

FORMULATION DEVELOPMENT OF HAIR RINSE CREAM FROM LEMONGRASS OIL ADDED WITH VARIOUS FIXATIVES: CASE STUDY IN LOCK OF HAIR

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ABSTRACT

According to the previous research, essential oil from *Cymbopogon citratus* Stapf (Lemongrass) was able to inhibit *Malassezia furfur* and was formulated as hair tonic. However, sensory efficiency of lemongrass oil hair products has not been reported. This research aimed to formulate and evaluate sensory efficiency of lemongrass oil hair rinse cream added with fixatives. It was found that the chief chemical constituents of lemongrass oil determined by GC-MS were cis-citral and trans-citral. In addition, total content of both citral isomers in our lemongrass oil was 76.56 percent which met Thai Industrial Standard. It was shown that all formulae of lemongrass oil hair rinse cream added with fixatives possessed satisfy physical stability. Sensory efficiency evaluation of all hair rinse cream formulae added with fixatives was performed by rinsing hair lock and rating by 30 evaluators. The results revealed that hair shining, styling, hair softness, ability to reduce hair loss, weighting, odor after 2-days rinsing and odor after freshly rinsing of hair lock rinsed with all formulae were not statistical difference. Unless the hair rinse cream using natural leech lime oil as fixative which showed a higher hair shining than hair rinse cream without fixative with statistical difference ($P < 0.05$). It was suggested that leech lime oil possessed organic acid namely citric acid that could increase hair shining and hair plenty. Lemongrass oil hair rinse cream using leech lime oil as fixative possessed physical stability, satisfy sensory efficiency and showed ability for further commercial development.

KEYWORDS: Fixatives, Hair Rinse Cream, Lemongrass Oil, Lock Of Hair.

According to the previous researches, 2 % of essential oil from *Cymbopogon citratus* Stapf (Lemongrass) was able to inhibit *Malassezia furfur*, pathogenic yeast that cause dandruff (Wuthi-udomlert, 2011). In addition, lemongrass oil hair tonic was also formulated for used as antidandruff preparation (Chaisripipat and Lourith, 2013). However, sensory efficiency of lemongrass oil hair products has not been reported. This research aimed to formulate lemongrass oil hair rinse cream added with various fixatives. For finding the best hair rinse cream formula, sensory efficiency of all lemongrass oil hair rinse cream formulae consisting of hair shining, styling, hair softness, ability to reduce hair loss, weighting, odor after 2-days rinsing and odor after freshly rinsing were evaluated using lock of hair.

MATERIALS AND METHODS

Materials

Lemongrass oil was purchased from Thai China Flavours & Fragrances Industry Co. (Thailand). Ingredients of hair rinse cream were bought from Namsiang Group Co.,Ltd.

Methods

Analysis Of Lemongrass Oil Constituents

The lemongrass oil components were analyzed using Gas Chromatograph - Mass Spectrometer

(GC-MS) equipped with autoinjector. Essential oil was diluted with ethanol to give final concentration at 1 $\mu\text{l/ml}$. The separation was performed on a Rxt-5[®] (30 m x 0.32 mm id x 0.25 μm film thickness) capillary column. Working condition consisted of injector at 250°C which transferred line to MSD at 250°C. Oven temperature was started with 80°C to 250°C at 10°C/min. Helium was used as carrier gas at a flow rate 1 ml/min. while split ratio was 1: 5. The ionization was 0 kV and m/z was scanned over 35/550 amu at 1,111 amu/sec. Components in essential oil were identified by comparing the mass spectra of each compound with data in the NIST mass spectral libraries.

Preparing The Lock Of Hair

The hair collected from hair salon was washed with tap water, cleaned with baby shampoo, rinse with tap water again and dried using hair dryer. After that, the hair was grouped and fastened with glue resulting in lock of hair.

Formulation Of Lemongrass Oil Hair Rinse Cream

Various formulae of hair rinse cream containing lemongrass oil as active ingredient were prepared using many groups of emulsifiers by beaker method. Only 1 formula of hair rinse cream possessing satisfy physical characters was chosen after overnight left.

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Selection The Fixatives Added To Lemongrass Oil Hair Rinse Cream

Various fixatives were screened by adding them to the selected hair rinse cream. Finally, 3 fixatives were chosen and added to the hair rinse cream that hence resulting to 3 formulae of hair rinse cream and 1 formula without fixative.

Evaluation The Sensory Efficiency Of Lemongrass Oil Hair Rinse Cream Added With 3 Fixatives And Without Fixative

Sensory efficiency evaluation of 4 hair rinse cream formulae, with and without fixatives, were performed by rinsing hair lock and rating by 30 evaluators about these characters; hair shining, styling, hair softness, ability to reduce hair loss, weighting, odor after 2-days rinsing and odor after freshly rinsing. The physical stability of all lemongrass oil hair rinse cream formulae was performed using freeze-thaw cycling method.

RESULTS AND DISCUSSION

Lemongrass oil components analyzed by GC-MS was revealed in table 1 and figure 1.

Tables 1: Chemical constituents of lemongrass oil

| Compound number | Retention time (min) | Chemical name | Relative percent |
|-----------------|----------------------|-------------------------|------------------|
| 1 | 6.86 | 6-Methyl-5-hepten-2-one | 1.48 |
| 2 | 7.02 | beta-Myrcene | 8.47 |
| 3 | 8.43 | l-Limonene | 1.34 |
| 4 | 17.84 | cis-Citral | 33.65 |
| 5 | 18.40 | trans-Geraniol | 4.11 |
| 6 | 19.23 | trans-Citral | 42.91 |
| 7 | 24.35 | Geranyl acetate | 2.01 |
| 8 | - | Unknown | 6.03 |

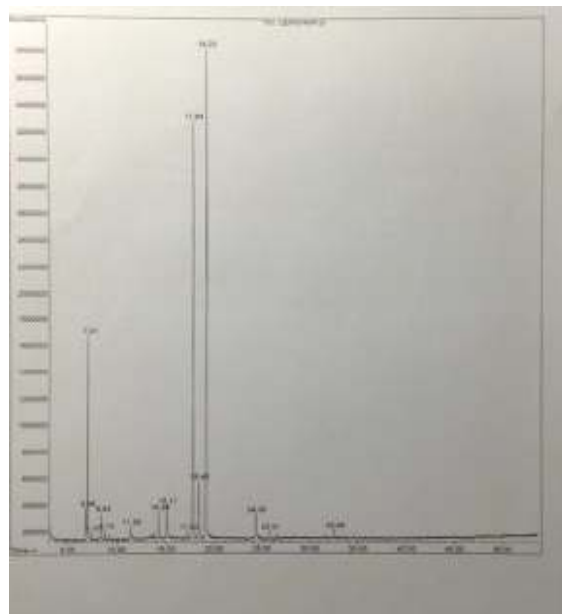


Figure 1: Chromatogram of lemongrass oil

According to table 1 and figure 1, 7 compounds were found in lemongrass oil, including 6-methyl-5-hepten-3-one, beta-myrcene, l-limonene, cis-citral, trans-geraniol, trans-citral, and geranyl acetate. Thai Industrial Standard 1681-2541 (Ministry of Industry, 2000) indicated that lemongrass oil must contain at least 70 percent of citral. Total content of both citral isomers in our lemongrass oil was 76.56 percent which met Thai Industrial Standard and confirmed a quality of this essential oil (Thai Industrial Standard 1681-2541).

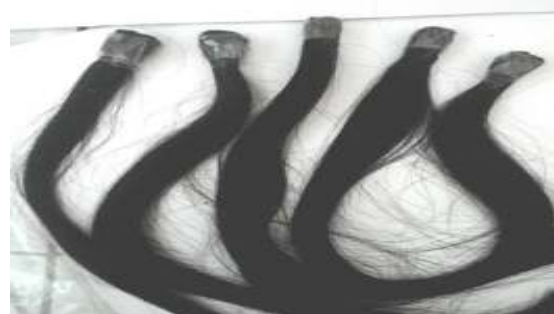


Figure 2: The lock of hair

Various formulae of 2 % lemongrass oil hair rinse cream were formulated using ingredients shown in table 2. After overnight left, it was found that formula T of hair rinse cream possessed satisfy physical characters. It was attributed to the suitable quantity of oil, fat, wax in formula T. Moreover, this formula possessed an optimum citric acid (2%) that hence leading to a suitable pH (6.0) for hair and scalp (Leelapornpisit, 2001; Wilkinson and Moore, 1982)

Therefore, formula T was chosen to add with various fixatives. The screening test revealed that 3 fixatives consisting of natural leech lime oil, synthetic jasmine fragrance and synthetic ratree fragrance were mixed well with lemongrass oil hair rinse cream. Therefore, 4 final lemongrass oil hair rinse cream formulae were formulated again and denoted as T1 (without fixative), T2 (using natural leech lime oil), T3 using synthetic jasmine fragrance) and T4 (using synthetic ratree fragrance).

Table 2: Four formulae of lemongrass oil hair rinse cream (for first screening)

| Ingredients | Formu la Q | Formu la R | Formu la S | Formu la T |
|--------------------------------|-----------------|-----------------|-----------------|-----------------|
| Oil phase | | | | |
| Mineral oil | 1.20 g | 1.20 g | 1.20 g | 1.20 g |
| Cetyl alcohol | 1.20 g | 1.20 g | 1.20 g | 1.20 g |
| Stearyl alcohol | 1.20 g | 1.20 g | 1.20 g | 1.20 g |
| Span 80 | 1.20 g | 1.20 g | 1.20 g | 1.20 g |
| Joboba oil | 2.00 g | 2.00 g | 1.20 g | 1.20 g |
| Dehyquat wax AB | 10.00 g | 10.00 g | 4.00 g | 4.00 g |
| Butylated hydroxytoluene (BHT) | 4.00 g | 4.00 g | 2.00 g | 2.00 g |
| Water phase | | | | |
| Tween 80 | 3.20 g | 3.20 g | 3.20 g | 3.20 g |
| Propylene glycol | 2.00 g | 2.00 g | 1.20 g | 1.20 g |
| DehyquatAC | 5.00 g | 5.00 g | 5.00 g | 5.00 g |
| Hydantoin | 0.80 g | 0.80 g | 1.00 g | 1.00 g |
| Lemongrass oil | 2.00 g | 2.00 g | 2.00 g | 2.00 g |
| 1% Stock Color | 0.64 g | 0.64 g | 0.64 g | 0.64 g |
| Citric acid | - | 10.00 g | 10.00 g | 2.50 g |
| Distilled water | 65.56 g | 55.56 g | 64.96 g | 72.46 g |
| Total | 100.00 g | 100.00 g | 100.00 g | 100.00 g |

Sensory efficiency of 4 hair rinse cream formulae; T1, T2, T3 and T4; consisting of hair shining, styling, hair softness, ability to reduce hair loss, weighting, odor after 2-days rinsing and odor after freshly rinsing were shown in table 3 -9, respectively.

Table 3: Hair shining of hair lock after rinsed with 4 hair rinse cream formulae

| Formula | Hair shining level (n = 30) | | | | Mean ± S.D. |
|---------|------------------------------|----------|----------|----------------------|--------------|
| | very good (4) | good (3) | fair (2) | Need improvement (1) | |
| T1 | 5 | 17 | 8 | - | 2.90 ± 0.66* |
| T2 | 12 | 14 | 4 | - | 3.27 ± 0.69* |
| T3 | 5 | 14 | 11 | - | 2.80 ± 0.71 |
| T4 | 14 | 9 | 7 | - | 3.23 ± 0.82 |

*P-value < 0.05 when comparing between T2 and T1 (Mann-Whitney Test)

Table 4: Hair styling of hair lock after rinsed with 4 hair rinse cream formulae

| Formula | Hair styling level (n = 30) | | | | Mean ± S.D. |
|---------|------------------------------|----------|----------|----------------------|--------------|
| | very good (4) | good (3) | fair (2) | Need improvement (1) | |
| T1 | 12 | 16 | 2 | - | 3.33 ± 0.61* |
| T2 | 14 | 16 | - | - | 3.47 ± 0.51* |
| T3 | 9 | 16 | 3 | 2 | 3.07 ± 0.83* |
| T4 | 13 | 11 | 6 | - | 3.23 ± 0.77* |

*P-value > 0.05 (Kruskal – Wallis Test)

Table 5: Hair softness of hair lock after rinsed with 4 hair rinse cream formulae

| Formula | Hair softness level (n = 30) | | | | Mean ± S.D. |
|---------|-------------------------------|----------|----------|----------------------|--------------|
| | very good (4) | good (3) | fair (2) | Need improvement (1) | |
| T1 | 6 | 17 | 7 | - | 2.97 ± 0.67* |
| T2 | 12 | 18 | - | - | 3.40 ± 0.50* |
| T3 | 10 | 8 | 10 | 2 | 2.87 ± 0.97* |
| T4 | 10 | 14 | 6 | - | 3.13 ± 0.73* |

*P-value > 0.05 (Kruskal – Wallis Test)

Table 6: Ability to reduce hairloss of hair lock after rinsed with 4 hair rinse cream formulae

| Formula | Ability to reduce hairloss level (n = 30) | | | | Mean ± S.D. |
|---------|---|----------|----------|----------------------|--------------|
| | very good (4) | good (3) | fair (2) | Need improvement (1) | |
| T1 | 17 | 13 | - | - | 3.53 ± 0.51* |
| T2 | 14 | 16 | - | - | 3.47 ± 0.51* |
| T3 | 13 | 12 | 5 | - | 3.27 ± 0.74* |
| T4 | 10 | 15 | 5 | - | 3.17 ± 0.70* |

*P-value > 0.05 (Kruskal – Wallis Test)

Table 7: Weighting of hair lock after rinsed with 4 hair rinse cream formulae

| Formula | Weighting level of hair lock (n = 30) | | | | Mean ± S.D. |
|---------|---------------------------------------|----------|----------|----------------------|--------------|
| | very good (4) | good (3) | fair (2) | Need improvement (1) | |
| T1 | 10 | 15 | 5 | - | 3.17 ± 0.70* |
| T2 | 6 | 24 | - | - | 3.20 ± 0.43* |
| T3 | 9 | 15 | 6 | - | 3.10 ± 0.71* |
| T4 | 9 | 14 | 5 | 2 | 3.00 ± 0.87* |

*P-value > 0.05 (Kruskal – Wallis Test)

Table 8: Odor after freshly rinsing hair lock with 4 hair rinse cream formulae

| Formula | Odor level after freshly rinsing (n = 30) | | | | Mean ± S.D. |
|---------|---|----------|----------|----------------------|--------------|
| | very good (4) | good (3) | fair (2) | Need improvement (1) | |
| T1 | 17 | 10 | 3 | - | 3.47 ± 0.68* |
| T2 | 14 | 14 | 2 | - | 3.40 ± 0.62* |
| T3 | 11 | 16 | 3 | - | 3.27 ± 0.64* |
| T4 | 17 | 11 | 2 | - | 3.50 ± 0.63* |

*P-value > 0.05 (Kruskal – Wallis Test)

Table 9: Odor after 2-days rinsing hair lock with 4 hair rinse cream formulae

| Formula | Weighting level of hair lock (n = 30) | | | | Mean ± S.D. |
|---------|---------------------------------------|----------|----------|----------------------|------------------|
| | very good (4) | good (3) | fair (2) | Need improvement (1) | |
| T1 | 21 | 8 | 1 | - | 3.67 ± 0.55*, ** |
| T2 | 9 | 16 | 4 | 1 | 3.10 ± 0.76* |
| T3 | 13 | 7 | 9 | 1 | 3.07 ± 0.94** |
| T4 | 16 | 7 | 6 | 1 | 3.27 ± 0.91 |

*P-value < 0.05 when comparing between T1 and T2 (Mann-Whitney Test)

**P-value < 0.05 when comparing between T1 and T3 (Mann-Whitney Test)

After 5 freeze thaw cyclings, all 4 hair rinse cream formulae (T1-T4) possessed physical stability. Because, the preparation did not change in colour and pH. In addition, no formulae of hair rinse cream showed a precipitation and phase separation.

According to table 3-9, the results revealed that hair styling, hair softness, ability to reduce hair loss, hair weighting, odor after 2-days rinsing and odor after freshly rinsing of hair lock rinsed with all formulae (T1-T4) were not statistical difference. However, hair shining, hair styling and hair weighing of hair lock rinsed with formula T2 (using natural leech lime oil as fixative) was higher than those of formula T1, T3 and T4. In addition, the hair rinse cream using natural leech lime oil as fixative (T2) showed a higher hair shining than hair rinse cream without fixative (T1) with statistical difference (P<0.05).

CONCLUSION

It was suggested that leech lime oil possessed organic acid namely citric acid that could increase hair shining and hair plenty (Krisdaphong, 2015). Therefore, Lemongrass oil hair rinse cream using leech lime oil as fixative possessed physical stability, satisfy sensory efficiency and showed ability for further commercial development.

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