



## Ten commonly available medicinal plants in Malaysia used for cosmetic formulations – A review

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### ABSTRACT



Malaysia is rich in natural and herbal resources which have the potential to be used as traditional medicine as well as cosmetics. These plant sources are used by the folklore to help in enriching their beauty. Leaves, fruits, flowers and roots of medicinal plants in Malaysia are used in cosmetic formulations to get different biological effects. Health issues with particular reference to skin issues, such as acne, dry skin, dull skin and alopecia can be alleviated by using these plants. Since time immemorial, herbal products have been used in maintaining and enhancing physical appearance of humans. Herbal cosmetics have growing demand in the world market and is an invaluable gift of nature. This review is about ten commonly available medicinal plants in Malaysia used in the cosmetic formulations which includes *Aloe vera*, *Curcuma longa*, *Cocos nucifera*, *Cucumis sativus*, *Melaleuca alternifolia*, *Punica granatum*, *Garcinia mangostana*, *Carica papaya*, *Lawsonia inermis* and *Hibiscus rosa-sinensis*. These are the ten plants that are commonly used traditionally in treating many skin conditions and hair problems. Using the herbal and natural ingredients in cosmetics alleviates the side effects almost to nil. This is predominantly lower than the side effects caused by synthetic cosmetics.

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### INTRODUCTION

Cosmetics can be defined as any product, composing and formulation that are used to apply to specific body parts to improve appearance. Lipstick, mascara, toner, blusher, hair oil are the examples of cosmetic which commonly used by an individual, especially women. There is an uptrend in the cosmetic consumers reflecting the growth of cosmetic industry. Cosmeceuticals are cosmetics that have pharmacological or medicinal ingredients which are intended to improve and benefit the physical appearance. Certain drugs have

been incorporated during the manufacturing process of the cosmeceuticals to repair bad skin conditions such as acne, rosacea skin condition, hyperpigmentation and many such conditions. The production of cosmeceuticals include pharmaceuticals, biotechnology, natural product, biology, cosmetics, and pharmacology fields to deliver effectively to the users. With such inclusions, there are certain criteria which need to be met with by the producer; they are safety, formulation stability and novelty.

Despite all the pharmacological as well as biotechnological inclusions in the cosmeceutical industry, usage of harmful chemicals such as preservatives, mineral pigments, colouring agents, stabilisers and glitter still persists. All these chemicals improves the effectiveness and increases the shelf life of the product, thus creating a roaring sale of the product and making the producer affluent. On the contrary, the consumer faces the harmful effects of these chemicals for a prolonged period. These harmful ingredients contained in the cosmetic product (Kalicanin and Velimirovic, 2016), with prolonged use may cause side effects as mild as skin irritation and as harmful as skin cancer. With such information, the usage of plant extract and herbal material have been growing in the cosmetic industry, considering its low toxic level and wide safety margin.

The usage of herbal plant in cosmetics and for people having challenging health issues, was discovered a long time ago. Approximately 12,000 years ago, the use of beneficial essential oil in terms of cosmetics was found in ancient Egypt. During Roman era and even in Japan, the function of cosmetics had come to the knowledge of the people and meant to enhance the beauty and nobility of a woman (Oana, 2017). Malaysia is a country which is rich in natural and herbal sources that have not yet been fully discovered to date. Natural products frequently being added with the functional botanical ingredient, which can be defined as a substance that is manufactured from plant parts such as leaves, roots, fruits, flowers and seeds. Plants have numerous useful ingredients that have the ability to calm, restore, treat and shield the skin from harmful chemical from pollution (Nye, 2019).

Nowadays, the incorporation of natural ingredient in cosmetics has been expanding as it upgrades the effectiveness of the product if it has been used daily and concurrently may reduce the side effect caused by harmful chemicals. Cosmetics that contain herbal extracts show antioxidant, anti-inflammatory and antimicrobial activities which are beneficial in taking care of the skin and hair (Fatima et al., 2013). Hence, this present review highlights ten common

medicinal plants found in Malaysia that can be used as an ingredient in cosmetic formulations (Table 1), together with a simple botanical description of the medicinal plants with its utilized part in contributing the amazing benefits.

## MATERIALS AND METHODS

### *Aloe vera*

#### Botanical description

*Aloe vera* (Figure 1) belongs to Aloaceae family and it is related to the lily family which is well-known for their beneficial chemical activity. The plant has thick, lance-shaped, sharp-pointed, spiked shaped leaves and appears similar to cactus. The leaves are juicy and green in colour. It consists of three layers whereby the outermost layer consists of 15-20 cells thick is important in the protection and production of carbohydrates and proteins. The middle layer consists of bitter yellow latex contains anthraquinones and glycosides. The innermost layer has a clear gel appearance which consists of 99% of water together with amino acids, lipids, vitamins, sterols, and glucomannans. *Aloe vera* is native to Africa and Mediterranean countries and wildy grown in the Cyprus island, Malta, Sicily, Canary cape, Cape Verde and also in India. *Aloe vera* grows in the various climates such as in temperate and subtropical areas and cannot withstand the freezing temperature.

#### Role in cosmetic formulations

*Aloe vera* has widely been used in the manufacturing of cosmetics. The mixing of *Aloe vera* in lipstick, hand cream and facial cream production has been increasingly popular. Manvitha and Bidya (2014) stated this plant is used in dermatology due to its varied beneficial powers - as a humidifier, natural moisturiser, skin smoothener, wrinkles reducer and acne treating quality. Apart from that, *Aloe vera* gel can be used to treat sunburns, to repair dead skin and cells. In another review, *Aloe vera* is reported to show anti-inflammatory activity. Thus, it has the ability to regenerate body cells and reduce pain (Rajeswari et al., 2012). The inhibition of the cyclooxygenase pathway and reduction of prostaglandin E2 formation from arachidonic acid showed potent anti-inflammatory action of this plant. C-glucosyl chromone which is an anti-inflammatory compound can also be isolated from its gel extracts (Surjushe et al., 2008).

Besides, this plant contains numerous antiseptic agents. Lupeol, salicylic acid, urea nitrogen, cinnamonic acid, phenols and sulphur are the agents that have the potential to fight on fungi, bacteria and

**Table 1: Ten commonly available medicinal plants in Malaysia used for cosmetic formulations**

No.	Scientific name	Local Malaysian name	Family
1.	<i>Aloe vera L.</i>	Lidah buaya	Aloaceae
2.	<i>Curcuma longa</i>	Kunyit	Zingiberaceae
3.	<i>Cocos nucifera L.</i>	Kelapa	Arecaceae
4.	<i>Cucumis sativus L.</i>	Timun	Cucurbitaceae
5.	<i>Melaleuca alternifolia</i>	Daun Tea Tree	Myrtaceae
6.	<i>Punica granatum</i>	Delima	Lythraceae
7.	<i>Garcinia mangostana L.</i>	Manggis	Clusiaceae
8.	<i>Carica papaya L.</i>	Betik	Caricaceae
9.	<i>Lawsonia inermis L.</i>	Inai	Lythraceae
10.	<i>Hibiscus rosa-sinensis</i>	Bunga raya	Malvaceae

viruses (Surjushe *et al.*, 2008). Thus, *Aloe vera* gel can be utilised in the treatment of skin problems due to infections such as benign skin cysts. Fungal infection caused by tinea can be inhibited by applying *Aloe vera* gel. Moreover, the gel also may help in inhibiting the growth of *Streptococcus* and *Shigella* species *in vitro* (Rajeswari *et al.*, 2012). In *Aloe vera* gel, mucopolysaccharides aids in moisturising the skin. *Aloe vera* gel has advantages such as maintaining skin integrity, reducing wrinkle and enhancing skin appearance caused by acne and erythema. Many manufacturers use aloe gel as skin tonic due to its gerontological property and rejuvenating effect. Therefore, cosmetic users use this gel for its cooling effect and moisturising activity (Sahu *et al.*, 2013).

*Aloe vera* gel is suitable to be used as a vehicle for topical drugs application on skin whereby it enhances the transdermal drug delivery system. A higher molecular weight of the co-applied compound shows less amount of gel component to be transported across the skin which leads to the enhancement of the co-applied compound absorption in the skin (Hamman, 2008). Besides, elements such as superoxide dismutase and glutathione peroxidase which are the useful antioxidants contained in this gel portray an anti-ageing property as it slows down the ageing process. As skin always being exposed to radiation and pollution, this gel can help to combat oxidation of the cells. Proline is a non-essential amino acid, which is a collagen constituent, helps in refining skin elasticity and holding the epithelial tissues of the skin. Hence, the skin will maintain its elasticity, smooth and rehydrate (Basmatker *et al.*, 2011). Apart from skin, this plant is also useful in treating nail inflammation. Isobarbaloin and salicylic acid have an analgesic activity which is vital in treating painful nail inflammation by repairing the nail tissues. The acidic characteristics may help in strengthen the hair bulb and simul-

taneously promote the growth of hair. Thus, hair loss problem can be countered by applying the gel on the scalp (Basmatker *et al.*, 2011).

**Figure 1: *Aloe vera L.*****Figure 2: *Curcuma longa***



Figure 3: *Cocos nucifera* L.



Figure 4: *Cucumis sativus* L.



Figure 5: *Melaleuca alternifolia*

### *Curcuma Longa*

#### Botanical description

*Curcuma longa* (Turmeric, Figure 2) belongs to Zingiberaceae family which is similar to ginger. This herbaceous plant is about 60-90 cm height, perennial and has short stem tufted leaf. Turmeric is the rhizome of this plant, yellowish-brown colour from outside and with bright yellow colour on the inside, with segmented skin and a rough appearance. This plant is commonly found in Cambodia, China, India, Nepal, Indonesia, Madagascar, Malaysia, Philippines and Vietnam. Temperature between 20 to 30°C with the suitable amount of rainfall is necessary for the growth of this plant. This plant can grow better under the shade, contrary to the rhizome which prefers appropriate sun exposure for excellent growth. A humid climate is also required for plant development. The flower of this plant is yellow, appears as a spiked structure as the petals are grouped together with a dense spike shape. The leaf is light green, oblong, broad and narrow toward the base with a pleasant aromatic smell. Turmeric has been called as the kitchen queen due to its role in Asian dish and its significant aromatic smells.

#### Role in cosmetic formulations

Turmeric has demonstrated in different cosmeceuticals as an active ingredient. The ability to purify and nourish the blood results in rather healthy and glowing skin (Rathaur *et al.*, 2012). In another review, the researcher stated that turmeric has certain constituents that are useful to cure scars and makes the skin glow (Lal, 2012). The antibacterial property of turmeric makes it a favourite cosmetic in preventing acne and eczema. Curcumin and its oil fraction have shown to suppress the growth of the different type of bacteria such as *Streptococcus*, *Staphylococcus* and *Lactobacillus* Rathaur *et al.* (2012). Besides, the application of paste or decoction that contain turmeric may treat leprosy and the turmeric powder is excellent in alleviating smallpox and chickenpox (Vashist *et al.*, 2014).

One of the phytochemical constituents of turmeric, is its antioxidant content, which is said to be potent whereby it is claimed eight times more powerful when compared to vitamin E in combating lipid peroxidation Nisar *et al.* (2015). Turmeric is a prooxidant and plays remarkable antioxidant roles and that therefore used in cosmetics to prevent premature ageing, looking younger, and concomitantly may prevent tumour and cancer (Rathaur *et al.*, 2012). Gopinath and Karthikeyan (2018) had stated that turmeric had been incorporated in cosmetology by women for a long time as traditionally women smeared their skin with turmeric paste. It is benefi-

cial in reducing unnecessary facial hair growth, curing and reducing acne formation and improving skin complexion. In addition, the researcher explains that women in Tamil Nadu still apply turmeric daily on their face before taking bath as their option.

### ***Cocos Nucifera***

#### **Botanical description**

*Cocos nucifera* L. (Coconut, Figure 3) belongs to Arecaceae family which is the same family as palm tree. However, there is no known genus other than *Cocos*. This plant belongs to the subfamily of *Cocoideae* and has two different types; tall and dwarf. The dwarf coconut tree grows faster and produces fruits faster than the tall one. The older plant with an age of 80 years can grow taller than the 40 years old tree. The height is usually around 35-40 meters. The native distribution of coconut is in Southeast Asia, which includes Malaysia, Indonesia, Philippines, and Melanesia. It is also seen in Pacific island, India, Sri Lanka, East Africa and tropical islands such as Seychelles and Mauritius. Coconut can easily grow in the sandy area and near the sea. Coconut fruit is a fibrous drupe and consists of few layers. The outer layer is a hard and thin exocarp, whereas the thick layer is the fibrous mesocarp. It follows with a layer of hard endocarp or shell, a layer of white kernel and then a cavity filled with coconut water. The exocarp is green when immature and turns to yellow when it has reached its maturity. The shape is varied, either elongated or almost spherical. The white kernel is usually used in cooking, medicine and also cosmetics.

#### **Role in cosmetic formulations**

In this globalisation, coconuts have been extensively applied widely in cosmetics and other industry. Coconuts have been called as 'tree of life' and 'tree of heaven' due to its maximum benefits in daily life. Coconuts have been incorporated in cosmetics such as shampoos, moisturizers, soaps, cleansers and hand washing liquid (Agyemang-Yeboah, 2011). Sumit *et al.* (2012) had stated that coconut oil has been used in dry skin treatment. The oil can be used effectively as a skin moisturiser and softener in either liquid or solid form. The usage of virgin coconut oil as a moisturiser has no adverse effect and is rather safe if used on a daily basis.

This wondrous fruit also has an antioxidant property such as L-arginine which may have the ability to fight against free radicals formation. Apart from that, vitamin C (15mg/100ml) content in coconut prevented lipid peroxidation when tested in rats. Virgin coconut oil potentially can enhance the formation of naturally occurring antioxidant enzymes

in rats when it is been consumed on a daily basis as a supplement (Debmandal and Mandal, 2011). An antimicrobial activity also clearly been shown by coconut oil. *P. aeruginosa*, *E. coli*, *Proteus vulgaris* and *Bacillus subtilis* are the bacteria which are easily being inhibited by coconut oil. Monolaurin content in coconut oil inhibits the growth of these bacteria and concurrently may enhance the absorption towards skin with the presence of surfactant when it is formulated as cream. Besides, the lauric acid in the coconut also has been recognized as a potent antimicrobial agent (Pham, 2016).

Coconut oil is an excellent ingredient for hair cosmetics. Low molecular weight and linear chain are the characteristics of triglyceride lauric acid which can penetrate directly into the hair shaft. The thick layer of coconut oil on the hair fibres may improve the moisture of the hair. It also has an ability to minimise protein loss from either damaged or undamaged hair when it is being applied before and after washing the hair grooming products (Dias, 2015). Apart from that, coconut has been used in Hawaii as a fragrance. Other than that, coconuts are also used as massage oil and soap through a saponification process. Lauric oil is the dominant fatty acid contained in the coconut and widely includes in detergents, soaps, and also cosmetics (Chan and Elevitch, 2006). Hence, it is proven that coconut can be used in cosmetics as it has its own significant phytochemical with different functions in many products.

### ***Cucumis Sativus***

#### **Botanical description**

*Cucumis sativus* L. (Cucumber, Figure 4) belongs to Cucurbitaceae family that is in the same group with melon, watermelon and squash. Cucumber is one of the most common crops that are grown worldwide due to its properties to grow and harvest easily. After tomato, cabbage and onion, cucumber is one of the most important vegetables in Asia. It is stated to be one of the oldest vegetables being cultivated historically. The cucumber plant is a climber for up to two meters with its non-woody stem. The cucumber fruit is green in colour, cylindrical, elongated, and tapered at both ends. The texture is crisp, juicy and watery, making cucumber is one of the important ingredients to make a vegetable salad. The flavour is, however, is very mild. *Cucumis sativus* is native to the foothills of Himalayas of Nepal and has been spreading to the neighbouring areas in Asia, Europe and Africa. The flesh of cucumber fruit is slightly green and the inner part of cucumber contain rows of white seeds. The flesh is crispy and the inner part is watery and has a jelly-like texture.

#### **Role in cosmetic formulations**

The usage of cucumber in cosmetics are varied as it has different beneficial actions on human skin. [Aswal et al. \(2013\)](#) stated that cucumber is effective in cooling, healing and soothing of skin irritation from sun exposure or skin problem itself. Fresh fruit juice may nourish the skin and sooth the irritated skin, as well as time, reduce swelling ([Mukherjee et al., 2013](#)). A test done by researcher shows this fruit extract does not cause any irritation to the skin when it is used as diluted formulation, oil-in-water emulsion-based creams, eye gel, and even eye cream formulation. Apart from that, the photosensitivity test of the formulations containing cucumber shows a negative result, proving that cucumber is safe to be used in cosmetics. No skin sensitization detected on all subjects when the experiment is done ([Fiume et al., 2014](#)).

In another test by [Akhtar et al. \(2011\)](#), cucumber has the potential to reduce the production of sebum about 90%. It is due to isotretinoin content inside the cucumber, which provides a supply of vitamin A into the skin resulting in the reduction of sebaceous gland size. This event is simultaneous with the inhibition of sebum production due to suppressed sebaceous lipid synthesis of the skin. Thus, any cosmetic formulations that contain cucumber may have the ability to reduce acne formation. Cucumber extracts in a cosmetic formulation may have improved skin colour due to its capacity in reducing the melanin content in the skin resulting in fairer and glowing skin appearance. Another significant phytochemical content of cucumber in cosmetics is as antioxidant ([Sotiroudis et al., 2010](#)). Cucumber shows impelling antioxidant effect that is useful to inhibit the formation of free radicals, hence reducing wrinkles and helps in slowing down ageing process ([Aswal et al., 2013](#)). Cucumber extract is commonly used in multiple skin problem which includes pain due to sunburn ([Akhtar et al., 2011](#)).

### ***Melaleuca Alternifolia***

#### **Botanical description**

Tea tree plant or its scientific name *Melaleuca alternifolia* (Figure 5) belongs to Myrtaceae family, group as eucalyptus, guava and clove. This woody plant is an evergreen shrub that can grow up to six meters. It is native in Australia, at the area of New South Wales and Queensland. The suitable place for this plant to grow is at the field with light-sandy soil or medium soil and does not prefer to be produced in the shade. This warm-liking-climates plant pollinates by insect mediators as it produces snowy-white flowers. Traditionally, the aborigines utilised this plant by crushing the leaves to extract the tea tree oil. It has a pleasant aromatic scent with a hint

of lemongrass scent notes. Nowadays, this beneficial plant has been cultivated to other areas such as United States, Zimbabwe, India, China, New Zealand and other countries, including Malaysia.

#### **Role in cosmetic formulations**

Tea tree is mostly used in its oil form. The major component contained in this oil is terpinen-4-ol which contributes the most in fighting against microorganisms. *Candida albicans*, *Escherichia coli* and *Staphylococcus aureus* are the common microorganisms that were inhibited in the experiment, proving that tea tree has antimicrobial activity ([Carson and Riley, 1995](#)). In another experiment, researchers stated that tea tree oil is outstanding in fighting against Gram-negative and Gram-positive bacteria, for example, *Staphylococcus*, *Streptococcus* and *Pseudomonas aeruginosa*, and other organisms such as *Dermatophytosis* and *Herpes simplex virus*. Thus, it can be sufficient to be used in cosmetics as well as against nail fungal infections ([Sarkic and Stappen, 2018](#)).

When tea tree gel with the strength of 5% applied on acne lesion, it can reduce the number of lesions functionally as compared with placebo ([Sarkic and Stappen, 2018](#)). The ability to resist against *Propionibacterium acnes* and other secondary bacteria causing acne has made this ingredient as one of the exceptional ingredients in cosmetics. It gives a calming effect and reduces swelling and erythema around the pimple. The topical application of tea tree in daily use as moisturisers, toners, cleansers and night creams is advantageous for healthy skin management ([Southwell, 1999](#)). At the strength of 1-3%, any lip balm or lipsticks which contains tea tree oil may help in reducing and treating sore and cracked lips due to prolonged exposure to sun and wind-burn. Apart from that, tea tree oil can be infused in a mouthwash or toothpaste in preventing a plague formation and halitosis ([Sarkic and Stappen, 2018](#)). The higher concentration of tea tree oil in a dental care product can help particularly in sensitive teeth caused by disturbed microflora in the mouth ([Southwell, 1999](#)).

### ***Punica Granatum***

#### **Botanical description**

Pomegranate or *Punica granatum* (Figure 6) is in Lythraceae family. This plant is native to Northern Africa and the Caucasian region but it is already been distributed to other regions including the Southern United States and Asian country. Nowadays, pomegranate can be obtained easily all over the world since most countries have cultivated this plant. The plant is a shrub-type plant with the height



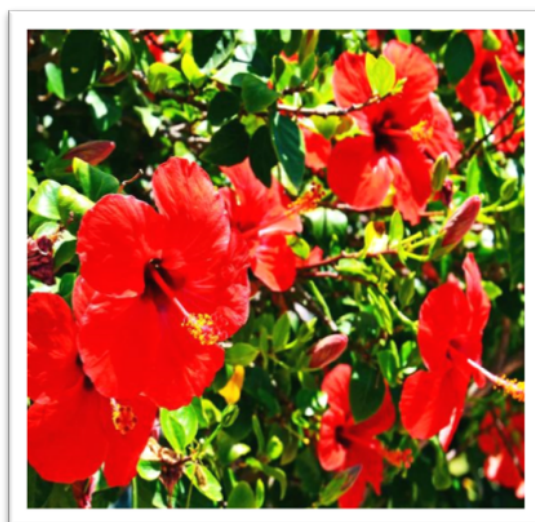
**Figure 6: *Punica granatum***



**Figure 9: *Lawsonia inermis L.***



**Figure 7: *Garcinia mangostana***



**Figure 10: *Hibiscus rosa-sinensis***



**Figure 8: *Carica papaya L.***

up to 10 meters. This woody plant has trunks that are covered in a greyish or brownish cracked bark. Its young leaves are in red and eventually turn to green when it is matured. It has a narrow and lance-shaped, glossy and leathery type of leaves.

Pomegranate fruit is almost perfectly round in shape with various sizes. The outer part is red in colour with the leathery layered yellow inner skin. The interior fruit is segmented by different membranous walls that packs the red, pink or white pulps inside. The pulp/aril is slightly acidic, juicy and each pulp has a small, hard seed. It is said that high temperature climate may produce the best flavoured fruit. Traditionally, pomegranate has been consumed for medicinal purpose. The folklore utilized the fruit as a remedy for multiple health problems such as persistent cough, intestinal worms, diarrhea and dysentery. Current research has been using pomegranate

and it is suggested that this fruit is essential in cancer treatment, preventing heart attack and lower blood glucose level in diabetic patients.

### Role in cosmetic formulations

Pomegranate is extracted to use in cosmetic formulation hence maximizing the benefit and effectiveness of the products. One of the main benefits of pomegranate is as antioxidant sources. A test was done by [Boggia et al. \(2016\)](#) confirms these pomegranates were rich in antioxidant content. Apart from it, an anti-browning activity was also being proved when solutions containing pomegranate were applied on cut apple. Phenolic extract of pomegranate peels has high antioxidant activity and it is proven by 2,2-diphenyl-1-picrylhydrazyl-hydrate (DPPH) scavenging activity and ferric reduction assays done by researchers ([Shiban et al., 2012](#)). The antioxidant activity might be due to the diverse phenolic compound contained such as anthocyanin which is known to scavenge free radicals and reduce lipid oxidation in tested subjects ([Viuda-Martos et al., 2010](#)).

Previous experiments prove that pomegranate peel aqueous extract may have the ability in promoting dermal regeneration, and at the same time, the seed oil may enhance the epidermal regeneration ([Viuda-Martos et al., 2010](#)). Skin damage can be due to many reasons and one of the sources is exposure to UV radiation. Due to the issue, a product containing pomegranate may reduce skin damage caused by UVB which may induce collagenase, gelatinase and another skin-damaging enzyme ([Afaq et al., 2009](#)). Apart from repairing the skin, pomegranate may reduce melanocyte formation and melanin synthesis resulting in a whitening effect of the skin when it is orally administered ([Viuda-Martos et al., 2010](#)). Vitamin C content in the pomegranate has been tested and it proves that is rich in vitamin C pomegranate. From different parts of the fruit tested, pomegranate peels contain high vitamin C content than other parts of the fruits ([Opara et al., 2009](#)). Other than that, pomegranate also shows antimicrobial activity. It may delay the growth of *Staphylococcus aureus* and effective against *E. coli*, *Klebsiella pneumoniae*, *Bacillus subtilis*, and *Salmonella typhi*. A methanolic extract of pomegranate peels has potent antimicrobial activity against *Listeria monocytogenes* and *Yersinia enterocolitica* ([Viuda-Martos et al., 2010](#)). Therefore, it is proven that pomegranate is not only good as a functional food but also has multiple benefits, particularly in cosmetics.

### *Garcinia Mangostana*

#### Botanical description

*Garcinia mangostana* L. (Mangosteen, Figure 7) belongs to family Clusiaceae which contains for up to 35 genus and up to 800 species classified under it. The tree is tall, evergreen, large, and has smooth bark with white or yellow latex. It is not a fast-growing tree and has been well-known in the South-east Asia region. The plant is native to Malay Peninsula, Indonesia and the Borneo islands. However, it has been distributed throughout the Southeast Asia region such as Thailand, Laos, Philippines and Burma. Other than that, mangosteen has been distributed to Australia, India, Africa, Central and South America, and even in a greenhouse located in England. Ripe mangosteen fruit is dark-red in colour and has a weight ranging about 70 – 150g. The skin is thick, light red coloured and kind of soft woody layer. The pulp or aril is white, fleshy and sweet with a seed at the centre. The shape is round, ovoid with a pointed tip. It has a pleasant smell and a nice flavour with a hint of citrus and peach. Mangosteen is categorised as one of the fruits with the most delicate taste in the world, leaving other tropical fruits behind, hence, it is known as 'Queen of Fruits'.

### Role in cosmetic formulations

According to [Chen et al. \(2011\)](#) mangosteen pericarp in the polyphenol extractions shows an excellent antioxidant activity. However, the aqueous phase polyphenols show more exceptional antioxidant properties as compared to the organic phase polyphenols. [Suttirak and Manurakchinakorn \(2014\)](#) reported there were a presence of antioxidant activity in the mangosteen peel extract and its bioactive compounds. Therefore, this natural source is suitable to be incorporated in food, pharmaceutical and cosmetic products. Apart from alpha mangostin compound, other compound extracted from the mangosteen fruit rind also shows antioxidant activity and reduce free radicals. It was reported by [Suryantari et al. \(2017\)](#), alpha mangostin was used as a control solution and still, there was a band formation developed on all of the silica gel plates with a significant Rf value and a high colour intensity. From this finding, it is agreed that other than alpha mangostin, there are compounds that contribute to the antioxidant properties of mangosteen.

[Pothitirat et al. \(2010\)](#) had done the experiment on the antimicrobial activity of mangosteen in the treatment of acne. Researcher stated the major constituents of mangosteen is  $\alpha$ -mangostin and the compound has an antimicrobial activity against *Propionibacterium acnes* and *Staphylococcus epidermidis* which may cause acne formation on the skin. A mangosteen crude extract with 0.5% concentration contained in an anti-acne gel formulation, incorpo-



rated with other ingredients, yield the highest effectiveness to inhibit the growth of bacteria causing acne (Sukatta *et al.*, 2008). Besides, mangosteen pericarp can be used as one of the ingredients in hair growth and hair tanning products. The extract has the ability to enhance the proliferation of hair dermal papilla cells as compared to untreated control cells. Then, it can increase the synthesis of melanin more than four times as compared to untreated cells. As a result, mangosteen pericarp is a safe ingredient in the hair growth and hair tanning products (Tan, 2016).

### **Carica Papaya**

#### **Botanical description**

*Carica papaya* L. (Papaya, Figure 8) belongs to Caricaceae family, is a major fruit that is cultivated in tropical and sub-tropical regions. It is said to be originated from Central America, located from Argentina and Chile to south Mexico. This plant is widely distributed and cultivated everywhere, including Malaysia and Thailand. The tree is a semi-woody, fast-growing, single stem, straight and contains permanent leaf scars. The leaves are large, arranged in crown form, palmately-lobed, displayed a waxy surface and in dark green colour. The fruit is yellowish-orange colour when ripe and green when immature, oval to nearly round shape, waxy and thin skin. When it is ripe, the flesh of papaya will be aromatic, has various colour shades of orange or red, tastes sweet and juicy. The seeds are greyish-black coloured, ovoid shape and located at the centre. The fruit preferred full sunlight for maximum and well-developed growth. The trees can survive the humid surrounding. However, it grows best at temperatures of 22-26 °C, well-drained and rich in an organic matter soil. Papaya plant can grow up to 30 feet in height with a stem diameter of 8 inches. The fruit is best eaten fresh and contains high nutritional values such as vitamin C, provitamin A, carotenoids, as well as low in calories. This plant has been used traditionally in treating many health ailments such as the treatment of dengue fever and indigestion.

#### **Role in cosmetic formulations**

Papaya has multiple benefits not only in treating illness but also in cosmetic for years. It has vitamin A that helps in the restoration of damaged skin and the fruit peel may be used as a whitening agent. Apart from that, a mixture of papaya peel and honey helps in soothing the damaged skin and acts as a moisturising agent Yogiraj *et al.* (2014). Furthermore, Kothari and Seshadri (2010) reported that papaya seeds methanolic extract showed high antioxidant properties when compared to *Annona squamosa* seeds. Since papaya contains phenolic

compounds, it may play a role in contributing to the total antioxidant content. Besides, in a test done by another researcher, it was found that the antioxidant properties by DPPH assay from papaya extract showed strong reducing power. Simultaneously, it possessed strong moisture absorption and a retention effect as compared to hyaluronic acid and glycerol (Zhang *et al.*, 2012). Thus, it proves the ability of papaya as a potential moisturising agent and antioxidant sources to the skin.

An excellent antibacterial activity shows by papaya is another reason it is used in cosmetics. The effect of papaya leaves extract against *Bacillus subtilis*, *Pseudomonas aeruginosa*, *Staphylococcus aureus*, *Klebsiella pneumoniae* and *Escherichia coli* shows the high zone of inhibitions (Suresh *et al.*, 2008). The seeds of papaya show a bacteriostatic activity against some microorganisms such as *Salmonella typhi*, *Proteus vulgaris* and *Enterobacter cloacae* (Parle and Gurditta, 2011). Papaya also shows its excellent wound healing properties and skin-repairing abilities. The topical application of papaya on a burned skin may reduce tissue necrosis, can avoid infection and promotes wound healing (Karunamoorthi *et al.*, 2014). Traditionally, papaya has been used in treating many skin problems such as soft tissues injury and infections on the skin (Parle and Gurditta, 2011). This fruit has been used as medicine and cosmetics for a long time. Besides of its nutritional value and benefits in human health, it is safe to use conditionally.

### **Lawsonia Inermis**

#### **Botanical description**

*Lawsonia inermis* L. (Henna, Figure 9) is a plant that belongs to Lythraceae family. This shrubby plant has branched, small, glabrous, with greyish brown stems. The bark is woody and can grow up to 5 meters in height. This tree is preferable to grow in dry tropical and subtropical regions such as Sri Lanka, India, North Africa and the Middle East. It has been widely used for multiple purposes in Africa, Asia and the Middle East. The leaves are elliptic or broad lanceolate, small for about 1.3-3.2 cm by 0.6-1.6 cm, have a tapered base with very short petioles. Its flower is white or rose in colour, small in size which is less than 1.3cm and numerous in quantity. The reproductive propagation of this plant is by its seed. Its bark, leaves and seeds are the parts which are commonly used worldwide for many medicinal purposes.

#### **Role in cosmetic formulations**

According to Youssif *et al.* (2016), henna leaves had been used as a prophylaxis treatment to any skin

diseases. Besides, it has been used as a paste or decoction to heal boils, burns and bruises. Stubborn skin problem also can be treated according to Ayurvedic Indian Pharmacopoeia (Agarwal *et al.*, 2014). Besides, being used as a fragrance, the flowers can also be used to heal bruises (Buddhadhev and Buddhadhev, 2016). Other than that, burns and scalds can also be treated with henna bark by applying henna bark decoction (Agarwal *et al.*, 2014). Moreover, antibacterial activity of henna has been discovered through a few researches. The alcohol extract of henna leaves had the ability to resist *Staphylococcus epidermidis*, *Staphylococcus aureus* and *Pseudomonas aeruginosa* (Al-Rubiay *et al.*, 2008). Chengaiah *et al.* (2010) stated that henna leaves alcoholic extract showed inhibition against *Micrococcus pyrogenes* var aureus and *Escherichia coli*. Henna leaves have the ability to fight against both Gram positive and Gram negative bacteria (Borade *et al.*, 2011).

Furthermore, henna is opted to be incorporated in cosmetics due to its wound healing and skin-repairing activities. The henna extract shows increments in fibroblast, collagen bands and also less in inflammatory cells. Progressed in skin breaking strength, enhanced granulation tissues mass, and an increased rate of wound contraction were shown after using the henna extract (Buddhadhev and Buddhadhev, 2016). In a previous research of testing the wound healing activity of henna, it was reported that 71% decrement in wound size when the tested animals were treated with henna as compared to untreated animals (Borade *et al.*, 2011). From the above findings, henna is one of the natural sources opted to treat burned skin particularly. Apart from that, henna shows a significant antioxidant activity. In an experiment of detecting an antioxidant activity using henna leaves the result showed an increment in antioxidant enzymes. Consequently, the tumour was inhibited and incidence in tumour formation was also being reduced (Buddhadhev and Buddhadhev, 2016). This activity is due to the high quality of phytochemical contents in henna leaves.

### ***Hibiscus Rosa-Sinensis***

#### **Botanical description**

Hibiscus or its scientific name, *Hibiscus rosa-sinensis* (Figure 10) is one of the plants in Malvaceae family and grouped with the cotton plant. This plant is quite large and can grow in a warm and temperate condition as well as subtropical and tropical areas. This plant which is native to East Asia is also known as Chinese hibiscus, China rose and Hawaiian hibiscus. This shrubby and small plant is commonly exploited as an ornamental plant in

the garden. The leaves are ovate, lanceolate, irregular, coarsely arranged towards the top of the tree. The leaves are simple, petiolate with glandular hairs on the top of it. Moreover, the flowers are large, have five petals, about 7.5 cm in diameters. Hibiscus is very sensitive to frost, freeze or any cold temperature zones. It requires full sunlight and rich organic matter containing soil that is well-drained. This plant is very common in India, Sri Lanka, South Africa, Thailand, Philippines, Myanmar, China and Pakistan. It is also common in Malaysia and hence, Hibiscus flower is known as their national flower.

#### **Role in cosmetic formulations**

Hibiscus has been tested for its antioxidant activity and it is proven its ability to inhibit free radicals formation. The ethanolic and methanolic extracts of hibiscus both show an antioxidant activity when it is determined by using DPPH free radical scavenging activity assay. The antioxidant activity is somehow in a dose-dependent manner. However, the aqueous extract of hibiscus contains a rather higher antioxidant activity due to the high amount of tannins and anthocyanins (Khan *et al.*, 2017). The mucilage of hibiscus leaves also shows an antioxidant activity as compared to BHT and ascorbic acid (Vignesh and Nair, 2018).

Furthermore, hibiscus may also fight against microbes. In a study done by Vignesh and Nair (2018) resulted that hibiscus leaves mucilage showed its antibacterial activity against *Klebsiella pneumonia* and *Streptococcus pyrogenes*. Khan *et al.* (2017) stated that hibiscus extract inhibited the growth of *Escherichia coli*, *Enterobacter aerogenes* and *Bacillus subtilis*. Lokapure *et al.* (2014) tested the activity of hibiscus extract towards sun protecting factor (SPF) when it was used as a gel formulation. The gel could be stored at five and 25°C for up to two to three months. Besides, the gel showed its sun protecting ability by analysing it using UV spectrophotometry after being irradiated with UVB lamp. Therefore, hibiscus can be incorporated as one of the ingredients in the formulation of UV shield cream in the future.

Apart from that, hibiscus has been used traditionally in the hair treatment regimen. It is suggested that the root of this plant has the potential to slow down the hair greying process, concurrent with hair loss. The flowers can be exploited together with herbs to make medicated hair oil and scalp serum. Hibiscus leaves can be formulated into a paste and lather it on the scalp and hair as shampoo and conditioner (Vought, 2016). Malaysians also believe using hibiscus leaves may result in healthy hair, increasing hair volume, slowing down greying hair process and

reducing hair loss.

## CONCLUSIONS

Numerous herbal and natural products are easily found in Malaysia and can be used as one of the ingredients to be formulated in cosmetics. These are the ten plants which are commonly used traditionally in treating many skin ailments and hair problems. Different parts of the plant may produce different beneficial effects to the consumers. The incorporation of herbal and natural ingredients in cosmetics can be done due to low side effects than the synthetic ingredient. Suggested further studies on these plants needed to be done as most of the plant stated lack in scientific mechanism of actions of their benefits to human. Nevertheless, there are still many other plants needed to be studied and investigated as Malaysia is rich with its yet undiscovered natural sources.

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