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Formulation of face wash gel containing Thai herbal extract self-microemulsifying system

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Keywords: *Areca catechu L.*; *Curcuma longa L.*; *Garcinia mangostana L.*; *Oryza sativa L.*; Face wash gel; Self-microemulsifying

Objectives: The present work aimed to prepare the face wash gel containing Thai herbal extract – self-microemulsifying system. It was evaluated the physical appearance and contamination test.
Methods: The Thai herbal extract compound: *Curcuma longa L., Areca catechu L., Oryza sativa L.,* and *Garcinia mangostana L.* in ratio of 1:1:1:1, respectively was prepared by Dr.Chonlatid Sontimuang, Faculty of Traditional Thai Medicine, Prince of Songkla University. The Thai herbal extract was incorporated in self-microemulsifying system that developed by our research group. Then, it was homogenously mixed in face wash gel formulation: 10% w/w clear self-microemulsifying system, 8.34% w/w HPMC E5, 30% w/w glycerin, 0.05% w/w lauric acid, 0.15% w/w triethanolamine, 1% w/w paraben concentration, and purified water qs.to 100%. The Thai herbal face wash gel formulation was evaluated for its appearance, pH value, and viscosity of both fresh preparation and stability tested preparation as well as the contamination test using both manital salt agar (*Staphylococcus aureus*) and MacConkey agar (*Escherichia coli*) contamination test.
Results: Thai herbal face wash gel formulation containing Thai herbal extract: the *Curcuma longa L., Areca catechu L., Oryza sativa L.,* and *Garcinia mangostana L.* in ratio of 1:1:1:1, respectively based on self-microemulsifying system had a brownish yellow in appearance that was visually checked by researcher. It had a normal pH in range of 7 – 8 and good viscosity which ease to use and safe to contact with the skin. In addition, it had a good stability and no contamination of *Staphylococcus aureus* and *Escherichia coli*.
Conclusion: Prepared Thai herbal face wash gel formulation had good physical properties with safe to use. In addition, it will be developed as good herbal cosmetic products.

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Introduction

Nowadays, herbal formulations have growing demand in the Thailand market. In addition, the herbal products are more acceptable and interesting in the view that they are less side effects and safe than the synthetic products. In addition, many researches has been reported on the development of drug delivery system for herbal compounds such as curcumin[1], quercetin[2], paclitaxel[3], tea catechins[4], capsaicin[5,6], *Zingiber cassumunar*[7,8] etc. with the main idea of (1) it should deliver the drug at a rate directed by the needs of the body, over the period of treatment and (2) it should channel the active entity of herbal drug to the site of action.[9,10] Self-microemulsifying systems are a novel formulation that can improve the solubility of compound. They are defined as the mixture of oil, surfactant and co-surfactant act as carriers for compound entrapment by forming fine microemulsion. They have a small lipid droplet size (less than 200 nm) that dispersed in solution. Under visualization, they have a clear-to-translucent appearance. They have a large surface area dispersions that can be associated to increase the absorption of poorly water soluble compound.[11-13]
In our research group, it have been reported the preparation of the pseudoternary phase diagram of self-microemulsifying systems incorporating Thai herbal extract: the *Curcuma longa L., Areca catechu L., Oryza sativa L.,* and *Garcinia mangostana L.* in ratio of 1:1:1:1, respectively. After that, we selected the suitable region point from pseudoternary phase diagram to formulate the Thai herbal face wash gel. The Thai herbal face wash gel formulation was evaluated an appearance, pH value, and viscosity of both fresh preparation and stability tested preparation as well as the contamination test using both manital salt agar (*Staphylococcus aureus*) and MacConkey agar (*Escherichia coli*) contamination test.

Methods

***Preparation of herbal extract formulation*:** The traditional Thai herbal recipe, namely “Ya-Sa-Marn-Phlae”: the *Curcuma longa L., Areca catechu L., Oryza sativa L.,* and *Garcinia mangostana L.* in ratio of 1:1:1:1, respectively has

been used for the treatment of wounds and skin infections. [14,15] The herbal extract recipe was prepared by Dr.Chonlatid Sontimuang, Faculty of Traditional Thai Medicine, Prince of Songkla University.

***Thai herbal face wash gel preparations*:** From preliminary study, our research group prepared the pseudoternary phase diagram of self-microemulsifying systems which composed of caprylic acid (P.C. Drug Center Co.,Ltd, Thailand), mixture of Tween® 80 (P.C. Drug Center Co.,Ltd, Thailand) and absolute ethanol (8:2), and propylene glycol (P.C. Drug Center Co.,Ltd, Thailand) were used as oil phase, surfactant, and co-surfactant, respectively (unpublished results). This work selected one region point from pseudoternary phase diagram mixed into face wash gel formulation. 1% w/w Thai herbal extract was mixed in 10% w/w caprylic acid, 60% w/w mixture of Tween® 80 and absolute ethanol (8:2), and 30% w/w propylene glycol. The face wash gel formulation: 10% w/w clear self-microemulsifying system, 8.34% w/w HPMC E5 (HuzhouZhanwang Pharmaceutical Co.,Ltd, China), 30% w/w glycerin (Sigma-aldrich, USA), 0.05% w/w lauric acid (Namsiang company limited, Thailand), 0.15% w/w triethanolamine (Sigma-aldrich, USA), 1% w/w paraben concentration, and purified water qs.to 100% was easily prepared by beaker mixing.

pH test: A SevenEasy S-20 pH meter (Mettler Toledo, Switzerland) was used to measure the pH value of each formulation at room temperature. The glass electrode was dipped completely into pH 4.0, 7.0, and 10.0 standard buffers to calibrate the pH meter before the pH of the Thai herbal face wash gel was determined. The glass electrode was rinsed with distilled water between samples measurement. This measurement was determined in triplicate.

Viscosity measurement: A Brookfield viscometer (Brookfield engineering laboratories Inc, USA) was used to study of the viscosity of each Thai herbal face wash gel formulation at 25±2ºC with the spindle S-96 at 100 rpm. This parameter was measured in triplicate.

The stability test: Thai herbal face wash gel formulation was kept at 40±2°C 75%RH in stability chamber (Memmert GmbH + Co. KG, Germany) for 0, 1, and 2 months. For heating/cooling test 6 cycles, Thai herbal face wash gel formulation was kept in refrigerator at 4±2°C for 24 hours and subsequently moved to 40±2°C for 24 hours. The appearance of Thai herbal face wash gel formulation was visually observed by the researcher as well as pH and viscosity were determined.

The contamination test: Thai herbal face wash gel formulation was diluted with 0.9% sodium chloride solution into 10^{-1}, 10^{-2}, and 10^{-3} µg/mL, and then speeded onto Petri-dish that contained each manital salt agar (*Staphylococcus aureus*) or MacConkey agar (*Escherichia coli*) for contamination test. They were incubated at 37±2ºC for 24 hours.

Results

The color of the blank face wash gel formulation was white (Figure 1A) and the intensity of its color increased with the adding of the Thai herbal extract – self-microemulsifying system which was brownish yellow (Figure 1B). This might be due to the brownish yellow color of the combined Thai herbal extract.

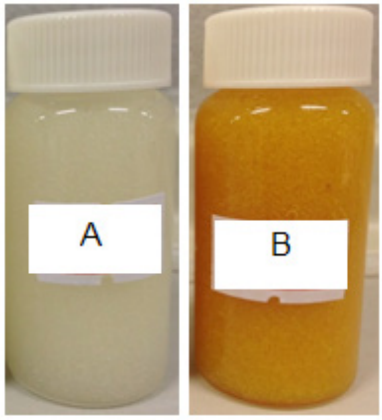

Figure 1. The appearance of blank face wash gel formulation (A) and Thai herbal face wash gel formulation – self-microemulsifying system (B)

The pH and viscosity of Thai herbal face wash gel formulation – self-microemulsifying system were not changed from blank face wash gel formulation. The pH values of Thai herbal face wash gel formulation – self-microemulsifying system are given in Figure 2. The pH value of fresh preparation of Thai herbal face wash gel formulation – self-microemulsifying system product was 8.03±0.01, while the pH value of this products after stability test varied from 7.40 to 7.99. Thus, the results showed that pH were slightly changed between fresh preparation and storage at 40±2°C 75%RH in stability chamber for 1 and 2 months, as well as heating/cooling test 6 cycles. The viscosity of Thai herbal face wash gel formulation – self-microemulsifying system is given in Figure 3. The viscosity of fresh preparation was 3207.44±69.01 cPs. The viscosity was increased after storage at different stability tests: at 40±2°C 75%RH in stability chamber for 1 and 2 months and heating/cooling test 6 cycles. In addition, the viscosity was decreased when this formulation was homogeneously mixed after stability testing. This might be the temperature effects which decreased the movement of polymer chain. Therefore, the results showed that the Thai herbal face wash gel formulation – self-microemulsifying system stood stable at stability testing condition with a little change.

Thai herbal face wash gel formulation – self-microemulsifying system was found that it was not contaminated with *Staphylococcus aureus* and *Escherichia coli* after incubation with manital salt agar and MacConkey agar, respectively at 37±2ºC for 24 hours (Figure 4).

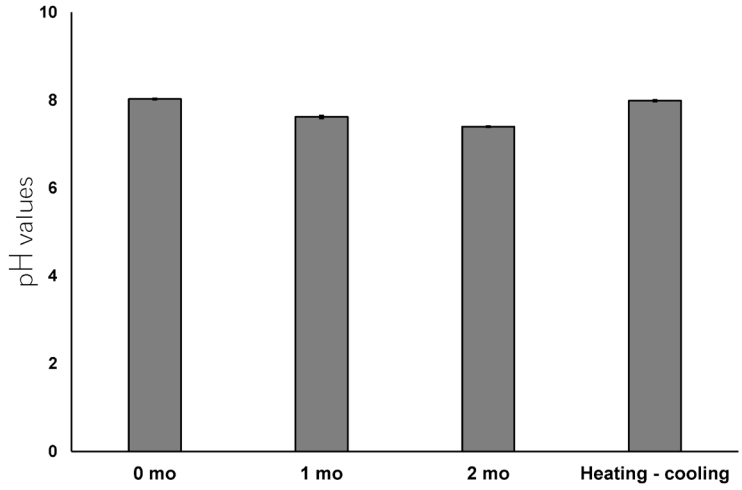

Figure 2. pH values of Thai herbal face wash gel formulation – self-microemulsifying system

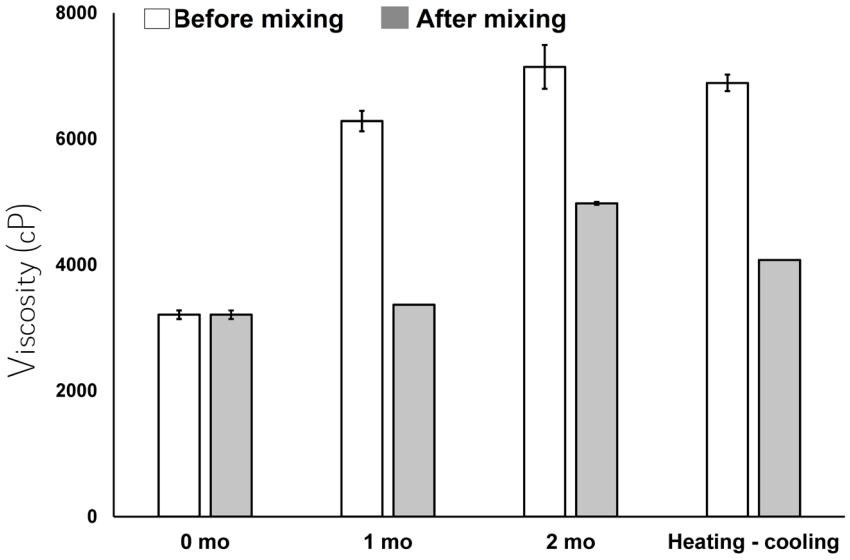

Figure 3. Viscosity of Thai herbal face wash gel formulation – self-microemulsifying system

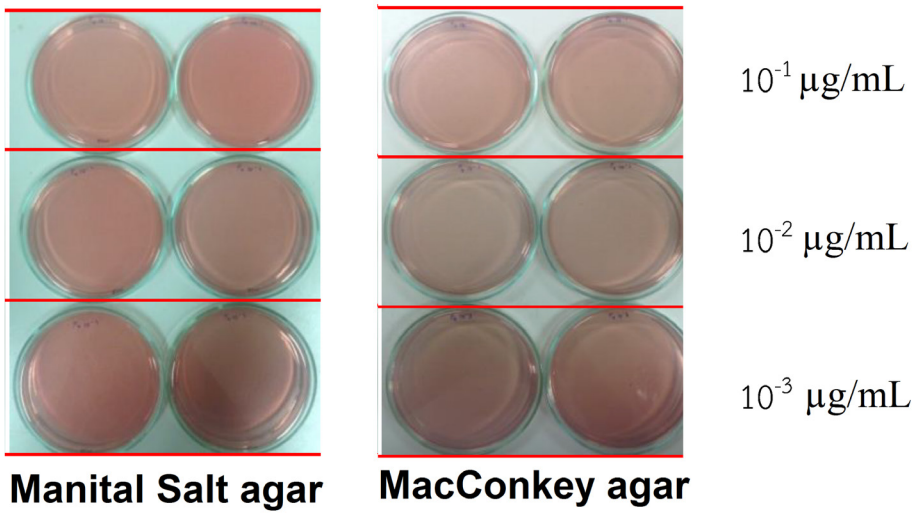

Figure 4. Contamination test of Thai herbal face wash gel formulation – self-microemulsifying system using manital salt agar (left) and MacConkey agar (right) when diluted with 0.9% sodium chloride solution into 10^{-1}, 10^{-2}, and 10^{-3} µg/mL

Discussion

The present work described with the preparation and evaluation of Thai herbal face wash gel formulation containing Thai herbal extract: the *Curcuma longa L., Areca catechu L., Oryza sativa L.,* and *Garcinia mangostana L.* in ratio of 1:1:1:1, respectively, namely "Ya-Sa-Marn-Phlae" recipe. It is tested and used for the treatment of wounds and skin infections.[14,15] The Thai herbal extract was incorporated into self-microemulsifying system reported by our research.

Then, it was homogeneously mixed in face wash gel formulation containing 8.34% w/w HPMC E5, 30% w/w glycerin, 0.05% w/w lauric acid, 0.15% w/w triethanolamine, 1% w/w paraben concentration, and purified water qs.to 100%. This Thai herbal face wash gel formulation had a brownish yellow in appearance. It had a normal pH in range of 7 – 8 and good viscosity which was ease to use and safe to contact with the skin. In addition, it had a good stability and no contamination of *Staphylococcus aureus* and *Escherichia coli*.

Conclusion

Thai herbal face wash gel formulation incorporating Thai herbal extract: the *Curcuma longa L., Areca catechu L., Oryza sativa L.,* and *Garcinia mangostana L.* in ratio of 1:1:1:1, respectively was initially prepared by our research group. It was tested basic properties such as appearance, pH value, viscosity, stability, and contamination. It was found that good physical property which could be used as herbal cosmetic products, and in the future, it will be evaluated the active compound content and *in vitro* study.

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