Thai Journal of Pharmaceutical Sciences (TJPS)

Journal homepage: http://www.tjps.pharm.chula.ac.th

Formulation of face wash gel containing Thai herbal extract microemulsion

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

Objectives: The objective of this work was to prepare the face wash gel formulation containing Thai herbal extract based on microemulsion system. The visual observation of appearance, viscosity, pH value, stability, and contamination test were evaluated.
Methods: The face wash gel formulation composed of 10% w/w clear microemulsion 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%. 1% w/w 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 incorporated into microemulsion system studied by our research group. The Thai herbal face wash gel formulation was studied the stability at 45±2ºC and heating/cooling condition, and then its appearance, viscosity, and pH value were determined. The Thai herbal face wash gel formulation was tested *Staphylococcus aureus* and *Escherichia coli* to detect the contamination.
Results: The Thai herbal face wash gel formulation was found that a brownish yellow in appearance by visual observation. Both fresh preparation and stability tested preparation showed good physical properties: pH value, viscosity, and no contamination of *Staphylococcus aureus* and *Escherichia coli* that was appropriately used to contact with the skin
Conclusion: This work reported that the Thai herbal face wash gel formulation had good physical properties which could be developed to new herbal cosmetic products.

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Introduction

Recently, the Thai herbal compounds are the good demand resulting in its rapid growth in Thailand. A great increase in the Thai demand for herbal cures, herbal skin care products and herbal cosmetic products were observed and interesting in the recent years. Microemulsion systems are described as a system of oil, water, and surfactant/co-surfactant that is a single optically isotropic and thermodynamically stable, clear, and translucent liquid solution as well as high solubilization power, and ease of preparation.[1,2] However, microemulsion systems have the disadvantage of surfactant and co-surfactant usage that are the use of surfactant and co-surfactant at quite high concentrations to reduce the interfacial tension and increase the flexibility of the interfacial film, which may lead to the risk of skin irritation.[2,3] Thus, nonionic surfactants are the choice for topical pharmaceutical formulations and cosmetics based on microemulsion preparation that cause less skin irritation comparing with ionic surfactants. Although, nonionic surfactants are safe for topical pharmaceutical formulations and cosmetics based on microemulsion preparation, they should be tested the skin irritation to confirm its property. Our research group prepared and evaluated the microemulsion-based pseudoternary phase diagram incorporating Thai herbal extract compound: the *Curcuma longa L., Areca catechu L., Oryza sativa L.,* and *Garcinia mangostana L.* in ratio of 1:1:1:1, respectively. The microemulsion system comprised of caprylic acid as oil phase, mixture of Tween® 80 and absolute ethanol (8:2) as surfactant, and water phase. The addition of an absolute ethanol as a co-solvent could reduce the required amount of high surfactant content in microemulsion systems. Thus, the objective of this research was to prepare the Thai herbal face wash gel formulation based on microemulsion system. It was evaluated for an appearance, viscosity, and pH value of both freshly preparation and stability tested preparation as well as the contamination test using a manital salt agar and MacConkey agar for *Staphylococcus aureus* and *Escherichia coli* test, respectively.

Methods

***Preparation of herbal extract formulation*:** The *Curcuma longa L., Areca catechu L., Oryza sativa L.,* and *Garcinia mangostana L.* in ratio of 1:1:1:1, respectively is the traditional Thai herbal recipe, namely “Ya-Sa-Marn-Phlae” that has been used for the treatment of wounds and skin infections.[4,5] 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 microemulsion systems which composed of caprylic acid (P.C. Drug Center Co., Ltd, Thailand) as oil phase, mixture of Tween® 80 (P.C. Drug Center Co., Ltd, Thailand) and absolute ethanol (8:2) as surfactant and cosurfactant, and water phase (unpublished results). The suitable region point from their pseudoternary phase diagram was selected to mix into face wash gel formulation. Firstly, the 1% w/w Thai herbal extract was incorporated into microemulsion: 20% w/w caprylic acid, 70% w/w mixture of Tween® 80 and absolute ethanol (8:2), and 10% w/w water phase. The face wash gel formulation: 10% w/w clear microemulsion 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.

***Formulation characterization*:** Appearance of Thai herbal face wash gel formulation was visually observed by the researcher. Thai herbal face wash gel formulation was determined the viscosity by a Brookfield viscometer (Brookfield engineering laboratories Inc, USA) at 25 ± 2ºC with the spindle S-96 at 100 rpm. SevenEasy S-20 pH meter (Mettler Toledo, Switzerland) was used to determine the pH value of Thai herbal face wash gel formulations. Before testing, the pH 4.0, 7.0, and 10.0 standard buffers were used to calibrate the pH meter by dipping completely the glass electrode into each standard buffers. Both pH and viscosity values were measured in triplicate.

The stability test: The stability test of Thai herbal face wash gel formulation was performed by storage at 2 conditions: (1) accelerated stability test at 40±2°C 75%RH in stability chamber (Memmert GmbH + Co. KG, Germany) for 0, 1, and 2 months and (2) 6 cycles heating/cooling stability test at 4±2°C for 24 hours and 40±2°C for 24 hours. The appearance, viscosity, and pH were evaluated.

The contamination test: Thai herbal face wash gel formulation was diluted with 0.9% NaCl 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 blank face wash gel formulation had white in appearance (Figure 1A), but it became the brownish yellow in appearance after mixing with microemulsion-loaded Thai herbal extract (Figure 1B). The Thai herbal extract had a brownish yellow in individual appearance. Moreover, when the microemulsion-loaded Thai herbal extract was homogeneously mixed in blank face wash gel formulation, the pH value and viscosity did not significantly change. Thus, the microemulsion-loaded Thai herbal extract did not affect the physical properties of face wash gel formulation.

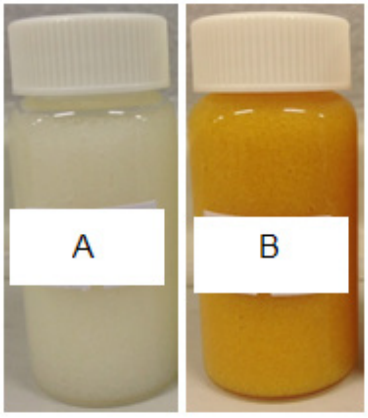

Figure 1. The appearance of face wash gel formulation (A) and Thai herbal face wash gel formulation based on microemulsion system (B)

The viscosity and pH value of fresh preparation of Thai herbal face wash gel formulation based on microemulsion system were 2337.63±5.13 cPs and 7.91±0.01, respectively (Figures 2 and 3). After stability test, its viscosity increased to 5488.83±257.77, 5260.13±115.82, and 5119.53±64.73 cPs when storage at 40±2°C 75%RH in stability chamber for 1 and 2 months and heating/cooling test 6 cycles, respectively. After that, it was homogenously mixed by physical preparation, the viscosity decreased to 4412.81±125.65, 4825.22, and 3153.08±75.13 cPs after storage at 40±2°C 75%RH in stability chamber for 1 and 2 months and heating/cooling test 6 cycles, respectively. This was due to the temperature might affect the movement of polymer chain in its formulation (Figure 2). Figure 3 showed the pH values of Thai herbal face wash gel formulation based on microemulsion system after stability test. It was found that the pH value were 7.43±0.06, 7.17±0.01, and 7.76±0.01 after storage at 40±2°C 75%RH in stability chamber for 1 and 2 months and heating/cooling test 6 cycles, respectively. Its pH value showed it could be appropriately used with the skin, however, the skin irritation test will be reported in another work.

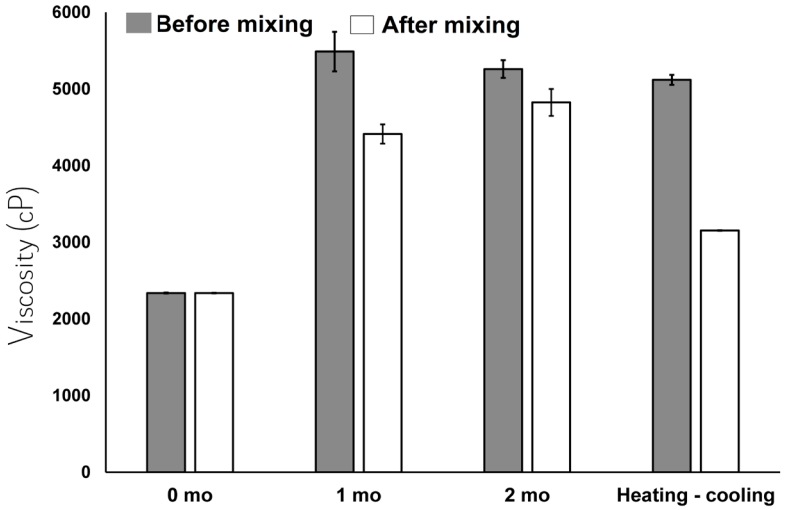

Figure 2. Viscosity of Thai herbal face wash gel formulation based on microemulsion system

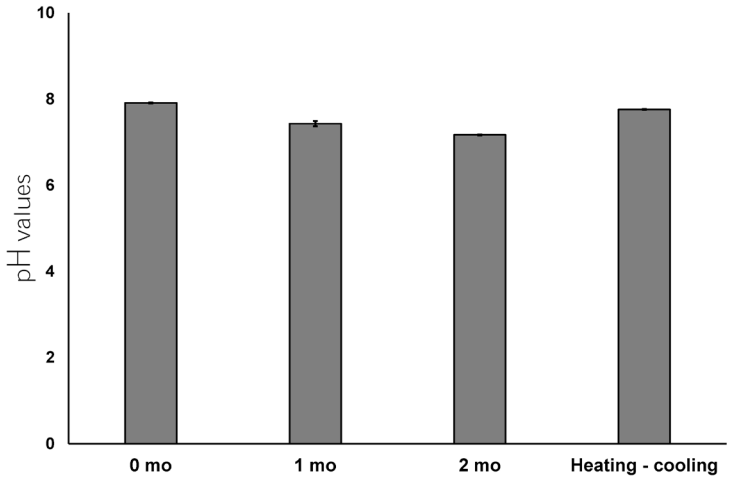

Figure 3. pH values of Thai herbal face wash gel formulation based on microemulsion system

The manital salt agar and MacConkey agar were used to test the *Staphylococcus aureus* and *Escherichia coli* contamination, respectively for Thai herbal face wash gel formulation based on microemulsion system, then it was incubated at 37ºC for 24 hours. It was found that no *Staphylococcus aureus* and *Escherichia coli* contamination on Thai herbal face wash gel formulation based on microemulsion system (Figure 4).

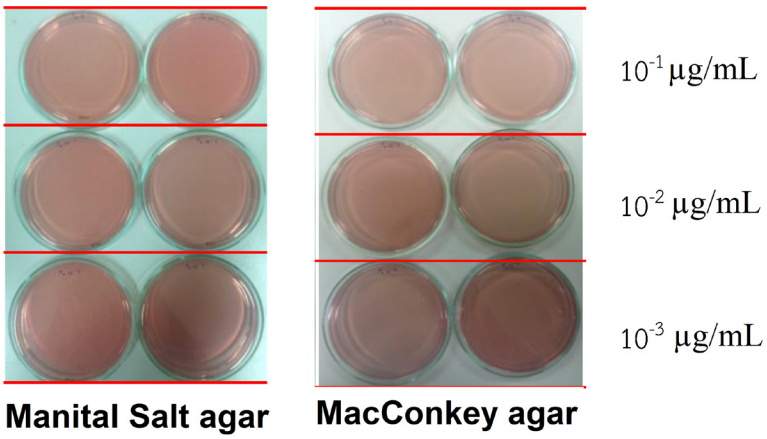

Figure 4. Contamination test of Thai herbal face wash gel formulation based on microemulsion system using manital salt agar (left) and MacConkey agar (right) when diluted with 0.9% sodium chloride solution into 10^{-1}, 10^{-2}, and 10^{-3} µg/mL

Discussion

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 are reported for the treatment of wounds and skin infections.[5,6] It was mixed into microemulsion system being a single optically isotropic and thermodynamically stable, clear, and translucent liquid solution, and then it was incorporated into 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 good stability and no contamination of *Staphylococcus aureus* and *Escherichia coli*.

Conclusion

The Thai herbal recipe extract composed of the *Curcuma longa L., Areca catechu L., Oryza sativa L.,* and *Garcinia mangostana L.* in ratio of 1:1:1:1, respectively could be homogeneously incorporated in microemulsion, and then could be mixed into face wash gel formulation. The results of appearance, viscosity, and pH value of Thai herbal face wash gel formulation showed good physical properties without contamination of *Staphylococcus aureus* and *Escherichia coli*.

Acknowledgements

The authors would like to acknowledge the Faculty of Pharmacy and the Research Institute of Rangsit University for financial supports (34/2558).

References

1. Lawrence MJ, Rees GD. Microemulsion-based media as novel drug delivery systems. Adv Drug Deliv Rev. 2000;45(1):89-121.
2. Boonme P, Boonthongchuay C, Wongpoowarak W, Amnuaikit T. Evaluation of nicotinamide microemulsion on the skin penetration enhancement. Pharmaceut Dev Tech. 2014:1-5.
3. Boonme P. Applications of microemulsions in cosmetics. J Cosmet Dermatol. 2007;6(4):223-8.
4. Chusri S, Settharaksa S, Chokpaisarn J, Limsuwan S, Voravuthikunchai SP. Thai herbal formulas used for wound treatment: a study of their antibacterial potency, anti-inflammatory, antioxidant, and cytotoxicity effects. J Altern Complement Med. 2013;19(7):671-6.
5. Chusri S, Tongrod S, Chokpaisarn J, Limsuwan S, Voravuthikunchai SP. Antagonistic interactions of “Ya-Sa-Marn-Phlae” ethanol extract in combination with topical antiseptics against clinical isolates of *Staphylococcus aureus*. BioMed Research International. 2014;2014:6.