# Development Of Lotion Formulations To Strengthen And Retain Moisturizer Of The Body Skin Using Natural Extracts Products

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**Abstract**
The structure of the lotion consists of two-phase which are a mixture of water and oil phases that contains natural extracts to increase skin moisturizer. The benefits of Bigel are non-gooey feeling and easy cleaning. However, the study and development of lotion formulations containing natural extracts should be concerned with the physical stability of lotion formulations, the penetration of active ingredient, and water evaporation from skin as well.
This work, we investigated the rate of water evaporation through the skin. We also develop the lotion formulations, evaluate the physical stability of lotion formulations and determine the penetration of active ingredient and water evaporation from skin for 6 lotion formulations as well.
Lotion formulations from natural extracts are formulated and mixed by the homogenizer. This research is involved with the development process of lotion containing natural extracts preparation and study the effect of the mixing speed and time. The physical and chemical stability of lotions evaluated under the typical and accelerated conditions. The lotions contain with natural extracts such as Cholesterol, Shea butter (refined), Olive oil (extra pure), Phytosteryl/Octyldodecyl lauroyl glutamate, Buckwheat wax, Raffinose, Hydrolyzed algin, Chlorella vulgaris extract and Maris aqua are prepared and compared each other.
To develop the lotion formulations containing natural extracts, we used four types of lotions mixed with the natural extracts. To mix the lotions with natural extracts, we used mixing speeds at 400, 800 and 1200 rpm for 10 minutes and 1200 rpm for 13 minutes. There is no significant difference in physical properties observed in lotions containing natural extracts (mixed at 1200 rpm for 13 minutes). Nevertheless, we found that the rate of water evaporation through the skin in this work (41.13±0.53) is higher than Bigel (39.86±1.09) and Organogel (37.94±1.14).
The lotion formulations can contain many kinds of natural extracts. The lotions should have non-gooey feeling and easy cleaning properties. We found that there is a better process to produce lotion formulations containing natural extracts to prevent water evaporation through the skin than Bigel and Organogel formulations.

**Keywords:** Lotion, Formulation, Natural Extracts

## INTRODUCTION

Natural extracts have been used to produce medicine, dietary supplement products, and cosmetic products until now. Nowadays, our societies have changed, the global economy has grown strongly to high value and the technology has progressed tremendously. Thus, there are many synthetic cosmetic products produced because the synthetic substances are available in a cheap price. However, it has been found that many synthetic cosmetic products that are toxic to humans. Thus, most consumers are interested and decided to use natural extracts products because it is harmless. Moreover, there are many kinds of herbal and effective pharmacopoeias in Thailand to support cosmetic factories continuously [1]. Nowadays, cosmetic products extremely play an important role in our daily life. Therefore, natural extracts cosmetic products would be more interesting because it has a fewer side effect than synthetic cosmetics. Natural cosmetic products has been used with difference proposes, for example, dry skin lotion, and protective body lotion, etc. [2].
Some natural extracts can increased the moisturizer of the skin, for example, Shea butter or karite butter. The karite butter obtains from karite nut and it can heal burn wounds, scars skin, psoriasis, dandruff, and stretch marks. Moreover, the karite butter can reduce wrinkles, increase the moisturizer of the skin, regenerate damaged cells, and improve blood circulation using cinnamic acid to protect the skin from ultraviolet [3]. Furthermore, pure olive oil (cold pressed) can repair the skin, penetrate well through the skin because its structure resembles as the skin nourishing oil, and protect the skin from ultraviolet-B. Olive oil contains with protein, vitamin A, vitamin E, anti-oxidant, monounsaturated fatty acids, polyunsaturated and buckwheat wax that can effect on moisturizer of the skin, anti-puffiness, etc. [4].
Ceramides are one of the skin protective natural extract products. Ceramides can extract from plants and their properties resemble as subcutaneous fat. It can counteract dry skin, increase moisturizer of the skin, skin aging and wrinkles [5].

As mentioned above, this research interested in the additional of natural extracts into the lotion formulations to strengthen and retain moisturizer of the skin. The additional of natural extracts into lotions can be increased the quantity of natural extracts cosmetic products and the price of products also. Furthermore, the additional natural extracts into lotions can use as the fundamental data and also applied for advance study.

**OBJECTIVES**

2.1 Developing the lotion formulations from natural extracts to increase moisturizer of the skin and strengthen the skin
2.2 Investigating the physical stability of lotion formulations under accelerated condition
2.3 To study the evaporation of water through the body skin from natural extract lotion formulations

**RESEARCH METHODOLOGY**

*A. Developing the natural extract lotion formulations by changing the moisturizer substances (Table 1)*

To prepare the oil contents part of the lotion, we applied heat using water bath to the moisturizer substances; Cholesterol, Shea Butter (refined), Olive Oil (extra pure), Phytosteryl/Octyldodecyl lauroyl glutamate, Ceramide complex (oil dispersible powder), Phytosphingosine, Buckwheat wax, Potassium cetyl phosphate, Hydrogenated palm glycerides, Propanediol, Ethylhexylglycerin respectively and also arranged the moisturizer substances from the highest to lowest melting point. The moisturizer substances show in Table 1. We blended the ingredients using Homogenizer until the temperature of the oil reached to $72^0$C and the oil visually homogeneous.

To prepare the water contents part of the lotion, we mixed Ceramide complex (powder), Raffinose, and purified water together. We used water bath to heat the water contents part and used Homogenizer at a speed 1,000 rpm for 15 minutes to mix all ingredients together. We blended the ingredients until the temperature of the water contents part reached $75^0$C and it visually homogeneous.

We mixed the water contents part and the oil contents part together and used Homogenizer for continuous blending until both parts visually homogeneous. Waiting until the temperature of the ingredients drops to $40^0$C. Then, add Phospholipid, Hydrolyzed algin, Chlorella vulgaris extract and Maris aqua into the homogeneous part and blended all together. Waiting until the temperature of products drop to the room temperature and then contains the products in the wide top containers.

**Table 1: This table shows the moisturizer substances**

| **Developing the lotion formulation from natural extracts by changing the moisturizer substances** | | | |
|---|---|---|---|
| **Ingredients** | **%** | | |
| | **LN 1** | **LN 2** | **LN 3** |
| 1. Cholesterol | 1.5 | 0.75 | 0.38 |
| 2. Shea Butter (refined) | 1.5 | 0.75 | 0.38 |
| 3. Olive Oil (extra pure) | 2 | 1 | 0.5 |
| 4. Ceramide Complex (CeraTouch™, powder) | 1.5 | 1.5 | 1.5 |
| 5. Cerasoft™ (synthetic ceramide)phytosteryl/octyldodecyl lauroyl glutamate | 2 | 1 | 0.5 |
| 6. Ceramide Complex (oil dispersible powder) | 0.5 | 0.5 | 0.5 |
| 7. Phytosphingosine | 0.63 | 0.63 | 0.63 |
| 8. Buckwheat wax | 1 | 0.5 | 0.25 |
| 9. Raffinose | 0.25 | 0.13 | 0.06 |
| 10. Phospholipid | 1 | 1 | 1 |
| 11. Sensitive cream maker™ potassium cetyl phosphate, Hydrogenate palm glyceride | 1.5 | 1.5 | 1.5 |
| 12. Mild preserved eco™ (preservative-free) | 0.5 | 0.5 | 0.5 |
| 13. Hydro algae™ aqua , Hydrolyzed algin , Chlorella vulgaris extract , Maris aqua | 1 | 0.5 | 0.25 |
| 14. Distilled water | 35.13 | 39.75 | 42.06 |

*B. Developing the natural extract lotion formulations by adding the skin protective substance*

The preparation of the ingredients for this case are similar to A. This method, we add the skin protective substance show in Table 2.

*C. Studying the physical stability of the lotion formulations from the natural extracts by storage in the heating-cooling condition*

We store the products in the refrigerator at the temperature 4°C, the relative humidity 75% RH±5% RH for 48 hours. Then, move the products into the incubator at the temperature 45°C for 48 hours and the relative humidity is 75% RH±5%. We count this process as 1 round. We have done this process for 6 rounds. Analyzing the physical properties of the products after finishing those processes. We will analyze the physical properties of the products in 1) – 3) [6].

1) **Acid-Base (pH):** Using 10 mL of products and pH meter to measure pH where we measured pH of the products for 3 times (Mettler Toledo, FE20 FiveEasy™ pH, USA). Recording the pH values and expressing pH values in the mean values form (n=3) [4].
2) **Viscosity:** Putting 1 gram of the lotion formulations into the box test and measuring the viscosity using the Rheometer at the temperature $25^0$C where the shear stress is 1/5. Measuring the viscosity for 3 times per each sample. We analyzed

the viscosity using HAAKE Rheo Win Job manager (Rheometer & Viscometers, thermo fisher scientific version HAAKE MARS III, USA) [7].

3) **Spread ability:** Putting 0.5 grams of the lotion formulations between two horizontal plates (20 x 20 $cm^2$) where the weight of the top plate is 220±1 grams. The temperature of this process is 25.0±0.5°C. Measuring the spread diameters ϕ for 3 times after pressing the top plate for 30 seconds. Recording the spread diameters of the samples and expressing in the mean values and the standard deviation (mean+SD) form [8].

*D. Studying the evaporation of water through the skin by modified De Vringer [9] method.*

We start this study by pouring 25 grams of ion-free water into a 30 mL beaker and covering the beaker with Whatman filter paper no. 1. Then, drop the lotion formulations 1 gram thoroughly on the filter paper. We store the beaker at the temperature 32 °C and measure mass of the samples at 0 and 24 hours. Finally, we estimated the efficient of the protective evaporation of water or occlusion factor F as

$F = 100 \times [(A-B)/A]$

Where A is the values of water evaporation through filter paper without sample, and B is the values of water evaporation through the filter paper with sample.

**Table 2: This table shows the skin protective Substances.**

| **Developing the lotion formulation from natural extracts by adding the skin protective substances** | | | |
|---|---|---|---|
| **Ingredients** | **%** | | |
| | **LN 4** | **LN 5** | **LN 6** |
| 1. Cholesterol | 1.5 | 1.5 | 1.5 |
| 2. Shea Butter (refined) | 1.5 | 1.5 | 1.5 |
| 3. Olive Oil (extra pure) | 2 | 2 | 2 |
| 4. Ceramide Complex (CeraTouch™, powder) | 1.5 | 0.75 | 0.38 |
| 5. Cerasoft™ (synthetic ceramide) phytosteryl/octyldodecyl lauroyl glutamate | 2 | 2 | 2 |
| 6. Ceramide Complex (oil dispersible powder) | 0.5 | 0.25 | 0.13 |
| 7. Phytosphingosine | 0.63 | 0.31 | 0.16 |
| 8. Buckwheat wax | 1 | 1 | 1 |
| 9. Raffinose | 0.25 | 0.25 | 0.25 |
| 10. Phospholipid | 1 | 0.5 | 0.25 |
| 11. Sensitive cream maker™ potassium cetyl phosphate, Hydrogenate palm glyceride | 1.5 | 1.5 | 1.5 |
| 12. Mild preserved eco™ (preservative-free) | 0.5 | 0.5 | 0.5 |
| 13. Hydro algae™ aqua , Hydrolyzed algin , Chlorella vulgaris extract , Maris aqua | 1 | 1 | 1 |
| 14. Distilled water | 35.13 | 36.94 | 37.84 |

## RESULTS AND DISCUSSION

*A. Results of the development of a lotion formulations to strengthen and retain moisturizer of the skin using natural extracts products*

The result from the study of the physical stability of 6 lotion formulations where the speed of mixing are 400, 800, 1,200 rpm for 10, and 13 minutes, indicated that at speed 1,200 rpm for 13 minutes, the lotions have the appropriate viscosity shown in Figure 1. According to the high speed of mixing lotions, the result of this experiment shown that the size of the oil and water particles are small. The small particles of the oil and water can increase the viscosity of the lotions. The results from the study of mixing lotion formulations at the speed 1,200 rpm for 13 minutes under the accelerated condition are similar for all lotion formulations.

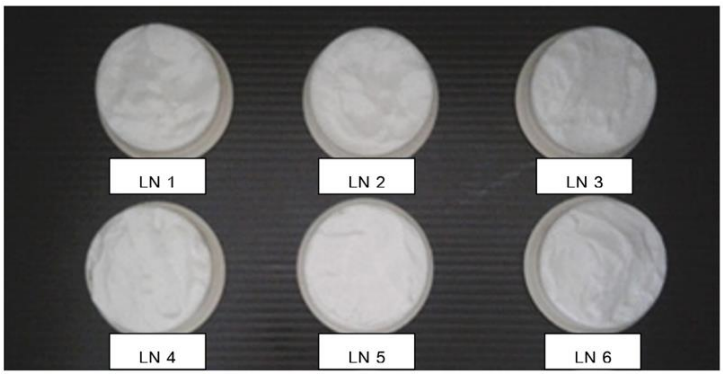


**Figure 1: This picture shows the physical characteristics of the lotion from 6 formulations (N=3)**

*B. Result from the study of physical stability of natural extract lotion formulations under accelerated condition*

1) **Acid-Base (pH):** The structure and pH of the skin are different with each human organ. The pH of the face and body of human are 5.4-5.9. Cosmetic products for the skin can help to balance the pH of the skin by effectively increasing the exfoliating and supporting the natural protective skin guard. The pH of 6 natural extracts lotion formulations LN1,

LN2, LN3, LN4, LN5, LN6 from the measurement are 5.57, 5.52, 5.63, 5.65, 5.50, 5.8. This indicated that the pH of lotions are in the range 5.4-5.9 [7]. One can see that, the pH of the natural extract lotion formulations are in the range of the pH of the human skin.

2) **Viscosity:** Rheology is relating to the quantity and stability of the lotion formulations. This topic, we compared the viscosity of 6 natural extract lotion formulations LN1 to LN6. We used the speed of blending at 400, 800 and 1,200 rpm for 10 minutes. The mean values of viscosity at the mixing speed 400, 800 and 1,200 rpm are 25,140±4.06 cP, 40,100±2.52 cP, and 61,033±3.30 cP respectively. The mean value of viscosity at the mixing speed 1,200 rpm for 13 minutes is 61,933±3.33 cP. From these result, we found that, the increasing of mixing speed and time of mixing affected the viscosity of lotions. The speed of mixing lotions reduced the size of the oil and water particles. This yield the viscosity of lotions increased [7] as shown in Figure 2.
3) **Spread ability:** The spreadability is a characteristic of the semi-solid state of matter to determine the shape and volume of the containers. To measure the spreadability, we measured the diameter of spreading lotions (φ). The result of spreading lotions show in Table 3. From the study of [10], the diameter of spreadability of cream and gel should be less than 50 mm or φ≤ 50 mm. Our results correspond with [10] and show in Table 3 and Figure 2.

**Table 3: This table shows the spread ability of the 6 natural extract lotion formulations (1200 rpm for 13 minutes).**

| Formulations | Spread ability (mm) |
|---|---|
| LN1 | 31.19 |
| LN2 | 31.21 |
| LN3 | 31.22 |
| LN4 | 32.33 |
| LN5 | 34.21 |
| LN6 | 35.88 |

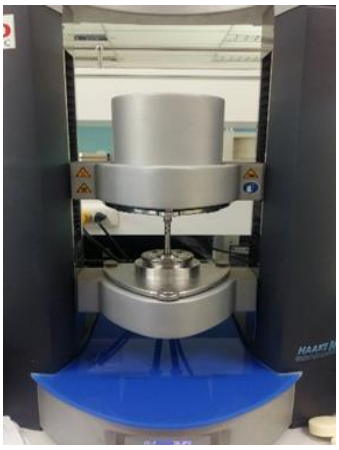

**Figure 2: This picture shows the viscosity testing of the natural extracts lotion formulations using HAAKE Rheo Win Job Manager (rheometers & viscometers, Thermo fisher scientific serie HAAKE MARS III, USA)**

*C. Investigating the water evaporation through the skin for the natural extract lotion formulations and compared with Bigel and Organogel formulations*

We arranged the volume of water evaporation through the skin for 24 hours from small to large values of lotion formulations. We found that for the LN1 at a mixing speed of 1,200 rpm for 13 minutes, the occlusion factor is 41.13±0.53 which is the highest value compared with other lotion formulations. For Bigel and Organogel formulations, the occlusion factors are 39.86±1.09 and 37.94±1.14 respectively. We show the occlusion factors in Table 4.

When we applied the natural extracts lotion formulations (1,200 rpm for 13 minutes) to the body skin, a thin film occurred and covered the body skin. The thin film can prevent the evaporation of water through the skin. We called this property of the thin film as “occlusion effect”. The high values of the occlusion effect mean a high moisturizer of the body skin. This work we used Bigel, Bigel with sesame oil, and Organogel formulations. We found that the occlusion effect can effectively exist when the size of oil and water particles are small. The mixing speed of 1,200 rpm for 13 minutes can generate the small particles of oil and water. For this mixing speed, the lotions can increase the moisturizer of the body skin by 15 times compared with the particles in the micrometer scale lotions [9]. The result of this research correspond with [11]. Natural extract lotion formulations of this research are separated to oil and water phases or hydrogel. The hydrogel can distribute like colloids into hydrochloric compounds. The oil phase is a semi-solid geland contained with liquid, protosubstance, and crystalline wax fraction. Protosubstance or gel former can make the lotions stable and increase the humidity of lotions. We also found that the occlusion effect from natural extracts lotion formulations can exist than Bigel and Organogel formulations [12].

**Table 4: This table shows the occlusion factors of the 6 natural extract lotion formulations (1200 rpm for 13 minutes) with Bigel and Organogel formulations.**

| Formulations | Occlusion factor (24 h) |
|---|---|
| LN1 | 41.13±0.53 |
| LN2 | 40.10±1.53 |
| LN3 | 39.13±1.32 |
| LN4 | 35.20±0.39 |
| LN5 | 38.30±0.77 |
| LN6 | 37.13±1.66 |
| Bigel | 39.86±1.09 |
| Organogel | 37.94±1.14 |

**Figure 3: This picture shows the spreadability testing of the natural extracts lotion formulations using Texture Analyzer (stable micro system series-TA.XT Plus, UK)**

## CONCLUSION

In this work, we studied the development of natural extracts lotions formulations by changing the initial factors such as increasing moisturizer substances, body skin protection substances, the speed of mixing lotions and also the time of mixing lotions. We also analyze the quantity of natural extracts lotions formulations.

The study of lotions' physical stability by comparing 6 natural extract lotion formulations which is the speed of mixing are 400, 800 and 1200 rpm and the mixing time are 10, and 13 minutes. We found that lotions have the appropriate viscosity caused by increasing the speed of mixing lotions. By increasing the speed of mixing lotions, the size of oil and water particles distribute in the lotions decreased.

The result of mixing lotions at 1200 rpm for 13 minutes under accelerated conditions is similar to the case of 10 minutes of mixing lotions. We also found that the 6 natural extract lotion formulations are appropriately distributed.

For studying the water evaporation through the skin from natural extract lotion formulations *(1200 rpm for 13 minutes) compared with Bigel and Organogel formulations, we found that when applying natural extracts lotion formulations to the skin, the invisible strong thin film exists on the skin and the film does not flake. The lotions can combine with many kinds of medicines. Crystalline wax fractions appear in the lotions. The crystalline wax has a high occlusion factor and it can protect the evaporation of water through the body skin. The occlusion effect in the natural extract lotions can exist more than in Bigel and Organogel formulations.*

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