut oil skincare body cream with Plub-plung fragrance was the most preferred. Therefore, Plub-plung fragrance was selected for the further development.

When comparing coconut oil skincare body cream by adding 1.5-3% concentration of Plub-plung fragrance by means of paired preference test. The result showed that there was significant



difference ( $P < 0.05$ ) between them. (Appendix D, table 10) So, skincare body cream with 1.5% concentration of Plub-plung fragrance was selected.

#### 4. Development of coconut oil skincare body cream with Thai flower fragrance

The best formula and the most preferred Thai flower fragrance (Plub-plung) from the previous step, were applied for the step of development until gaining satisfactory results. The formulation of coconut oil skincare body cream for the first development was shown in table 4. 9-point hedonic scaling test and just right scale were used by thirty panelists. The result of 9-point hedonic scaling test and just right scale were shown in table 5 and 6, respectively.

##### 4.1 The first development of coconut oil skincare body cream with Thai flower Fragrance, o/w type (8oz, 228 ml)

Table 4: Formula of coconut oil skincare body cream with Thai flower fragrance at the first development

Ingredients	Percentage (%)
<b>Oil Phase</b>	
Coconut oil	30.00%
Sweet almond oil	23.00%
Polysorbate tween 60	12.00%
Cetyl alcohol	6.50%
<b>Water Phase</b>	
Hot distilled water	21.50%
Xanthan gum	0.30%
Aloe vera extract	2.00%
Sorbitol	2.00%
<b>Additional phase</b>	
Vitamin E	1.00%
Grapeseed oil	0.50%
<i>Crinum Lily</i> (Plub Plung)	1.50%

Table 5: Liking score (9-Point Hedonic Scaling Test) of first development of coconut oil skincare body cream with Thai flower fragrance

Attributes	Mean±S.D.
Overall	6.30±1.01
<b>Before testing</b>	
Color	7.43±1.56
Aroma	5.97±1.25
Viscosity	5.37±1.58
<b>During testing</b>	
Stickiness	5.50±1.48
Absorbency	4.97±1.32
<b>After testing</b>	
Stickiness	5.73±1.12
Gloss on the skin	6.13±1.32
Moist	6.37±1.13



Table 6: Just right scale analysis of first development of coconut oil skincare body cream with Thai flower fragrance

Attributes	Much too much	Moderately too much	Slightly too much	Just right	Slightly too little	Moderately too little	Much too little
Color			10.00%	<b>83.00%</b>	7.00%		
Aroma	3.00%	10.00%	<b>47.00%</b>	33.00%		7.00%	
Viscosity	13.00%	17.00%	<b>60.00%</b>	3.00%	7.00%		
Stickiness during use	3.00%	23.00%	<b>38.00%</b>	30.00%	3.00%	3.00%	
Absorbency	3.00%	<b>44.00%</b>	37.00%	13.00%	3.00%		
Stickiness after use		13.00%	<b>47.00%</b>	40.00%			
Gloss on the skin	3.00%		<b>47.00%</b>	33.00%	10.00%	7.00%	
Moist		3.00%	23.00%	<b>55.00%</b>	16.00%	3.00%	

The result of average score of overall liking of the product was 6.30 (like slightly). The average score of color was quite accepted with the average score of 7.43 but the average score of Plub-plung aroma and viscosity before use were not acceptable. Both results were neither like nor dislike around 5. Therefore, the aroma and viscosity should be improved. Some comments from panelists were aroma quite strong and the presence of coconut aroma as well as more viscosity in skincare body cream.

The result of stickiness and absorbency during use were not accepted and stickiness of skincare body cream like jam and difficult to absorb (Figure 6).

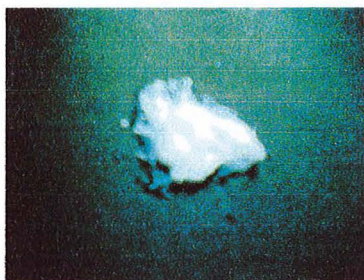


Figure 6: Coconut oil skincare body cream with Plub-plung fragrance at the first development

After testing skincare body cream, the result of stickiness needed to be significantly improved but the average score of gloss on the skin and moist were quite high with the score higher than 6.

From table 6, the result of color was just right around 83%. Attributes of aroma, viscosity and stickiness during use were slightly too much from table 6. Even though the aroma of Plub-plung was quite strong but it could not cover aroma of coconut oil. Therefore, the second development of skincare body cream was done by adding Ratee fragrance to improve the aroma of this cream because Ratee aroma was the strongest fragrance out of all fragrant plants present (<http://flowersandherbs.cscoms.com/flower/content/ff152.htm>). The percentage of Plub-plung and Ratee fragrance were 1% and 0.5%, respectively). Stickiness was improved by decreasing the amount of cetyl alcohol. Because cetyl alcohol is fatty alcohol which utilizes as an emollient, emulsifier, thickener, and carrying agent for other ingredients. It could made cream thickener (Bednarczyk A.A. and Kramar A.,1975). For decreasing viscosity of cream was conducted by increasing the amount of distilled water and aloe vera extract.

Stickiness after use and gloss on the skin were slightly too much that made glossier on the skin of panelists and they didn't like it. For moist of the product was accepted because more oil phase could increase the moisture to their skins.

4.2 The second development of coconut oil skincare body cream with Thai flower  
Fragrance, o/w type (8oz,228ml)

As the second development of coconut oil skincare body cream with Thai flower fragrance. The amount of coconut oil, sweet almond oil, grapeseed oil, plub-plung fragrance were decreased while the amount of hot distilled water, aloe vera extract and sorbital were increased with the addition of Ratee fragrance in following formula (table7).

Table 7: Formula of coconut oil skincare body cream with Thai flower fragrance at the second development

Ingredients	Percentage (%)
<b>Oil Phase</b>	
Coconut oil	25.00%
Sweet almond oil	20.00%
Polysorbate tween 60	12.00%
Cetyl alcohol	6.50%
<b>Water Phase</b>	
Hot distilled water	26.5%
Xanthan gum	0.30%
Aloe vera extract	4.50%
Sorbitol	2.50%
<b>Additional phase</b>	
Vitamin E	1.00%
Grapeseed oil	0.20%
Crinum Lily	1.00%
(Plub Plung)	
Cestrum Nocturnum	0.50%
(Ratee)	



Table 8: Liking score (9-Point Hedonic Scaling Test) of second development of coconut oil skincare body cream with Thai flower fragrance

Attributes	Mean±S.D.
Overall	6.93±0.35
Before testing	
Color	7.50±0.74
Aroma	6.87±1.15
Viscosity	6.40±1.26
During testing	
Stickiness	6.33±1.18
Absorbency	5.93±1.02
After testing	
Stickiness	6.10±1.08
Gloss on the skin	6.23±1.23
Moist	6.63±1.36



Table 9: Just right scale analysis of second development of coconut oil skincare body cream with Thai flower fragrance

Attributes	Much too much	Moderately too much	Slightly too much	Just right	Slightly too little	Moderately too little	Much too little
Color			10.00%	90.00%			
Aroma		3.00%	33.00%	61.00%	3.00%		
Viscosity		3.00%	43.00%	51.00%	3.00%		
Stickiness during use		13.00%	47.00%	40.00%			
Absorbency		13.00%	68.00%	13.00%	3.00%	3.00%	
Stickiness after use		7.00%	59.00%	27.00%	7.00%		
Gloss on the skin	7.00%		40.00%	53.00%			
Moist		24.00%	13.00%	55.00%	5.00%	3.00%	

According to table 8, Panelists liked the overall product slightly but higher than the first development with the average score of 6.93. Moreover, other attributes obtained the higher scores than the first development. Especially, aroma of the product had the average score of 7.50 (like moderately) which was more accepted by panelists. Because the combination of Plub-plung and Ratee fragrance were compatible and available to cover the aroma of coconut oil in this cream. Ratee aroma was the strongest fragrance out of all fragrant plants present that can combine with softly Plub-plung aroma and cover the aroma of coconut oil in this cream. (<http://flowersandherbs.cscoms.com/flower/content/ff.152htm>)

The result of stickiness and absorbency during use cream, and the average score were 6.35 and 5.93 respectively. The characteristic of stickiness of skincare body cream was more watery but it was still slightly difficult to absorb (Figure 7) because the amount oil and sweet almond oil were decreased.



Figure 7: Coconut oil skincare body cream with Plub-plung and Ratee fragrance at the second development

The average score of stickiness, gloss on the skin and moist were increased with the range of 6.10-6.63 (like slightly) due to a decrease in the volume of cetyl alcohol.

From table 9, the result of color, aroma, viscosity, gloss on the skin and moist after use fell in just right. In addition, there was no presence of coconut oil aroma in this formula. However, stickiness during and after use as well as absorbency were in slightly too much.

4.3 The third development of coconut oil skincare body cream with Thai flower fragrance, o/w type (8oz, 228ml)

The third development of coconut oil skincare body cream with Plung-plung and Ratee fragrance was done by reducing the percentage of cetyl alcohol from 6.5 to 5.5% and increasing the percentage of hot distilled water and aloe vera extract from 26.5 to 27% and from 4.5 to 5.0, respectively (table 10).

Table 10: Formula of coconut oil skincare body cream with Thai flower fragrance at the third development

Ingredients	Percentage (%)
<b>Oil Phase</b>	
Coconut oil	25.00%
Sweet almond oil	20.00%
Polysorbate tween 60	12.00%
Cetyl alcohol	5.50%
<b>Water Phase</b>	
Hot distilled water	27.00%
Xanthan gum	0.30%
Aloe vera extract	5.00%
Sorbitol	2.50%
<b>Additional phase</b>	
Vitamin E	1.00%
Grapeseed oil	0.20%
<i>Crinum Lily</i> (Plub Plung)	1.00%
<i>Cestrum Nocturnum</i> (Ratee)	0.50%



Table 11: Liking score (9-Point Hedonic Scaling Test) of third development of coconut oil skincare body cream with Thai flower fragrance

Attributes	Mean±S.D.
Overall	7.23±0.23
<b>Before testing</b>	
Color	7.87±0.74
Aroma	7.27±1.07
Viscosity	6.97±1.08
<b>During testing</b>	
Stickiness	6.80±1.35
Absorbency	6.77±1.54
<b>After testing</b>	
Stickiness	6.87±1.09
Gloss on the skin	7.03±1.23
Moist	7.43±1.14



Table 12: Just right scale analysis of third development of coconut oil skincare body cream with Thai flower fragrance

Attributes	Much too much	Moderately too much	Slightly too much	Just right	Slightly too little	Moderately too little	Much too little
Color			3.00%	97.00%			
Aroma			17.00%	77.00%	3.00%	3.00%	
Viscosity		3.00%	13.00%	78.00%	3.00%	3.00%	
Stickiness during use		7.00%	40.00%	53.00%			
Absorbency	7.00%		46.00%	47.00%			
Stickiness after use			33.00%	67.00%			
Gloss on the skin		3.00%	37.00%	60.00%			
Moist		3.00%	7.00%	87.00%	3.00%		

According to table 11, the average score of overall liking was 7.23 (like moderately). Generally, the mean of all attributes were upper than previous development. Color and aroma of the product had the average of 7.87 and 7.27, respectively whereas viscosity, stickiness and absorbency after use were between like slightly and like moderately (6.77-6.97). Both average score of gloss on the skin and moist after use fell in like moderately. In addition, this cream was not too sticky and less glossy (figure 8) due to a decrease in cetyl alcohol and coconut oil. Generally, cetyl alcohol and coconut oil are effect to thickener. Because thickeners can be completely natural like waxes but also synthetic or semi-synthetic. They have molecular structures including polysaccharides, alcohols or waxes that made cream or lotion to sticky.



Figure 8: Coconut oil skincare body cream with Plub-plung and Ratee fragrance at the third development

Table 12 showed that all attributes such as color, aroma, viscosity, stickiness during and after use, absorbency, gloss on the skin and moist of the product fell in just right.

5. Determination of final product quality

5.1 Physical properties

5.1.1 Color

Table 13: Color value of coconut oil skincare body cream with Plub-plung and Ratee fragrance.

Replication	Color value (Hue Value)
1	9/10Y
2	9/10Y
3	9/10Y

From table 13, the color was no error in three replications. There were presented in the same color, 9/10Y.

### 5.1.2 Viscosity

Table 14: Viscosity value of coconut oil skincare body cream with Plub-plung And Ratee fragrance at 25°C

Replication	Shear rate (1/s)	Viscosity (Pa.s)
1	50	3.69
2	50	3.84
3	50	4.22
Average	50	3.92

From table 14, the average viscosity of coconut oil skincare body cream with Plub-plung and Ratee fragrance was 3.92 Pa.s when considering at the rate of 50 (1/s) with 25°C.

### 5.2 Chemical property

Table 15: pH value of coconut oil skincare body cream with Plub-plung and Ratee fragrance

Replication	pH value
1	6.7
2	6.6
3	6.7
Mean±S.D	6.7±0.03

For chemical quality, pH was only one quality to be measured in the project. The average value of coconut oil skincare body cream with Plub-plung and Ratee fragrance was 6.7 (table 15). Its pH was in the standard of Somerset company, the pH range of cream was 6.0-7.0.

### **5.3 Microbiological properties**

- Total Plate Count: 100/g Max
- Yeast and Mold: None
- Coliform: None
- *Escherichia coli*: None
- *Staphylococcus aureus*: None

The results of microbiological qualities of the product showed that microorganism could not grow higher than 100 CFU/g. Yeast and mold, coliform, *Escherichia coli* and *Staphylococcus aureus* were not found in coconut oil skincare body cream with Plub-plung and Ratee fragrance because the product contained Paraben-DU, Greapfruit Seed Extract, Potassium Sorbate, Vitamin E that can be used as preservative, antioxidant/enhances effects of natural antioxidants.

## **6. Consumer acceptance test for coconut oil skincare body cream with Thai flower fragrance (Plub-plung and Ratee)**

Consumer acceptance test for coconut oil skincare body cream with Thai flower fragrance (Plub-plung and Ratee) was conducted at Assumption University (Hua Mark campus), Ramkamhang road, and Param 9 road by using 100 target consumers who worked or studied or stayed in an air-conditioned atmosphere or had dry skin. Samples were taken by using convenience sampling method. Consumers were asked the questions related to demographic data, consumer buying behavior, and product evaluation.

### **6.1 Demographic data**

The demographic data was gathered from 100 target consumers. In the part of demographic data, the consumers were asked the questions about gender, age, education, occupation and income. The result was shown in table 16.



Table 16: Demographic data of consumers

Demographic data	General information	Percentage (100%)
1. Gender		
	Female	79.12
	Male	20.88
2. Age		
	15-20 years	22.34
	21-25 years	53.19
	26-30 years	10.64
	31-35 years	6.38
	36-40 years	2.13
	More than 40 years	5.32
3. Education		
	High school or lower	22.83
	Bachelor degree	61.96
	Master degree	11.96
	Ph.D or higher	3.25
4. Occupation		
	Student	66.30
	Lecturer	4.35
	Government officer	3.26
	Employee	9.78
	Owner	11.96
	Others	4.35
5. Income (Bath/ month)		
	Lower than 5,000	40.22
	5,001 - 8,000	21.75
	8,001 - 10,000	6.52
	10,001 - 15,000	9.78
	15,001 - 20,000	5.43
	More than 20,001	16.30

From table 16, it was found that the gender of consumers consisted of 79.12% female and 20.88% of male who used skincare body cream or lotion. The most of target consumers was student (66.30%) whose age between 21 and 25 years (around 53.19%). The majority of consumers graduated bachelor degree (61.96%) with the average income of lower than 5,000 baht per month (40.22%).

6.2 Consumer buying behavior

Consumers were asked about buying behavior on skincare body cream such as frequency of buying, brands chosen, forms of the product and the time they normally used the product. The results were shown in table 17.

Table 17: Consumer buying behavior

Consumer buying behavior	Percentage (%)
1. Used any skincare body cream	
Yes	93.48
No	6.52
2. Brand(s) of skincare body cream	
Nivea	31.03
Johnson & Johnson	10.34
Citra	16.09
Vaseline	14.94
Pond	5.75
Others	21.85
3. Type of product	
Lotion	78.32
Oil/ointment	1.20
Gel	0.00
Cream	20.48
4. Frequency of using skincare body cream	
Twice per day	55.56
More than twice per day	6.17
Occasionally	3.70
Once per day	34.57

Table 17: Consumer buying behavior (Continue)

Consumer buying behavior	Percentage
5. Time for using skincare body cream	
Anytime	56.98
Only after shower in the morning	8.14
Only after shower in the evening	15.12
Only during winter	5.81
Others	13.95
6. The average money that spend for skincare body cream per month	
201 to 300	18.60
301 to 400	22.09
101 to 200	36.05
less than 100	23.26

According to from table 17, the percentage of consumers used skincare body cream was 93.48% and 6.52% represented consumers who used only skincare body lotion. The available brand of skincare body cream commonly used by consumers was Nivea (31.03%). The most preferred type of products which consumers required was lotion (78.31%) and the second was cream (20.48%) However, cream was chosen for making because the objective was to increase more moisture to skin of consumers who lived in cold atmosphere. Most of consumers used skincare body cream twice per day (55.56%). They wanted to use cream at anytime (56.98%). Moreover, they regularly spent about 101-200 baht per month for skincare body cream.

6.3 Factors affecting the buying decision on skincare body cream

The characteristic of skincare body cream available in the market were very significant as factors affecting consumers' buying decision. Eight factors provided such as brand, price, package, color, fragrance, form of product, ingredients and quality of product after use were determined and calculated in terms of percentage, which were shown in table 18.

Table 18: Factor affecting the buying decision on skincare body cream

Factors	Level of importance (percentage)				
	The most important	Very important	Moderately important	Slightly important	Not important
1. Brand	11.96	20.65	<b>48.91</b>	14.13	4.35
2. Price	7.61	25.00	<b>45.65</b>	19.57	2.17
3. Package	7.61	20.65	<b>46.74</b>	21.74	3.26
4. Color	5.43	26.09	<b>44.57</b>	19.56	4.35
5. Fragrance	20.65	32.61	<b>42.39</b>	4.35	
6. Form of Product	21.74	23.91	<b>32.61</b>	19.13	2.61
7. Ingredients	<b>48.91</b>	28.26	20.65	2.18	
8. Quality of product after use	<b>67.39</b>	18.48	13.04	1.09	

From table 18, it was found that the most two important factors affecting the consumers, buying decision on skincare body cream were ingredients (48.91%) and quality of product after use (67.39%). The factors of brand, package and price were moderately

important. The percentage of them were 48.91, 46.74 and 45.65, respectively. Because nowadays almost brands of skincare body cream in the market have the same price and package. Furthermore, fragrance and form of product were considered as moderately important because each product was similar to another.

The average overall liking of coconut oil skincare body cream with Plub-plung and Ratee fragrance was 7.53. It presented that consumers moderately liked this product.

**6.4 Coconut oil skincare body cream with Plub-plung and Ratee fragrance evaluation**

Product knowledge, acceptability, package as well as price of product were judged by 100 target consumers. The results were shown in table 19

Table 19: Coconut oil skincare body cream with Plub-plung and Ratee fragrance evaluation

Product information	Percentage (%)
1. Consumers knew about coconut oil	
Yes	69.23
No	30.77
2. Type of product containing coconut oil which had been seeing	35.87
Cosmetics	4.35
Toiletries	52.17
Food additive	7.61
Drugs	
3. Product acceptability	
Accept	95.56
Do not accept	4.44
4. If the product sample is available in the market	
Will buy	61.36
Not sure	35.23
Will not buy	3.41
5. Package of the product	
Pumping bottle	51.69
Normal container	42.70
Others	5.61



Table 19: Coconut oil skincare body cream with Plub-plung and Ratee fragrance evaluation (cont.)

Product information	Percentage
6. Price of the product sample in 250 ml container	
51 – 70 baht	12.50
71 – 90 baht	13.64
91 – 110 baht	17.05
111 – 130 baht	7.95
131 – 150 baht	14.77
more than 150 baht	34.09

From table 19, most of consumers knew about function of coconut oil in the aspect of its benefit to skin and health (69.23%). The types of product that consumers had been seeing were food additives (52.17%) and cosmetics (35.87%). The product acceptability was magnificently high, 95.56%. But some consumers did not accept the product (44.44%) because skincare body cream is a specific product for target consumers who live in cold atmosphere such as air-conditioned room or want to improve their dry skins.

61.36% of consumers would buy this product (61.36%) if this product would be launched in the market because some of consumers had knowledge about benefit of coconut oil and aloe vera to health and skin. While 35.23% of consumers were not sure because they wanted to use taster sample of product for testing whether to know it is allergic to their skins or not. Only 3.41% of consumers would not buy this product, the reason were they did not like the characteristic of gloss on the skin including the slower absorbency of this product when compared with lotion only.

When considering the package of the product sample, it was found that almost consumers preferred pumping bottle (51.69%) and preferred normal container (having cover on the top of the bottle) was 42.70%. Other packages that consumers preferred (5.61%) were refill, and pouring bottle. The price of this product for 250ml, should not be higher than 150 baht (34.09%) because they thought that the price related to ingredients used in the product as well as the quality of checking the product from the laboratory.

## Conclusion

From the focus group discussion, the respondents needed skincare body cream which made their skin high moisture, not allergic, not much sticky and not have strong smell. The types of aroma that target consumers preferred to add in skincare body cream were flower aroma such as Plub-plung, Jasmine, Peeb, Jampa, and Ratee fragrance.

For study the effect of coconut oil and aloe vera extract in skincare body cream on sensory evaluation. It was found that there was no effect between coconut oil and aloe vera extract on sensory evaluation.

The final formula of coconut oil skincare body cream with Plub-plung and Ratee fragrance consisted of 25% coconut oil, 5% aloe vera extract, 20% sweet almond oil, 12% polysorbate tween 60, 5.5% cetyl alcohol, 27% hot distilled water, 0.3% xanthan gum, 2.5% sorbitol, 1% vitamin E, 0.2% grapeseed oil, 1% Plub-plung fragrance and 0.5% Ratee fragrance.

For the determination of final product quality, the color of coconut oil skincare body cream with Plub-plung and Ratee fragrance was white, 9/10Y, viscosity was 3.92 Pa.s at 25°C and pH of the product was 6.7. The results of microbiological qualities of the product showed that microorganism could not grow higher than 100 CFU/g. Yeast and mold, coliform, *Escherichia coli* and *Staphylococcus aureus* were not found in coconut oil skincare body cream with Plub-plung and Ratee fragrance.

From the consumer acceptance test for coconut oil skincare body cream with Plub-plung and Ratee fragrance, the average overall liking score was 7.53 (moderately like). Moreover, 95.56% of consumers accepted the product, and 61.36% would buy the product if it would be available in the market.

## Reference

1. Bernd Brackmann, 2005, Trends in Cosmetic Care Products, pages 564-569
2. Bruce Fife, 2001, Bruce Fife's book The Healing Miracles of Coconut Oil., pages 274-342
3. Wikipedia, the free encyclopedia, 2003, encyclopedia of coconut oil, pages 132-139, coconut fruit, pages 145-155
4. <http://en.wikipedia.org/wiki/Coconut>
5. [http://en.wikipedia.org/wiki/Cestrum\\_nocturnum](http://en.wikipedia.org/wiki/Cestrum_nocturnum)
6. [http://en.wikipedia.org/wiki/Coconut\\_oil](http://en.wikipedia.org/wiki/Coconut_oil)
7. <http://flowersandherbs.cscoms.com/flower/content/ff1s2.htm>
8. <http://houseofstrauss.co.uk/modules/wfsection/article.php?articleid=435>
9. [http://welcome2thai.com/source/welcome\\_article/28-1.gif](http://welcome2thai.com/source/welcome_article/28-1.gif)
10. [http://www.coconut-connections.com/skin\\_care.htm](http://www.coconut-connections.com/skin_care.htm)
11. <http://www.coconut-info.com/>
12. <http://www.coconut-oil-uk.com/Virgin-Coconut-Oil.html>
13. <http://www.google.co.th/search?q=somerset+cream&hl=th>
14. <http://www.kalyx.com/store/proddetail.cfm/AffiliateID/200312729/ItemID/280/CategoryID/4500.0/SubCatID/295.0/file.htm>
15. <http://www.makingcosmetics.com/store/index.html?lang=en&target=d46.html&lmd=38785.428403>
16. [http://www.naturia.per.sg/buloh/plants/crinum\\_lily.htm](http://www.naturia.per.sg/buloh/plants/crinum_lily.htm)
17. <http://www.panmai.com/Tip/Tip06/Champa.jpg>
18. <http://www.pharmacare.com.au/invite/#>
19. <http://www.prachinburi.go.th/pic/flower.jpg>
20. <http://www.positivehealth.com/permit/Articles/Regular/mcintyre81.htm>

21. <http://www.thailabonline.com/aromaproductlist.htm>
22. <http://www.rareflora.com/cestrumnoc.htm>
23. <http://www.youthingstrategies.com/qualities.htm>



# Appendix A

## Focus Group Discussion





### **Questions for focus group discussion**

1. Which brand of skincare body cream are you currently using/like to use?
2. Why did you choose this brand? Give the reason to support your answer.
3. What is the reason for you to use skincare body cream?
4. How often do you normally use skincare body cream?
5. What are the main factors you consider when choosing a product?
6. What color and characteristic of skincare body cream you like?
7. What is the quality of skincare body cream you desire?
8. What feeling do you expect after using skincare body cream?
9. Is the package a major factor for making a decision to buy skincare body cream?
10. What type of aroma do you like for skincare body cream?
11. Are you interested in product that has the ingredients extracted from natural products in Thailand?
12. Which natural ingredient added in skincare body cream do you prefer?
13. Are you interested in skincare body cream containing Thai flower fragrance?
14. Which Thai flower fragrance do you prefer in skincare body cream?
15. Do you know the quality or function of natural ingredients in the aspect of cosmetic function?
16. How do you think about Thai flower fragrance in skincare body cream?
17. Have you ever seen skincare body cream using natural and Thai flower fragrance as ingredients?
18. What do you think about product using natural ingredients and Thai flower fragrance as ingredients?
19. Which type of package, size and price range of skincare body cream are desirable?
20. If skincare body cream containing natural ingredients with Thai flower fragrance is available in the market, would you buy it or not? Why?

# Appendix B

## Questionnaires



Questionnaire 1

9-Point Hedonic Scaling Test

Product: Coconut oil skincare body cream

Name \_\_\_\_\_ Date \_\_\_\_\_

Instruction: 1. Please wash your hands and arms then dry them before starting.  
2. Take 1 spoon of product sample on your left hand. Spread the cream on the side of your arm until the cream disappears and determine attributes of product during and after use. Then evaluate hedonic scale in each attributes of sample by using the following numbers.

- 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	_____	_____	_____	_____
Overall	_____	_____	_____	_____
Before testing	_____	_____	_____	_____
Color	_____	_____	_____	_____
Viscosity	_____	_____	_____	_____
During use	_____	_____	_____	_____
Stickiness	_____	_____	_____	_____
Absorbency	_____	_____	_____	_____
After use	_____	_____	_____	_____
Stickiness	_____	_____	_____	_____
Gloss on the skin	_____	_____	_____	_____
Moist	_____	_____	_____	_____

Comments: \_\_\_\_\_

Thank your for your cooperation.

**Questionnaire 2**

**Preference Test**

**Product:** Coconut oil skincare body cream with Thai flower fragrance

Name \_\_\_\_\_ Date \_\_\_\_\_

**Instruction:** 1. Please wash your hands and arms then dry them before starting.  
2. Take 1 spoon of product sample on your left hand. Spread the cream on the side of your arm until the cream disappears and determine aroma after use by using the following numbers.

- 1 = The most preferred
- 2 = The second most preferred
- 3 = The third most preferred
- 4 = The fourth most preferred

Code	
471	_____
397	_____
437	_____

**Comments:** \_\_\_\_\_  
\_\_\_\_\_

Thank you for your cooperation.

**Questionnaire 3**

**Paired Preference Test**

**Product:** Coconut oil skincare body cream with Thai flower fragrance

**Name** \_\_\_\_\_ **Date** \_\_\_\_\_

**Instruction:** 1. Please wash your left hand and arms then dry them before starting.  
2. In front of you, there are two samples. Beginning with the sample on the left, test each one and then circle the sample that you prefer.

724

396

**Comments:** \_\_\_\_\_  
\_\_\_\_\_

Thank you for your cooperation.





## Questionnaire 4

### Development of Coconut oil skin care body cream

#### 9-Point Hedonic Scaling Test and Just Right Scale

Name \_\_\_\_\_ Date \_\_\_\_\_

**Instructions:**

- 1) Please wash and dry your hands and arms before starting.
- 2) Take a spoon of the product sample and spread the cream on the side of your left arm until the cream disappears and determine the attributes of the product during and after use. Then evaluate the hedonic score in each attribute of the sample by using the following numbers and mark X in the channel which is related to your feeling.

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

**Overall** \_\_\_\_\_

**fore testing**

**olor:** \_\_\_\_\_

Much too ght	Moderately too light	Slightly too light	Just right	Slightly too dark	Moderately too dark	Much too dark
-----------------	-------------------------	-----------------------	------------	----------------------	------------------------	------------------

**roma:** \_\_\_\_\_

Much too weak	Moderately too weak	Slightly too weak	Just right	Slightly too strong	Moderately too strong	Much too strong
------------------	------------------------	----------------------	------------	------------------------	--------------------------	--------------------

**iscosity:** \_\_\_\_\_

Much too ittle	Moderately too little	Slightly too little	Just right	Slightly too much	Moderately too much	Much too much
-------------------	--------------------------	------------------------	------------	----------------------	------------------------	------------------

**uring use**

**ickiness:** \_\_\_\_\_

Much too hin	Moderately too thin	Slightly too thin	Just right	Slightly too thick	Moderately too thick	Much too thick
-----------------	------------------------	----------------------	------------	-----------------------	-------------------------	-------------------

**bsorbency:** \_\_\_\_\_

Much too slow	Moderately too slow	Slightly too slow	Just right	Slightly too quick	Moderately too quick	Much too quick
------------------	------------------------	----------------------	------------	-----------------------	-------------------------	-------------------

**fter use**

**tickiness:** \_\_\_\_\_

Much too thin	Moderately too thin	Slightly too thin	Just right	Slightly too thick	Moderately too thick	Much too thick
------------------	------------------------	----------------------	------------	-----------------------	-------------------------	-------------------

loss on the skin : \_\_\_\_\_

Much too little	Moderately too little	Slightly too little	Just right	Slightly too much	Moderately too much	Much too much
-----------------	-----------------------	---------------------	------------	-------------------	---------------------	---------------

loist: \_\_\_\_\_

Much too little	Moderately too little	Slightly too little	Just right	Slightly too much	Moderately too much	Much too much
-----------------	-----------------------	---------------------	------------	-------------------	---------------------	---------------

Comments (if any):

Thank you for your participation



## **Questionnaire 5**

### **Consumer Acceptance Test**

Dear participants,

The development of “**Coconut oil skincare body cream with Plub- plung(*Crinum Lily*) and Ratee (*Cestrum Nocturnum*) fragrance**” is developed in hope to utilize Thai traditional coconut plant and Thai natural flower such as Plub-plung (*Crinum Lily*) and Ratee(*Cestrum Nocturnum*) fragrance to produce a new skincare body cream which is beneficial to human skin.

Coconut oil is rich in vitamin E. It is an ideal ointment for the relief of dry, rough and wrinkled skin. Coconut oil can be absorbed easily, keeping the skin soft and yet without feeling greasy. Moreover, coconut oil is stable and thus, it helps to prolong the shelf life of the product.

Plub Plung and Ratee are traditional Thai flowers providing aroma which promote relaxation of mind and body.

I would like to ask for your cooperation in answering this questionnaire subjected to your real opinion, feeling and behavior. All of the information provided by you will be useful to the research and will be kept confidentially.

#### **Instruction:**

Please wash your hands and arms and then dry them. Next, take a spoon of the product with your right hand and spread it on the side of your left arm. Spread the cream gently until it disappears and determine the quality of the product.

Thank you for your cooperation.

Monthida J.  
April 8, 2006

For Official use

ID□□□

**Part I: Demographic Data**

**1) Gender**

☐ Male ☐ Female

**A**

☐

**2) Age**

☐ 15 – 20 years

☐ 21– 25 years

☐ 26 – 30 years

**B**

☐

☐ 31 – 35 years

☐ 36 – 40 years

☐ more than 40 years

**3) Education**

☐ High School or lower

☐ Bachelor degree

**C**

☐

☐ Master degree

☐ Ph. D or higher

**4) Occupation**

☐ Student

☐ Lecturer

☐ Government officer

**D**

☐

☐ Employee

☐ Owner

☐ Others (please specify) \_\_\_\_\_

**5) Income (Bath/month)**

☐ Lower than 5,000

☐ 5,001 – 8,000

☐ 8,001 – 10,000

**E**

☐

☐ 10,001 – 15,000

☐ 15,001 – 20,000

☐ More than 20,000

**Part II: Consumer's Behavior**

**6) Are you currently using any skincare body products?**

☐ Yes ☐ No (pass to Q 10)

**F**

☐

**7) Which brand of skincare body products do you normally use?**

☐ Nivea

☐ Johnson's and Johnson's

**G**

☐

☐ Citra

☐ Vaseline

☐ Ponds

☐ others (please specify) \_\_\_\_\_



## 8) What type of skincare body products do you normally use?

H

☐ Lotion☐ Oil/ointment☐☐ Gel☐ Cream

## 9) How often do you apply skincare body product(s) per day?

I

☐ Once per day☐ Twice per day☐☐ More than twice per day☐ Occasionally

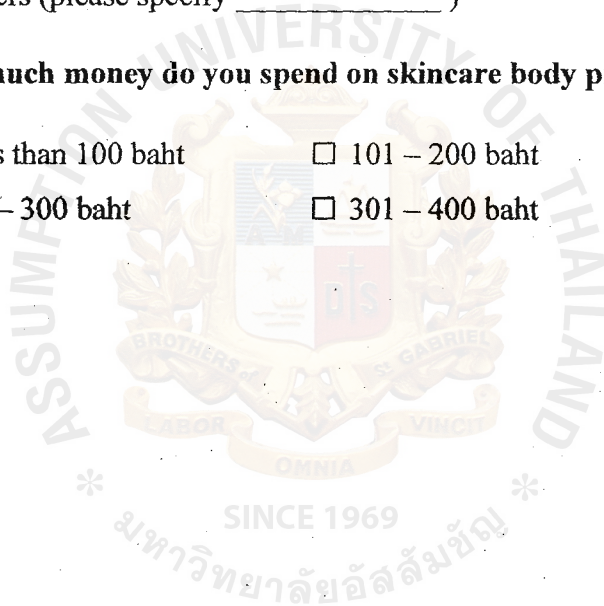
## 10) When do you normally use skincare body lotion?

J

☐ Any time☐☐ After showering in the morning only☐ After showering in the evening only☐ During winter☐ Others (please specify \_\_\_\_\_)

## 11) How much money do you spend on skincare body products per month?

K

☐ Less than 100 baht☐ 101 – 200 baht☐☐ 201 – 300 baht☐ 301 – 400 baht

12) According to your opinion, please rate the importance of each following factors affecting skincare body cream buying on decision. (Mark X in the channel which is related to your feeling.)

Factor	Level of Importance				
	Most important	Very important	Important	Slightly important	Not important
Brand					
Price					
Package					
Color					
Fragrance					
Form of product (lotion, cream, gel, etc.)					
Ingredients used in the product					
Quality during and after use					

L

☐

M

☐

N

☐

O

☐

P

☐

Q

☐

R

☐

S

☐

**Part III: Product Evaluation**

**13) Have you ever heard of coconut oil?**

☐ Yes   ☐ No

T  
☐

**14) What type of product containing coconut oil that you had been seeing?**

☐ Cosmetics                      ☐ Toiletries  
☐ Food additive                      ☐ Drugs

U  
☐

**15) Overall, how would you rate this product?**

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

V  
☐

Score \_\_\_\_\_

**16) Is this product acceptable?**

☐ Yes   ☐ No

W  
☐

**17) Would you buy this product if it is commercially available?**

☐ Yes, because \_\_\_\_\_  
☐ Maybe, because \_\_\_\_\_  
☐ No, because \_\_\_\_\_

X  
☐

**18) What kind of packaging would you prefer to see this product in?**

☐ Normal container (with cover on top)                      ☐ Pumping bottles  
☐ Others (please specify) \_\_\_\_\_

Y  
☐

19) How much would you be willing to pay for 250ml of this product?

Z

- ☐ 51 – 70 baht
- ☐ 71 – 90 baht
- ☐ 91 – 110 baht
- ☐ 111 – 130 baht
- ☐ 131 – 150 baht
- ☐ More than 150 baht

20) Comments (if any)

Thank you for your participation



# Appendix C

Determination of Microbiological Properties





## Materials and methods for microbiological qualities

### 1. Mesophilic aerobes

#### Requirement

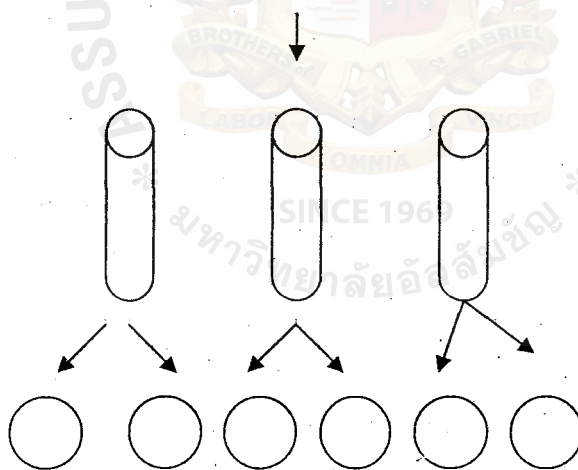
- PCA
- 90 ml of 0.1% Peptone solution
- 9 ml of 0.1% Peptone solution

#### Preparation of requirement

- PCA
  - Tryptone 5 g
  - Yeast extracts 2.5 g
  - Glucose 1 g
  - Agar 15 g
  - H<sub>2</sub>O 1000 ml
  - Clave 121°C/15 min
- 0.1% Peptone
  - Peptone 1 g
  - H<sub>2</sub>O 1000 ml
  - Clave 121 °C/15 min

#### Method

10 g of skincare body cream blend in 90 ml peptone (put 1 ml in each tube)



Added 9 ml of peptone to tube and spread plate by using 0.1 ml on PCA. Incubated at 37 °C for 2 days.

## 2. Psychotrophs

### Requirement

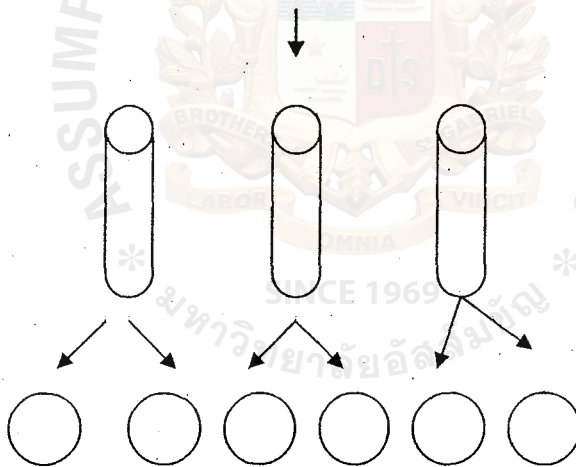
- PCA
- 90 ml of 0.1% Peptone solution
- 9 ml of 0.1% Peptone solution

### Preparation of requirement

- PCA
  - Tryptone 5 g
  - Yeast extracts 2.5 g
  - Glucose 1 g
  - Agar 15 g
  - H<sub>2</sub>O 1000 ml
  - Clave 121°C/15 min
- 0.1% Peptone
  - Peptone 1 g
  - H<sub>2</sub>O 1000 ml
  - Clave 121 °C/15 min

### Method

10 g of skincare body cream blend in 90 ml peptone (put 1 ml in each tube)



Added 9 ml of peptone to tube and spread plate by using 0.1 ml on PCA. Incubated at 6.5 °C for 10 days.

### 3. Yeast and Mold

#### Requirement

- PCA
- 90 ml of 0.1% Peptone solution
- 9 ml of 0.1% Peptone solution

#### Preparation of requirement

##### • PDA

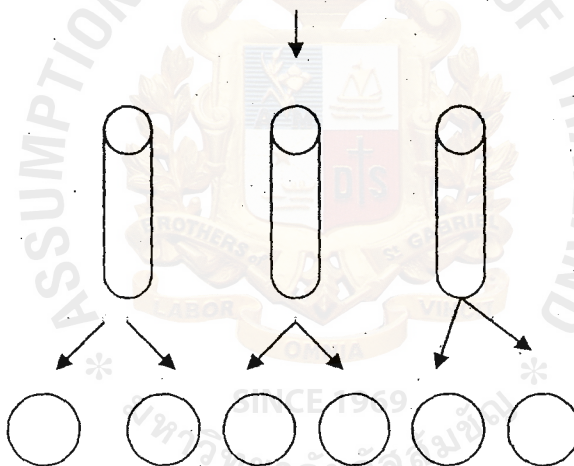
- PDA            5 g
- H<sub>2</sub>O            1000 ml
- Clave 121°C/15 min
- Add 10% tartalic acid 1ml/100ml(PDA)

##### • 0.1% Peptone

- Peptone        1 g
- H<sub>2</sub>O            1000 ml
- Clave 121 °C/15 min

#### Method

10 g of skincare body cream blend in 90 ml peptone (put 1 ml in each tube)



Added 9 ml of peptone to tube and spread plate by using 0.1 ml on PDA. Incubated at 37 °C for 2 days.

#### 4. Total coliform (MPN)

##### Requirement

- Lauryl Sulfate Tryptose Broth (LST)
- Brilliant Green Lactose Broth (BGBB)
- 90 ml of 0.1% Peptone solution
- 9 ml of 0.1% Peptone solution

##### Preparation of requirement

###### • LST

- LSTB 35.6g
- H<sub>2</sub>O 1000 ml
- 9 ml/tube, added Durham tube
- Clave 121°C/15 min

###### • BGBB

- Peptone 1 g
- Lactose 10 g
- Oxgall 20 g
- Brilliant Green 0.01 g
- H<sub>2</sub>O 1000 ml
- Clave 121 °C/15 min

###### • 0.1% Peptone

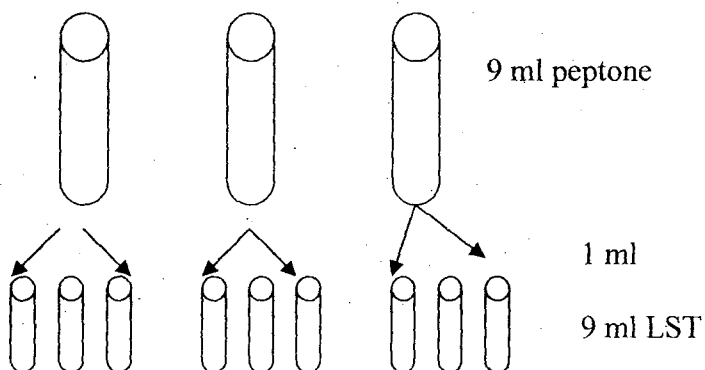
- Peptone 1 g
- H<sub>2</sub>O 1000 ml
- Clave 121 °C/15 min

##### Method

10 g of skincare body cream blend in 90 ml peptone (put 1 ml in each tube)

1 ml  
↓

Added 9 ml of peptone to tube, After that added 1 ml



Incubated at 30°C for 2 days.



Gas production = positive presumptive coliform



Confirm test: Take 1 loop of suspension into BGGB



35°C for 2 days



MPN coliform





## 5. *Escherichia coli*

### Requirement

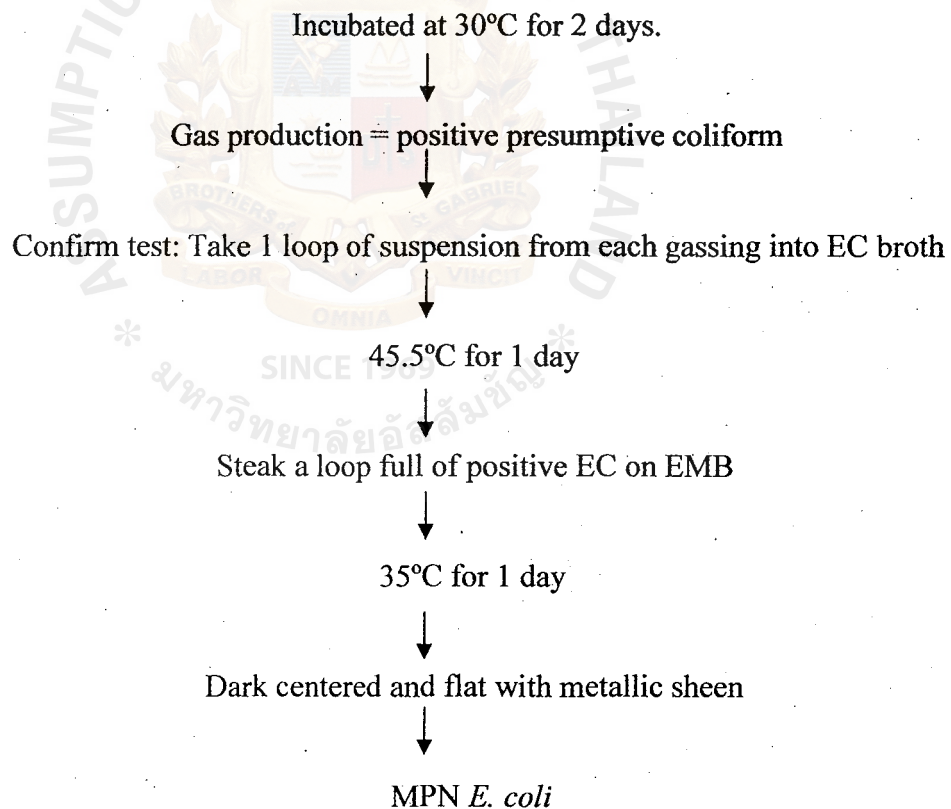
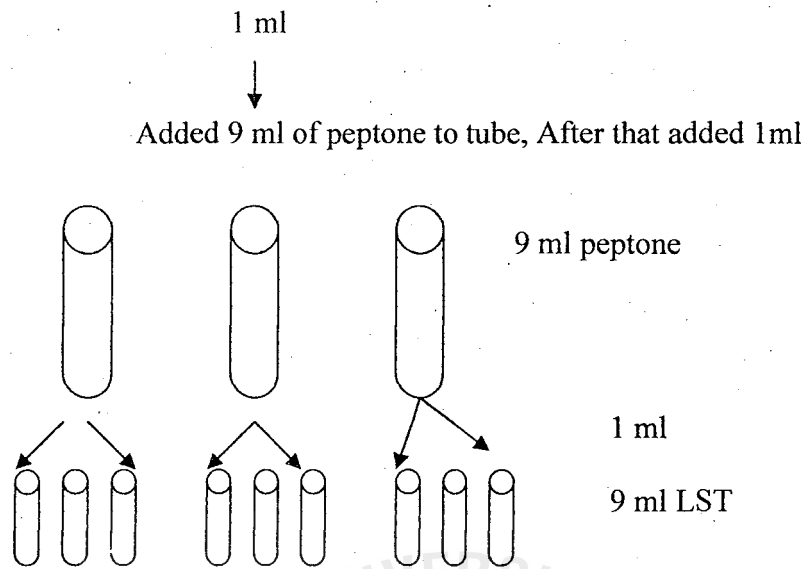
- Lauryl Sulfate Tryptose Broth (LST)
- EC Broth
- EMB
- 90 ml of 0.1% Peptone solution
- 9 ml of 0.1% Peptone solution

### Preparation of requirement

- LST
  - LSTB 35.6 g
  - H<sub>2</sub>O 1000 ml
  - 9 ml/tube, added Durham tube
  - Clave 121°C/15 min
- EC Broth
  - Tryptone 20 g
  - Lactose 5 g
  - Dipotassium hydrogen phosphate 4 g
  - Potassium Dihydrogen phosphate 1.5 g
  - NaCl 5 g
  - Bile salt 1.5 g
  - H<sub>2</sub>O 1000 ml
  - Clave 121 °C/15' min
- EMB
  - Bacto peptone 10 g
  - Lactose 10 g
  - Dipotassium phosphate 2 g
  - Agar 15 g
  - Eosin 0.4 g
- 0.1% Peptone
  - Peptone 1 g
  - H<sub>2</sub>O 1000 ml
  - Clave 121 °C/15 min

Method

10 g of skincare body cream blend in 90 ml peptone (put 1 ml in each tube)



## 6. *Staphylococcus aureus*

### Requirement

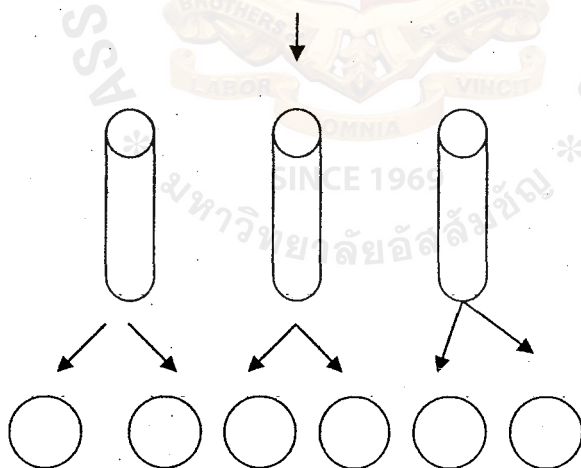
- Baird-Parker (BP) medium containing egg yolk
- 90 ml of 0.1% Peptone solution
- 9 ml of 0.1% Peptone solution

### Preparation of requirement

- Baird-Parker (BP) medium containing egg yolk
  - Baird-Parker's agar 60 g
  - H<sub>2</sub>O 950 ml
  - Clave 121°C/15 min
  - NaCl+ egg yolk (25+25) 50 ml
    - NaCl (25 ml of 85%NaCl and clave 121°C/15 min)
    - Egg yolk
      - SM9 HgCl 0.1 g
      - H<sub>2</sub>O 100 ml
      - Immerse egg 1 hour into 0.1% HgCl solution
      - Immerse egg 3 hours into 70% Ethanol
- 0.1% Peptone
  - Peptone 1 g
  - H<sub>2</sub>O 1000 ml
  - Clave 121 °C/15 min

### Method

10 g of skincare body cream blend in 90 ml peptone (put 1 ml in each tube)



Added 9 ml of peptone to tube and spreaded plate by using 0.1 ml on BP. Incubated at 37 °C for 2 days.

*Staphylococcus aureus* is jet black to dark grey, smooth convex with entire margins with off white edges and may show clear zone.

## Appendix D

### Statistic Analysis



Appendix table 1: Multiple comparisons of overall liking of coconut oil and aloe vera extract skincare body cream

Dependent Variable: Overall liking

Multiple Comparisons

Dependent Variable: Y

			Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
(I) TRT	(J) TRT	Lower Bound				Upper Bound	
LSD	Treatment 1	Treatment 2	-.2000	.2194	.364	-.6360	.2360
		Treatment 3	.1667	.2194	.449	-.2694	.6027
		Treatment 4	.3000	.2194	.175	-.1360	.7360
	Treatment 2	Treatment 1	.2000	.2194	.364	-.2360	.6360
		Treatment 3	.3667	.2194	.098	-6.9352E-02	.8027
		Treatment 4	.5000*	.2194	.025	6.398E-02	.9360
	Treatment 3	Treatment 1	-.1667	.2194	.449	-.6027	.2694
		Treatment 2	-.3667	.2194	.098	-.8027	6.935E-02
		Treatment 4	.1333	.2194	.545	-.3027	.5694
	Treatment 4	Treatment 1	-.3000	.2194	.175	-.7360	.1360
		Treatment 2	-.5000*	.2194	.025	-.9360	-6.3981E-02
		Treatment 3	-.1333	.2194	.545	-.5694	.3027

Based on observed means.

\*. The mean difference is significant at the .05 level.



Appendix table 2: Multiple comparisons of color of coconut oil and aloe vera extract skincare body Cream

Dependent Variable: Color

Multiple Comparisons

Dependent Variable: Y  
Scheffe

(I) TRT	(J) TRT	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Treatment 1	Treatment 2	-.3000	.2202	.605	-.9277	.3277
	Treatment 3	-6.6667E-02	.2202	.993	-.6944	.5610
	Treatment 4	-.3333	.2202	.517	-.9610	.2944
Treatment 2	Treatment 1	.3000	.2202	.605	-.3277	.9277
	Treatment 3	.2333	.2202	.772	-.3944	.8610
	Treatment 4	-3.3333E-02	.2202	.999	-.6610	.5944
Treatment 3	Treatment 1	6.667E-02	.2202	.993	-.5610	.6944
	Treatment 2	-.2333	.2202	.772	-.8610	.3944
	Treatment 4	-.2667	.2202	.691	-.8944	.3610
Treatment 4	Treatment 1	.3333	.2202	.517	-.2944	.9610
	Treatment 2	3.333E-02	.2202	.999	-.5944	.6610
	Treatment 3	.2667	.2202	.691	-.3610	.8944

Based on observed means.

Appendix table 3: Multiple comparisons of stickiness during testing of coconut oil and aloe vera extract skincare body cream

Dependent Variable: Stickiness during testing

Multiple Comparisons

Dependent Variable: Y  
Scheffe

(I) TRT	(J) TRT	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Treatment 1	Treatment 2	-.3333	.2643	.663	-1.0867	.4201
	Treatment 3	6.667E-02	.2643	.996	-.6867	.8201
	Treatment 4	.1333	.2643	.968	-.6201	.8867
Treatment 2	Treatment 1	.3333	.2643	.663	-.4201	1.0867
	Treatment 3	.4000	.2643	.517	-.3534	1.1534
	Treatment 4	.4667	.2643	.379	-.2867	1.2201
Treatment 3	Treatment 1	-6.6667E-02	.2643	.996	-.8201	.6867
	Treatment 2	-.4000	.2643	.517	-1.1534	.3534
	Treatment 4	6.667E-02	.2643	.996	-.6867	.8201
Treatment 4	Treatment 1	-.1333	.2643	.968	-.8867	.6201
	Treatment 2	-.4667	.2643	.379	-1.2201	.2867
	Treatment 3	-6.6667E-02	.2643	.996	-.8201	.6867

Based on observed means.

Appendix table 4: Multiple comparisons of absorbency during testing of coconut oil and aloe vera extract skincare body cream

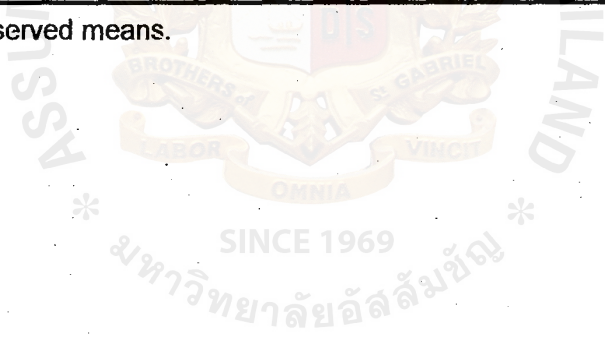
Dependent Variable: Absorbency during testing

Multiple Comparisons

Dependent Variable: Y  
Scheffe

(I) TRT	(J) TRT	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Treatment 1	Treatment 2	-.2667	.2714	.810	-1.0405	.5071
	Treatment 3	6.667E-02	.2714	.996	-.7071	.8405
	Treatment 4	.2667	.2714	.810	-.5071	1.0405
Treatment 2	Treatment 1	.2667	.2714	.810	-.5071	1.0405
	Treatment 3	.3333	.2714	.681	-.4405	1.1071
	Treatment 4	.5333	.2714	.284	-.2405	1.3071
Treatment 3	Treatment 1	-6.667E-02	.2714	.996	-.8405	.7071
	Treatment 2	-.3333	.2714	.681	-1.1071	.4405
	Treatment 4	.2000	.2714	.909	-.5738	.9738
Treatment 4	Treatment 1	-.2667	.2714	.810	-1.0405	.5071
	Treatment 2	-.5333	.2714	.284	-1.3071	.2405
	Treatment 3	-.2000	.2714	.909	-.9738	.5738

Based on observed means.



Appendix table 5: Multiple comparisons of gloss on the skin after testing of coconut oil and aloe vera extract skincare body cream

Dependent Variable: Gloss on the skin during testing

Multiple Comparisons

Dependent Variable: Y  
Scheffe

(I) TRT	(J) TRT	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Treatment 1	Treatment 2	-6.6667E-02	.1890	.989	-.6056	.4723
	Treatment 3	-.1333	.1890	.919	-.6723	.4056
	Treatment 4	.2000	.1890	.773	-.3389	.7389
Treatment 2	Treatment 1	6.667E-02	.1890	.989	-.4723	.6056
	Treatment 3	-6.6667E-02	.1890	.989	-.6056	.4723
	Treatment 4	.2667	.1890	.577	-.2723	.8056
Treatment 3	Treatment 1	.1333	.1890	.919	-.4056	.6723
	Treatment 2	6.667E-02	.1890	.989	-.4723	.6056
	Treatment 4	.3333	.1890	.381	-.2056	.8723
Treatment 4	Treatment 1	-.2000	.1890	.773	-.7389	.3389
	Treatment 2	-.2667	.1890	.577	-.8056	.2723
	Treatment 3	-.3333	.1890	.381	-.8723	.2056

Based on observed means.

Appendix table 6: Multiple comparisons of moist after testing of coconut oil and aloe vera extract skincare body cream

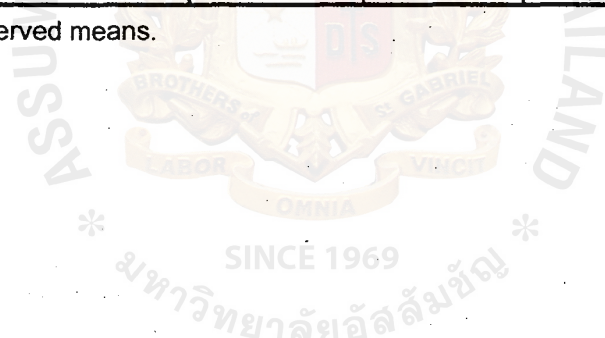
Dependent Variable: Moist after testing

Multiple Comparisons

Dependent Variable: Y  
Scheffe

(I) TRT	(J) TRT	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Treatment 1	Treatment 2	1.000E-01	.1536	.935	-.3380	.5380
	Treatment 3	3.333E-02	.1536	.997	-.4047	.4713
	Treatment 4	.2000	.1536	.640	-.2380	.6380
Treatment 2	Treatment 1	-1.0000E-01	.1536	.935	-.5380	.3380
	Treatment 3	-6.6667E-02	.1536	.979	-.5047	.3713
	Treatment 4	1.000E-01	.1536	.935	-.3380	.5380
Treatment 3	Treatment 1	-3.3333E-02	.1536	.997	-.4713	.4047
	Treatment 2	6.667E-02	.1536	.979	-.3713	.5047
	Treatment 4	.1667	.1536	.759	-.2713	.6047
Treatment 4	Treatment 1	-.2000	.1536	.640	-.6380	.2380
	Treatment 2	-1.0000E-01	.1536	.935	-.5380	.3380
	Treatment 3	-.1667	.1536	.759	-.6047	.2713

Based on observed means.



Appendix table 7: Multiple comparisons of stickiness after testing of coconut oil and aloe vera extract skincare body cream

Dependent Variable: Stickiness after testing

Multiple Comparisons

Dependent Variable: Y  
Scheffe

(I) TRT	(J) TRT	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Treatment 1	Treatment 2	-.2667	.2466	.761	-.9697	.4364
	Treatment 3	6.667E-02	.2466	.995	-.6364	.7697
	Treatment 4	.2333	.2466	.826	-.4697	.9364
Treatment 2	Treatment 1	.2667	.2466	.761	-.4364	.9697
	Treatment 3	.3333	.2466	.611	-.3697	1.0364
	Treatment 4	.5000	.2466	.257	-.2031	1.2031
Treatment 3	Treatment 1	-6.6667E-02	.2466	.995	-.7697	.6364
	Treatment 2	-.3333	.2466	.611	-1.0364	.3697
	Treatment 4	.1667	.2466	.928	-.5364	.8697
Treatment 4	Treatment 1	-.2333	.2466	.826	-.9364	.4697
	Treatment 2	-.5000	.2466	.257	-1.2031	.2031
	Treatment 3	-.1667	.2466	.928	-.8697	.5364

Based on observed means.



Appendix table 8: Multiple comparisons of viscosity during testing of coconut oil and aloe vera extract skincare body cream

Dependent Variable: Viscosity during testing

Multiple Comparisons

Dependent Variable: Y  
Scheffe

(I) TRT	(J) TRT	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Treatment 1	Treatment 2	-.3667	.2778	.629	-1.1587	.4254
	Treatment 3	.3000	.2778	.761	-.4921	1.0921
	Treatment 4	1.000E-01	.2778	.988	-.6921	.8921
Treatment 2	Treatment 1	.3667	.2778	.629	-.4254	1.1587
	Treatment 3	.6667	.2778	.132	-.1254	1.4587
	Treatment 4	.4667	.2778	.425	-.3254	1.2587
Treatment 3	Treatment 1	-.3000	.2778	.761	-1.0921	.4921
	Treatment 2	-.6667	.2778	.132	-1.4587	.1254
	Treatment 4	-.2000	.2778	.915	-.9921	.5921
Treatment 4	Treatment 1	-1.0000E-01	.2778	.988	-.8921	.6921
	Treatment 2	-.4667	.2778	.425	-1.2587	.3254
	Treatment 3	.2000	.2778	.915	-.5921	.9921

Based on observed means.

Appendix table 9: Paired-preference test between Plub-plung and Ratee fragrance

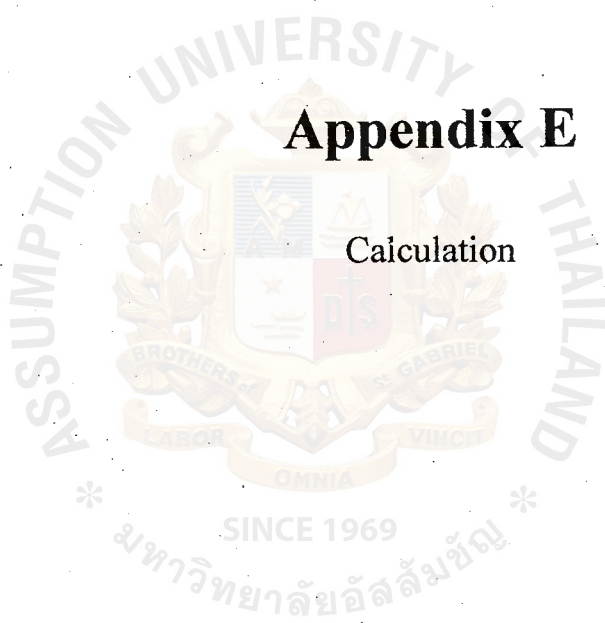
Paired Samples Test								
	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Pair 1 PLUB - RATEE	.5333	.8604	.1571	.2121	.8546	3.395	29	.002

Appendix table 10: Paired-preference test between 1.5% and 3% concentration of Plub-plung fragrance

Paired Samples Test									
		Paired Differences							
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper	t	df	Sig. (2-tailed)
Pair 1	FRA1 - FRA2	.4194	.9228	.1657	8.086E-02	.7579	2.530	30	.017

# Appendix E

Calculation



Development of Coconut oil skin care body cream

Preference ranking test

Determination of the most preferred fragrance using Friedman’s Test and LSD ranking test

- A: Sample 628 (Treatment 1 – Ratee)
- B: Sample 471 (Treatment 2 – Jampa)
- C: Sample 397 (Treatment 3 – Plub Plung)
- D: Sample 437 (Treatment 4 – Peeb)

Null hypothesis,  $H_0: \mu_A = \mu_B = \mu_C = \mu_D$   
Alternative hypothesis,  $H_A: \mu_A \neq \mu_B \neq \mu_C \neq \mu_D$

Parameter	Details	Values
b	No. of panelists	30
t	No. of treatments	4
t + 1	No. of treatments + 1	5
$X_j$	Rank sum of sample j	A = 69 B = 83 C = 73 D = 75
	Rank sum differ	AB = 14 AC = 4 AD = 6 BC = 10 BD = 8 CD = 2
Degree of freedom	No. of treatments - 1	3

$$T_{\text{calculated}} = \{[12 / (b \times 4) (5)] \sum X_j^2\} - 3b (t + 1)$$
$$= \{[12 / 600] \sum 69^2 + 83^2 + 73^2 + 75^2\} - 90(5)$$
$$= 0.02 \times 22604 - 450$$
$$= 2.08$$

At 95% confidence level,  $T_{\text{table}} = 7.81$

$$T_{\text{calculated}} < T_{\text{table}}$$

Null hypothesis,  $H_0$  was accepted. There was non significant difference among treatments ( $P>0.05$ ). Since Null hypothesis was accepted, there was no need to carry out LSD ranking test to determine the most preferred fragrance. It showed that the liking of the fragrance was well distributed among 30 panelist.



