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MOISTURIZING ROLL-ON DEODORANT COMPRISING OF A MIX EXTRACT FROM FRUITS OF EMBLICA AND MA-KHWAEN

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INTRODUCTION

Body odor is caused by bacterial growth and the smell associated with bacterial breakdown of perspiration in armpits, feet and other areas of the body. Human perspiration is largely odorless until it is fermented by bacteria that thrive in hot, humid environments especially at the human underarm which is consistently warm and moisten by excreted sweat. The alkaline pH soap makes the skin loses its acid mantle (pH 4.5-6), disrupting the skin barrier and raising the skin pH to be susceptible to bacterial colonization. The bacteria feed on the sweat and on dead skin and hair cells, releasing trans-3-Methyl-2-hexenoic acid which is the primary cause of body odor. Underarm hair wicks the moisture away from the skin and aids in keeping the skin dry enough to prevent or diminish bacterial colonization. The hair is less susceptible to bacterial growth and therefore is ideal for preventing the bacterial odor[1, 2].

In tropical countries, deodorants are common cosmetic products used to mask unappreciated body odor caused by bacterial growth and bacterial breakdown of perspiration in special areas of the body. Deodorants are usually alcohol-based. Alcohol initially stimulates sweating, but may also temporarily kill bacteria. Deodorants can be formulated with other, more persistent antimicrobials that slow bacterial growth. Deodorants may contain perfume fragrances or natural essential oils intended to mask the odor of perspiration. The popular roll-on deodorant is a leave-on liquid deodorant contains in a glass bottle or plastic bottle with a revolving ball dispenser as an applicator for applying the deodorants on skin to affect body odor[3].

The present study aimed to formulate a patented moisturizing roll-on deodorant comprising of Aluminium chlorohydrate as an antiperspirant. The patented mix extract of *Phyllanthus emblica* L. (EUPHORBIACEAE) and *Zanthoxylum limonella* Alston (RUTACEAE) was added as the active extract for anti-microbial, anti-inflammatory and anti-tyrosinase benefits.

Antiperspirants affect odor as well as prevent sweating by affecting sweat glands. Aluminium chlorohydrate is one of the most frequent active ingredients in commercial antiperspirants. Aluminium-based complexes react with the electrolytes in the sweat to form a gel plug in the duct of the sweat gland. The plugs prevent the gland from excreting liquid and are removed over time by the natural sloughing of the skin. The blockage of a large number of sweat glands reduces the amount of sweat produced in the underarms[4]. A 2008 study stated that no scientific evidence supports the hypothesis that deodorants and/or antiperspirants increase the incidence of breast cancer[5]. A small percentage of people are allergic to aluminium and may experience contact dermatitis when exposed to aluminium-containing deodorants[6, 7]. Various known natural cosmetically acceptable ingredients may be added to counteract skin irritation[8].

Adding natural anti-tyrosinase extracts to the cosmetic roll-on deodorant may benefit skin lightening of the underarms by their interference with the pigment process[9]. Tyrosinase is a copper contained monooxygenase which catalyses melanin synthesis of melanocytes. Tyrosinase inhibitors have become increasingly important in herbal medicine and cosmeceutical to prevent the hyperpigmentation through inhibition of enzymatic oxidation[10].

Emblica (*Phyllanthus emblica* L., EUPHORBIACEAE), or "Ma-Kham Pom" in Thailand, is a deciduous tree up to 20 m tall. The plants are found throughout India, Nepal, South China, Thailand, Indochina, Laos and Malaysia to North Australia. The acid fruits are eaten fresh or as condiments. All plants extracts used have an antiseptic working and are commonly taken for diahorrea and dysentery. The bark leaves and fruits are rich in tannins. The edible fruit contains vitamin C, tannins, polyphenols, alkaloids, flavoniods etc. The fruits possess anti-oxidant, anti-inflammatory, anti-microbial and tyrosinase activity; they are used for diverse internal ailments in Asiatic medicine[11, 12, 13, 14].

Ma-khwaen (*Zanthoxylum limonella* Alston, RUTACEAE) is an evergreen shrub, which harvested in the northern of Thailand. The extraction of roots, stem-barks, stems and fruits are widely used for antibacterial, anti-inflammatory, anesthetic properties and inhibit tyrosinase activity. The fruit is

non toxic, edible and has many active ingredients such as alkaloids, amides, coumarins, sterols and phenylpropanoid-ligans[15, 16].

The fruit extracts of Emblica and Ma-khwaen were mixed in a patented ratio to exhibit the best anti-microbial activity. TISTR reports (not presented) exhibited that the mix extract was anti-tyrosinase active at the IC_{50} 5.52 mg/ml; and the mix extract of 1.25 mg/ear is a potent anti-inflammatory active; it could reduce inflammation to 50% swelling of croton oil-induced rat ear edema at 2 hr better than std. Diclefenac. Formulation of a moisturizing roll-on deodorant comprising of the mix extract having anti-microbial, anti-inflammatory and anti-tyrosinase benefits could be an alternative product of commercial potential.

MATERIALS AND METHODS

Plant materials: The fruit powder of *P. emblica* and *Z. limonella* were provided by the Agricultural Technology Department, Thailand Institute of Scientific and Technological Research (TISTR).

Extraction of Emblica and Ma-khwaen: The dry fruit powder 500 g was macerated with ethanol-water. The ethanolic extracts were filtered and the solvent was removed under pressure using a rotary evaporator at 45 °C.

Formulations of roll-on deodorant: The patented anti-microbial, anti-inflammatory and anti-tyrosinase active mix extract of *P. emblica* and *Z. limonella* fruits was used to prepare 11 formulations of moisturizing roll-on deodorant, with varied amount of ingredients in the basic formula as shown in Table 1. The ingredients were mixed by stirring. The ethanol part was prepared by gradually sprinkle the thickening agent into ethanol while stirring; added and stirred the following ingredients in the order of mixing as humectants, stabilizer and Aluminium chlorohydrate (Aluminium 50%), preservative. The mix extracts solution was prepared in small amount of water, and then added into the ethanol mixture while stirring. Purified water was added and stirred, and then mixed thoroughly with perfume. RP-HPLC was used for quality control of the product.

Physical properties of roll-on deodorant: The physical characters such as appearance, texture, color and odor were then evaluated.

Stability study of the roll-on deodorant: The stability of samples was evaluated using heating and cooling method which defined as alternation of storage conditions from 45° C 24 hrs and 4° C for 24 hrs (1 cycle) for 6 cycles. The physical stability of samples was evaluated on phase separation, appearance, texture, color, and odor.

Anti-microbial effect of roll-on deodorant: The anti-microbial efficacy of the roll-on deodorant was assessed using the agar diffusion method against *Propionibacterium acnes*, *Staphylococcus aureus, S. epidermidis, Streptococcus pyogenes*, *Propionibacterium acnes* and *Candida albicans*. 20 ml of agar suspension was allowed to set in a Petri-dish before lightly swab the microbial dilution on it and let dry. Pipette 20 µl of samples onto the agar surface of microbial culture plate. Incubated the plate at 37 ^{0}C for 18-24 hrs and then evaluated the inhibition clear zone.

Table 1 The basic compositions of a roll-on deodorant formulation.

Ingredients	Function	% w/w
A	Thickening Agent	0.5 - 2.0
Propylene glycol	Humectants	2.0 - 4.0
B	Humectants	1.0 - 2.0
Polysorbate	Stabilizer	0.2-0.5
Ethanol	Solubilizer	10 - 30
Aluminium chlorohydrate	Antiperspirant	10-30
Perfume	Perfume	qs.
C	Preservative	0.2-1
Mix extract	Active ingredient	0.2-2.5
Aqua	Solubilizer	q.s.to100

RESULTS AND DISCUSSION

The roll-on deodorant formula I irritated the skin and was turbid after stand for 1 night. Ethanol was reduced in formula II and more humectants were added, but the product was still not clear. A stabilizer was added in formula III, but the product gave heavy feeling to skin. When reduced the humectants and stabilizer in formula IV, the product was turbid. Humectants and stabilizer were adjusted in formulas V, VI, VII which gave clear products and formula V gave the best moisturizing effect. Formulas VIII and IX were derived from formula V by adding an antiperspirant (Aluminium 50%).

Formulas X and XI were derived from formula IX. Formula X gave the most comfortable leave-on feeling and was chosen as the best roll on deodorant formula.

Stability assessment using heating and cooling method exhibited the physical characters and stability of various formulations of roll-on as shown in Table 2. All formulations had light yellow color, good consistency and good color at initial of study. During alternative storages for 6 cycles, formulas I, II, III and IV exhibited the instability indicating by the turbidity of these formulations, while other formulations (V, VI, VII, VIII, IX, X and XI) showed good stability. The product stability was due to roles of the stabilizer: formula I and II had no stabilizer, whereas formula III and IV had lower concentrations of the stabilizer. The stabilizer increased solubility of the mix extracts. attributing to the higher stabilized after storage.

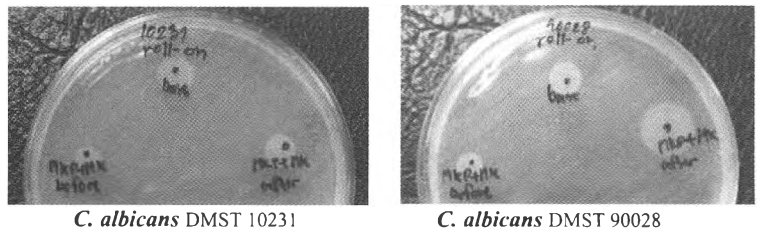
Table 2 Physical properties and stability of different formulations of roll-on deodorant, before and after Heating and cooling test

Formulas	Appearance		Odor	
	Initial	After storage conditions	Initial	After storage conditions
I	Clear	Not clear	Good	Good
II	Clear	Not clear	Good	Good
III	Clear	Not clear	Good	Good
IV	Not clear	Not clear	Good	Good
V	Clear	Clear	Good	Good
VI	Clear	Clear	Good	Good
VII	Clear	Clear	Good	Good
VIII	Clear	Clear	Good	Good
IX	Clear	Clear	Good	Good
X	Clear	Clear	Good	Good
XI	Clear	Clear	Good	Good

Formulas	Color		Separation	
	Initial	After storage conditions	Initial	After storage conditions
I	Light Yellow	Light Yellow	Homogeneous	Homogeneous
II	Light Yellow	Light Yellow	Homogeneous	Homogeneous
III	Light Yellow	Light Yellow	Homogeneous	Homogeneous
IV	Light Yellow	Light Yellow	Homogeneous	Homogeneous
V	Light Yellow	Light Yellow	Homogeneous	Homogeneous
VI	Light Yellow	Light Yellow	Homogeneous	Homogeneous
VII	Light Yellow	Light Yellow	Homogeneous	Homogeneous
VIII	Light Yellow	Light Yellow	Homogeneous	Homogeneous
IX	Light Yellow	Light Yellow	Homogeneous	Homogeneous
X	Light Yellow	Light Yellow	Homogeneous	Homogeneous
XI	Light Yellow	Light Yellow	Homogeneous	Homogeneous

Formula X was chosen as the best formulation, owing to the high moisturizing effect, quick absorption into the skin, comfortable leave-on feeling and not skin irritate.

The results of *in vitro* anti-microbial assessment of the roll-on deodorant formula X was not clear, but seemed like it was active against 2 strains of *C. albicans* as shown in Figure 1 which compared between before and after 6 cycles of heating and cooling test (H&C).



C. albicans DMST 10231 ***C. albicans*** DMST 90028

Figure 1 Microbial inhibition of the roll-on deodorant formula X from mix extract of fruits of *P. emblica* and *Z. limonella* against 2 strains of *C. albicans*. The results in a Petri dish compared between roll-on base (central), roll-on deodorant (left) and roll-on deodorant after stability test (right).

CONCLUSION

The mix extract from fruits of *P. emblica* and *Z. limonella* could be added to roll-on deodorant formulation, attributing to increase the anti-microbial, anti-inflammatory and tyrosinase inhibition effects of the product. This herbal roll-on deodorant product benefits low skin irritate and enhancing the skin whitening of armpits. Skin irritation could be counteracted by the anti-inflammatory property of the mix extract. The underarms benefit skin lightening from the anti-tyrosinase activity of the extracts.

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REFERENCES

1. Which works best: roll-on, stick or spray deodorant? Available at http://health.howstuffworks.com/wellness/men/sweating-odor/stick-or-spray-deodorant.htm, accessed 3 October 2012.
2. Paye M, Maibach HI, Barel AO. 2009. *Handbook of cosmetic science and technology* (3 ed.). Informa Health Care. p. 703. ISBN 1-4200-6963-2.
3. Roll-on. Available at http://www.thefreedictionary.com/roll-on, accessed 3 October 2012.
4. Deodorant. Available at http://en.wikipedia.org/wiki/Deodorant, accessed 3 October 2012.
5. Namer M, Luporsi E, Gligorov J, Lokiec F, Spielmann M. 2008. "The use of deodorants/antiperspirants does not constitute a risk factor for breast cancer". *Bull Cancer* 95 (9): 871–80.
6. Garg S, Loghdey S, Gawkrodger DJ. 2010. Allergic contact dermatitis from aluminium in deodorants. *Contact Dermatitis* 62 (1): 57–8. doi:10.1111/j.1600-0536.2009.01663.x. PMID 20136883.
7. Lukacs VA, Korting HC. 1989. Antiperspirants and deodorants--ingredients and evaluation. (in German). *Dermatosen in Beruf Und Umwelt* 37 (2): 53–7. PMID 2656175.
8. Herbal deodorant. Available at http://www.justice.gov.il/NR/rdonlyres/EB2DA5F4-CC0B-4AF6-B824-87AE183F4A82/3460/ChemistryHebrewtranslation.pdf, accessed 3 October 2012.
9. Smit N, Vicanova J and Pavel S. 2009. The hunt for natural skin whitening agents. Int J Mol Sci , Published online 10 Dec 2009. Available at http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2801997/, accessed 8 October 2012.
10. Moon, J. Yim, E. Song, G. Lee N. Hyun. C. (2010) Screening of elastase and tyrosinase inhibitory activity from Jeju Island plants. EurAsia J BioSci 4: 41-53.
11. Verma RC, Gupta A. 2004. Effect of pre-treatments on quality of solar-dried amla. Journal of Food Engineering 65: 397-402.
12. Kahkonen MP, Hopia AI, Vuorela HJ, Rauha JP, Pihlaja K, Kujala TS, Heinonen M. 1999. Antioxidant activity of plant extracts containing phenolic compounds. Journal of Agricultural and Food Chemistry 47: 3954–3962.
13. Lampronti I, Khan MTH, Bianchi N, Borgatti M and Gambar R. 2004. Inhibitory effects of medicinal plant extracts on interactions between DNA and transcription factors involved in inflammation. Minerva Biotechnological 16: 93–99.
14. *Phyllanthus emblica* L. – EUPHORBIACEAE. Available at http://www.biotik.org/laos/species/p/phyem/phyem_en.html, accessed 3 October 2012.
15. Tangjitjaroenkun J, Supabphol R and Chavasiri, W. 2012. Antioxidant effect of *Zanthoxylum limonella Alston*. Journal of Medicinal Plants Research: 1407-1414.
16. Charoenying P. LaosinwattanaC. Phuwiwat W. and Lomratsiri J. 2008. Biological activities of *Zanthoxylum limonella* Alston fruit extract. KMITL Science Journal: 8.