Synergy of Palm and Plant Extracts for Application in Cosmetics

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INTRODUCTION

Oleochemicals are chemicals derived from oils and fats; however, the term 'natural oleochemicals' often refers to oleochemicals derived from vegetable and animal oils and fats to differentiate them from 'synthetic oleochemicals', which are derived from petroleum. Oils/fats are triglycerides formed from one molecule of glycerol and three molecules of fatty acids. The reverse of this reaction, *i.e.* the hydrolysis of oils/fats to the corresponding fatty acids and glycerol, forms the basis of the oleochemical industry.

Using water or alcohols, oils/fats can be hydrolysed to fatty acids or esters and glycerol. Fatty acids or esters can be used as the starting material for the production of fatty alcohols and fatty nitrogens. These products can be further modified to produce various types of derivatives. Thus, oleochemicals are often divided into two categories, namely, basic oleochemicals and derivatives. The most common basic oleochemicals are fatty acids, fatty methyl esters, fatty alcohols, fatty amines and glycerol. Oleochemical derivatives refer to products derived from basic oleochemicals via epoxidation, ethoxylation, sulfation, sulfonation, *etc*. Through these various chemical reactions, thousands of products of different properties can be derived, and these find applications in different areas such as cosmetics and personal care products, detergents, textiles, plastics and pharmaceuticals.

The cosmetic industry is one of the potential growth areas identified in the development of oleochemical downstream processing for the production of high value-added products. Basic oleochemicals and derivatives are frequently used as emollients, humectants, emulsifiers, rheological additives and/or preservatives for the production of cosmetics and personal care (CPC) products (Salmiah *et al.*, 2004). Interestingly, consumers have a tendency to associate 'natural' with plant-derived products, and believe that these are milder and more environmental-friendly than petrochemical or animal-based products. Religious considerations also mean consumers prefer plant-derived products because they are regarded *kosher* or *halal*. 'Natural' is what consumers want, especially in CPC products, for which people want something made directly from nature.

CPC products cover a wide range which can be divided into four main categories, *i.e.* skin care, hair care, oral care and colour cosmetic items. The CPC products can be prepared in the form of lotions, creams, liquids, gels and sticks, using palm-based oleochemicals such as glycerine, fatty acids (lauric, myristic, palmitic and stearic acids), fatty alcohols and their esters. Palm-based oleochemicals being plant-derived, the products formulated from them are natural, mild, environmental-friendly and acceptable to all religions. Incorporation of natural products into the formulation introduces an opportunity to

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create product differentiations in order to capture a niche market. This article discusses and highlights the synergy of using palm-based oleochemicals in CPC formulations with plant extracts, such as from roselle, guava and *Ganoderma*, as the actives for specific functionality.

TOPICAL DELIVERY SYSTEMS

CPC products serve to clean, nourish, moisturise, stimulate or protect the skin, a large and an important organ of the human body. They are usually prepared in the form of an emulsion, a two-phase system which consists of two immiscible or partly miscible liquids, namely the oil and water phases, one being dispersed in the other in the form of very fine droplets. The oil phase of an emulsion normally consists of oil-soluble components such as emollients, emulsifiers and thickeners, while the water phase consists of water-soluble components, which include humectants, preservatives and rheological additives. The amount of palm-based materials in the formulations ranges from 45% to 98%, and basic palm-based cream, lotion and milk formulations are shown in *Table 1*. When an emulsion is applied on the skin, the water moisturises the skin while the oil phase prevents evaporation of water from the skin.

PLANT EXTRACTS AS ACTIVES

Malaysia is one of the 12 'megadiversity' countries of the world. The flora of Malaysia is exceedingly rich and is conservatively estimated to have a total of 15 000 species of flowering plants and more than 1170 species of ferns (Zakri and Latiff, 1998). Certain indigenous plants and their derivatives have long been used in traditional medicines by various ethnic groups in Malaysia. Therefore, biodiversity can play an important role, not only for pharmaceutical industry but also for the cosmetic industry as the herbal or plant actives can be incorporated in formulations for topical application to capture niche functionality. A good example is *Centella asiatica* (pegaga). The actives contain madecassoside, terminoloside, asiaticoside, madecassic acid and asiatic acid (Anonymous, 2014). This plant has an interesting history, and has been used in herbal medicine for ages, yet is relatively a newcomer to skin care cosmetics. It is an excellent ingredient to include in skin care creams and lotions as it has a pronounced effect on the health of the skin. It is an effective ingredient for collagen production, reduces fine lines and wrinkles, reduces stretch marks and supports scar and wound healing (Sene *et al*., 2007).

SYNERGY OF PALM OIL PRODUCTS WITH PLANT EXTRACTS

Numerous formulations can be derived from palm-based oleochemicals. By varying the amount of the oil components, the emulsion formed can be in the form of a milk, lotion or cream. Furthermore, depending on the production pro-

TABLE 1. BASIC PALM-BASED CREAM, LOTION AND MILK FORMULATIONS

Ingredients	Function	Cream (%)	Lotion (%)	Milk (%)
Water phase				
Deionised water	-	75-80	80-85	85-90
Glycerine	Humectant	2.0-5.0	2.0-5.0	2.0-5.0
Preservative	Preservative	0.3-0.7	0.3-0.7	0.3-0.7
Oil phase				
Isopropyl palmitate	Emollient	3.0-5.0	2.0-4.0	1.0-2.0
Stearic acid	Emollient/co-emulsifier	4.0-5.0	3.0-4.0	2.0-4.0
Glyceryl monostearate	Emulsifier	4.0-5.0	3.0-5.0	2.0-4.0
Medium chain triglycerides	Emollient	3.0-5.0	3.0-5.0	3.0-5.0
Cetyl alcohol	Emollient/thickener	5.0-6.0	3.0-5.0	1.0-2.0
Trietanolamine	Neutraliser	0.5-1.0	0.5-1.0	0.5-1.0
Preservative	Preservative	0.3-0.7	0.3-0.7	0.3-0.7
Active ingredient	-	n.s	n.s	n.s
Perfume		0.5-1.0	0.5-1.0	0.5-1.0

Note: Ingredients in bold are derived from oleochemicals.

cess and the amount of surfactant/emulsifier used, various types of emulsion can be formed, *i.e*. macroemulsion, microemulsion or nanoemulsion. Hence, palm oil products and palm-based oleochemicals can be the basis of the delivery system, while incorporation of herbal or plant extracts create the niche functionality of the products for topical application.

Palm-based Hand and Body Lotion with Roselle Extract

Roselle, or *Hibiscus sabdariffa* L., is a member of the Malvaceae family. It is known as Florida cranberry due to its similarity in taste and flavour to cranberry. Believed to have originated from Sudan, roselle is grown as a rain-fed crop in Sudan and Egypt. Today, it is widely grown in the tropics. Analyses have shown that the edible portions of roselle contain different types of vitamins and minerals (Morton, 1987; Wong *et al*., 2002). A series of palm-based CPC products (facial toner, cleansing milk, day/night cream, hand and body lotion, sun block cream) were formulated using palm-based oleochemicals and roselle extracts (Rubaah *et al*., 2002; 2003; Salmiah *et al.,* 2004*).*

The effect of the palm-based hand and body lotion with roselle extract (HB3) on skin hydration was studied on 20 female test subjects. The untreated area showed a 1.8% increase in skin hydration, indicating that the room temperature and humidity were well controlled. A single application of HB3 resulted in an immediate 39.0% increase in skin hydration within 30 min of product application. The maximum increase in skin hydration was 46.5% at 60 min, which then reduced to 37.8% after 180 min of application (*Figure 1*). Topical application of the palm-based hand and body lotion with roselle extract enhanced skin hydration, and this may be due to higher amount of humectant such as glycerine or other moisturising agent in the roselle extract which may increase the water-binding capacity of the skin. Furthermore, the emollients used in the formulation provided an occlusive layer on the skin which prevented transepidermal water loss and thus increased the overall skin hydration.

Palm-based Lotion with *Ganoderma* Extract

Ganoderma is a basidiomycete, a lamellaless fungus belonging to the family Polyporaceae. In the oldest Chinese pharmacopoeia, *Ganoderma* was recorded as having the most effective and extensive healing powers. It is because of this recognition that there is a diligent research into a method of *Ganoderma* cultivation that is feasible for commercial production. Only in 1972 was the cultivation of *Ganoderma* successful (Teow, 1997). Analysis of *Ganoderma* revealed that it contains bitter terpenoids, steroids, nucleosides, nucleotides, glycans and proteoglycans, peptidoglycans as well as various other low molecular weight components (Takashi, 2001). A lotion formulated with palm-based oleochemicals and *Ganoderma* extract was found to exhibit a skin lightening effect comparable to lotions with licorice and arbutin, the commercial skin-whitening actives (Zafarizal and Rosnah, 2003) as shown in *Figure 2*. *Ganoderma* extract may have compounds that inhibit tyrosinase enzyme which catalyse the formation of skin melanin pigments.

Palm-based Facial Cream with Guava (*Psidium guajava*) Extract

Guava is rich in vitamins A and C, bearing seeds that are rich in omega-3, omega-6 polyunsaturated fatty acids and especially dietary fibre. A single guava (*P. guajava*) fruit contains over four times the amount of vitamin C as in a single orange (over 200 mg per 100 g serving), and also has good levels of the dietary minerals, potassium and magnesium, and generally a broad, low-calorie profile of essential nutrients. Guava contains carotenoids and polyphenols, the major classes of antioxidant pigments. A study on the topical application of palm-based facial cream with guava extract found that the forehead sebum level reduced significantly by about 36%, from an average

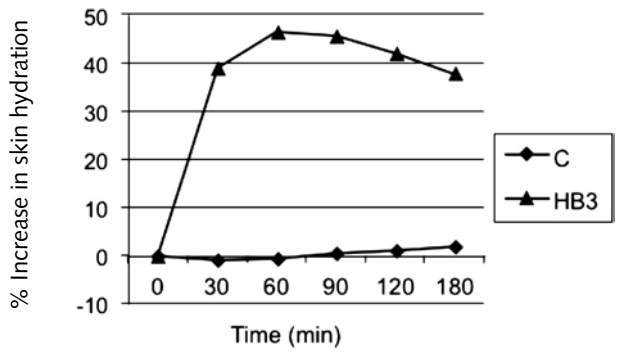
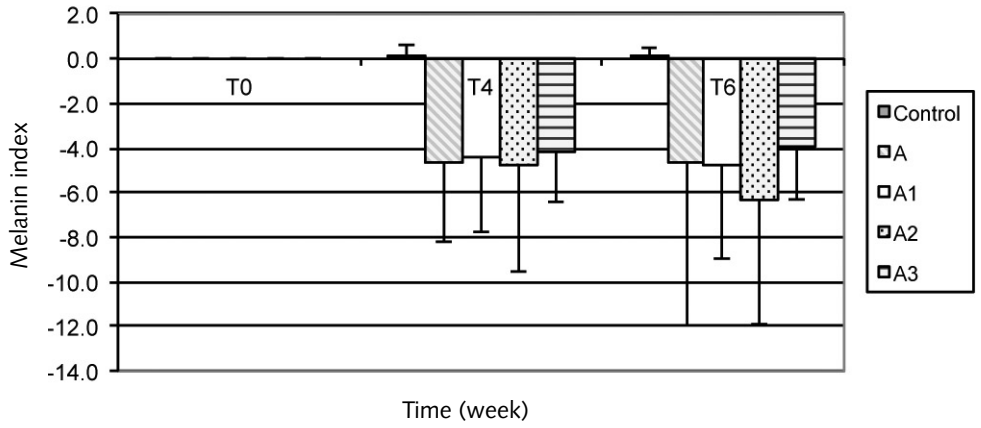


Figure 1. The effect of palm-based hand and body lotion with roselle extract (HB3) on skin hydration compared with untreated skin (C) against time.



Note: A= control, A1 = arbutin, A2 = *Ganoderma* and A3 = Licorice.

Figure 2. Skin whitening effect of cosmetic products formulated with palm-based oleochemicals and Ganoderma*.*

of 139.2 to 89.1 µg cm^{-2} (Zafarizal and Rosnah, 2010). The reduction in sebum level on the forehead indicated that the palm-based facial cream with guava extract can be used to control face sebum level and is suitable for the treatment of oily skin.

Palm-based Guava Cream with Scrub as an Anti-cracked Heel Agent

A study on the effect of guava cream with a scrub on cracked heels was conducted on 20 subjects (Zafarizal and Rosnah, 2007). The product was applied twice daily over four weeks with weekly measurements of skin hydration and skin roughness. All measurements were carried out using a Corneometer CM825 which measured skin moisture, and a Visioscan VC98 which measured skin surface profiles and calculated the skin roughness.

The study showed that areas treated with the guava scrub cream recorded an increase by 34.4%, 34.6%, 30.6% and 28.4% in skin hydration (*Figure 3*) and a decrease by -20.5%, -17.3%, -16.9% and -19.4% in skin roughness (*Figure 4*) after one, two, three and four weeks of product application, respectively. Hydrated skin is known to help in skin barrier recovery and also increases the skin firmness. Further evidence of the apparent improvement in skin profiles of cracked heels treated with guava scrub cream is shown in *Figure 5*. The progressive improvements in skin profiles of the cracked heels before and after product application are clearly shown.

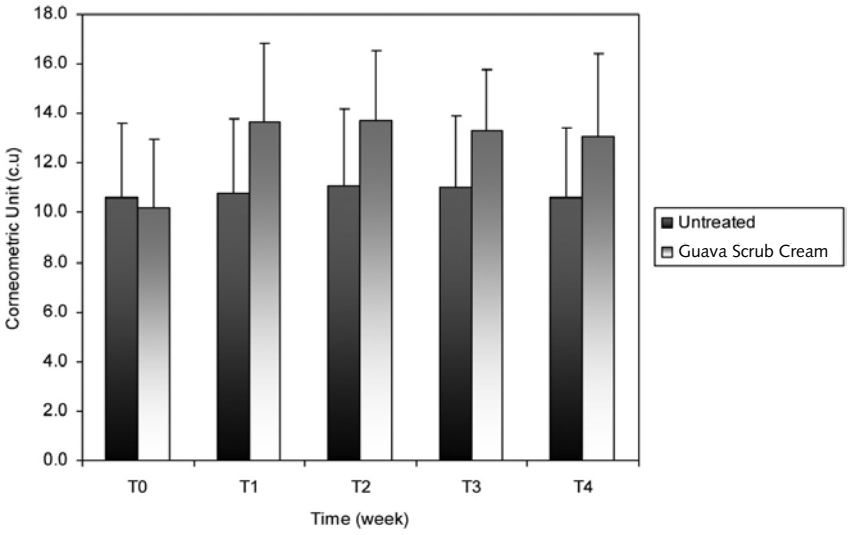


Figure 3. The effects of guava scrub cream on skin hydration.

CONCLUSION

The application of palm oil products and palm-based oleochemicals in CPC products is well understood. This article illustrates how meeting consumers' preferences leads to product differentiation with incorporation of plant extracts as actives. However, for this synergy to be successfully implemented and commercially viable, the herbal industry must ensure that the quality and supply of the actives are sustainable.

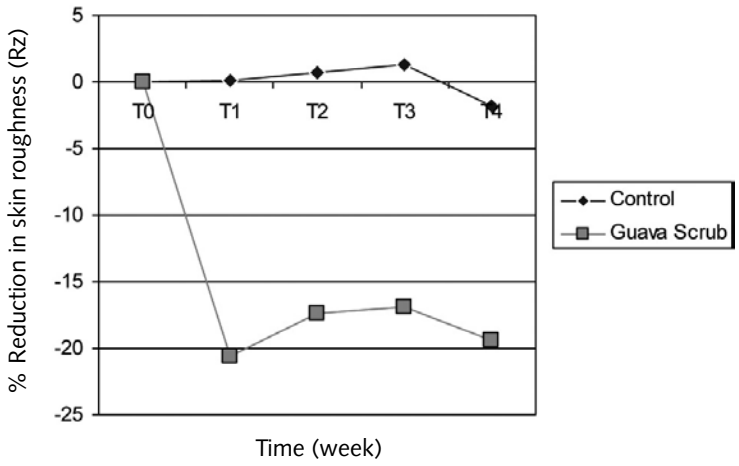
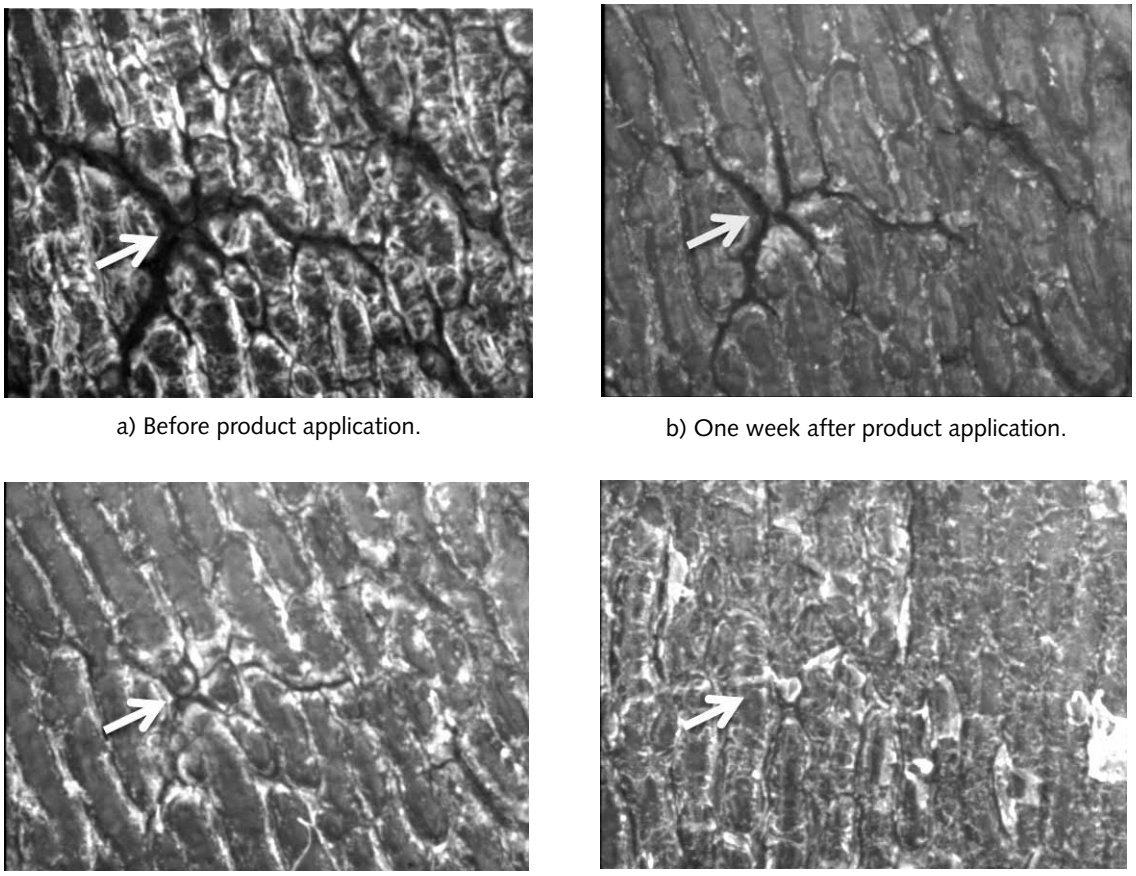


Figure 4. Percentage of skin roughness reduction of control area and area treated with guava scrub cream.



a) Before product application.

b) One week after product application.

c) Two weeks after product application.

d) Four weeks after product application.

Figure 5. Photographs of progressive improvement in skin profiles of a cracked heel treated with guava cream over four weeks.

ACKNOWLEDGEMENT

The authors wish to thank the Director-General, MPOB, for permission to publish this article.

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