Natural Actives Lend Color to Cosmetics and more....

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INTRODUCTION

The market for natural colors in cosmetics continues to expand worldwide on account of increased awareness among consumers of side effects associated with prolonged use of some synthetic coloring compounds, and the current trend towards healthful, natural ingredients in cosmetics. Manufacturers seek natural coloring materials that offer additional multifunctional effects in foundations, lip care products, hair coloring, and other color cosmetics, including UV protection, anti-aging, and related functionalities.

Several of the natural colors that meet these requirements evolved from traditional use in foods and cosmetics. These are usually plant pigments or dyes with a history of safe human use. Plant pigments such as anthocyanins, and carotenoids have scientifically validated antioxidant and anti-inflammatory benefits. Historically, plant pigments such as curcumin, beet anthocyanins, carotenoids from peppers and saffron, chlorophyll from green leaves, have been used to color food and cosmetics, for centuries. These extracts provide health benefits that go far beyond their coloring properties alone.

This overview highlights three other multifunctional natural plant extracts and their active coloring principles.

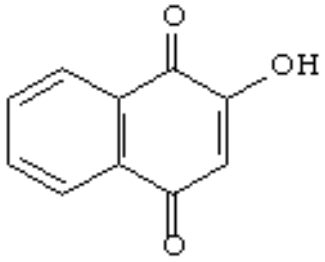
HENNA

The use of henna paste in coloring the skin and hair is well known. Lawsone (CAS #: 83-73-7, EINECS #: 201-496-3) is the active coloring principle in henna (*Lawsonia alba*, *Lawsonia inermis*, Family: Lythraceae), a small shrub with gray to brown bark. It is a phenolic compound present predominantly in the leaves of the plant. The leaf concentration of lawsone fluctuates according to climatic conditions. Leaves from plants grown in hotter climates are richer in lawsone than those from plants grown in cooler regions.

Henna is used in Ayurvedic medicine in the treatment of skin ailments, burns, wounds, and diarrhea to name a few. Henna has been used as a coloring and cosmetic agent for over three thousand years. Lawsone is widely used in cosmetology for its dyeing properties, uses as hair and nail color and in the traditional decoration of the soles of the feet and of the palms of the hands.

CHEMISTRY

Lawsone is a constituent of primary glycosides in henna leaves called hennosides A, B, and C and can be obtained from them after degradation and autoxidation. Lawsone, a quinone, dissolves rapidly in alkaline, aqueous solutions to produce an orange-red color. Dried powdered leaves of henna contain approximately 0.5 to 1.5 percent lawsone.



Lawsone (2-hydroxy-1,4-naphthoquinone)

TRADITIONAL TOPICAL APPLICATIONS

Herbalists use henna leaves to soothe fevers and headaches and as an astringent to treat insect bites, minor burns, inflammation and skin irritation. The leaf paste is traditionally formulated into medicated oils to inhibit graying of hair and to promote healthy hair growth.

Fresh leaves beaten into a paste with vinegar or limejuice are applied as poultice to the soles of the feet to cure “burning of the feet”. In the Middle East, leaves or the herb ground into a soft paste with water are applied with benefit in cases of rheumatism.

An ointment prepared from the leaves is used to treat wounds and ulcers. It is also an astringent gargle in ulcers of mouth Henna has also been employed as a deodorant.

In modern practice, Lawsone is a durable skin marking agent in patients undergoing external radiotherapy. Lawsone is used widely as a coloring agent and cosmetic additive.

CONTACT ALLERGY MISCONCEPTIONS

Allergic reaction to lawsone is rare. However, contact dermatitis is the most common allergic reaction reported. The dermatitis is a result of hypersensitivity after contact and remains localized to the area of contact. **Natural henna, and its active component lawsone, do not normally cause hypersensitivity.** Synthetic dyes added to lawsone such as para-phenylenediamine (PPD), para-toluylenediamine, and other related chemicals provoke an allergic reaction. These compounds are added to natural henna to enrich the color and shorten application times, resulting in a product called black henna.

In Khartoum, Sudan, fatal angioneurotic edema occurred in children exposed to henna-PPD mixtures. Individuals deficient in glucose-6-phosphate dehydrogenase (G6PD) were reported to have life-threatening hemolytic crises upon topical exposure. Commercial Henna should therefore be avoided by neonates and young children and also by individuals known to be G6PD deficient, to prevent accidental exposure to henna-PPD mixtures.

COSMECEUTICAL APPLICATIONS

1. Antifungal activity

Lawsone was found to be an anti-fungal toward *Alternaria, Aspergillius*, *Absidia*, and *Penicillium*. The minimum dose effective again test organism is found to be 0.1%. It exhibits fungicidal activity, wide fungi toxic spectrum and nonphytotoxicity.

2. Antibacterial activity

Antibacterial activities toward Brucella, Neisseria, Salmonella, and Streptococcus with a concentration of .005-.02% were observed. Additionally, lawsone extract from the leaves showed mild anti-bacterial activity against S. aureus and E. coli.

3. Benefits in Alopecia

In applications described in patent literature, henna extract was used with other hair growth promoting agents delivered transdermally. Lawsone may promote hair growth by acting on 5-alpha- reductase, an intracellular enzyme that converts the androgen testosterone into DHT (dihydrotestosterone). As DHT is implicated in the development of androgenic alopecia, Lawsone offers benefits by preventing its formation.

4. Hair conditioning properties

Natural henna is an excellent conditioning agent. Lawsone is widely used in shampoos, hair rinses, and conditioners.

5. Hair Dye

Henna has been used to dye hair for centuries. Lawsone by itself is colorless. However when exposed to sunlight or to air, it is converted to a new compound that has the characteristic red color. When lawsone is blended with *Indigofera tinctoria*, the hair dye can impart color in various shades ranging from brown to black.

The addition of herbs such as rhubarb, calendula, chamomile, and others to lawsone produces various shades of red. It can be used to cover gray hair without any adverse effects on hair structure. To obtain a long –lasting color, the pH of the composition must be in the acidic range (5.5) facilitated by using a weak acid such as adipic, citric or boric acid). Other applications of henna include its use in creating “temporary tattoos” to decorate the skin.

SAPPANWOOD EXTRACT

Caesalpinia sappan is a small thorny tree about 6-9 metres in height. It has prickly branches and compound leaves. The heartwood which is used in traditional medicine as well, is light yellow when freshly cut, but it quickly changes to red.

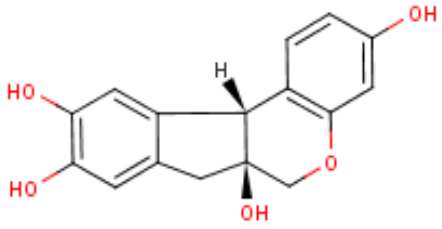
Brazilin is a red pigment obtained from the wood of the brazilwood family (*Caesalpinia sp*), and is also known as **Natural red 24**. Among the natural colorants, brazilin is the only substance dating from the pre-Columbian era to survive the competition of synthetic dyestuffs. Brazilwood has been traditionally used as a food coloring, for example to color Easter eggs.

Sappanwood used to be one of the main sources of trade during the 17th century between Japan and its Southeast Asia neighbors (especially Siam) onboard Red Seal Ships, and its name probably originates from the Malay word “sapang” for Japan.

Sappanwood has been traditionally used in Ayurveda in the management of burning sensation in the mouth and in the topical treatment of wounds and ulcers.

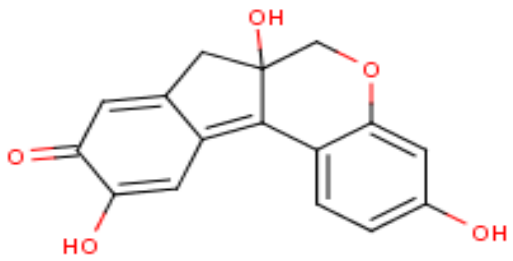
CHEMISTRY

The heartwood of *Caesalpinia sappan* contains a water-soluble compound brazilin. This transforms on oxidation to the red dyestuff, brazilein.



Structure of Brazilin

Brazilin itself is a leuco-compound, its solutions being achromatic in pure form. On oxidation, which proceeds somewhat slowly in absolute alcohol and more rapidly in aqueous solution, Brazilein, is formed. This change is also observed when pH changes from acidic to alkaline. Brazilein is, then, a chromophore or color-bearing compound, but it lacks strong auxochrome groups to make it a fast dye.



Structure of Brazilein

Industrially brazilin is commonly used either in the form of raw decoctions or in purer form with a variety of salts which promote oxidation and form lakes with superior colorant and fastness profiles.

The specific color produced by the pigment depends on its manner of preparation: in an acidic solution brazilin will appear yellow, but in an alkaline preparation it will appear red.

Brazilin **Brazilein**

Sappanwood Extract was found to be stable when tested for colour as 1% solution in ethanol in both acidic and alkaline pH ranges.

COSMECEUTICAL AND NUTRICOSMETIC APPLICATIONS

1. Antimicrobial Effects:

Recent studies show marked efficacy of brazilein against methicillin-resistant *Staphylococcus aureus* (MRSA), vancomycin-resistant enteroccci, multidrug-resistant *Burkholderia cepacia* and several other bacteria.

2. Immunocosmetic potential:

Brazilein and *Caesalpinia sappan* ethanol extract (SME) were shown distinctly inhibit the proliferation of T lymphocyte stimulated by Concanavalin A (Con A) and the proliferation of B lymphocyte stimulated by lipopolysaccharides (LPS). Brazilein also suppressed mice humoral immune response by plaque forming cell (PFC) test.

3. Anti-inflammatory Effects:

Brazilin is reported to exhibit anti-inflammatory and cancer chemopreventive activity by suppressing inducible nitric oxide.

Sappanwood extract can be used as a natural color in various nutracosmetics and cosmetic formulations with the added protective benefits of antimicrobial activity and potential "antiaging" effects.

4. Natural color

On account of its strong antibacterial action Sappanwood Extract can be incorporated to preserve the integrity of formulations and into cosmetic creams, gels and lotions to provide antibacterial benefits. Further, it lends bright color and aesthetic value to bath soaps, and color cosmetics. The property of color change with pH from yellow to red can be used advantageously to produce color changing lipsticks and other color cosmetics.

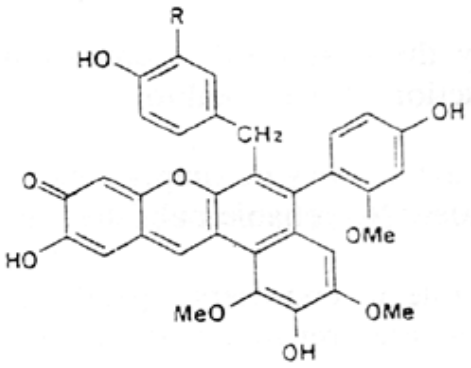
Laboratory studies showed that the extract is safe for use in lip cosmetics, as its LD_{50} was found to be greater than 2000mg/kg w/w in rats. The extract did not irritate or sensitize the skin.

RED SANDALWOOD EXTRACT

The heartwood of red sandalwood tree or Red Sanders (*Pterocarpus santalinus* Linn.) also known as ruby wood, sanders red, saunderwood, santalwood, *raktha chandana*, is used as an ingredient in Ayurvedic medicines to support the management of inflammatory conditions and to improve skin health. When included in traditional cosmetic formulations with turmeric, it imparts a healthy glow to the skin. It has also been used as talcum powder traditionally. The powdered heartwood has a pleasant aroma and an attractive red color. Ayurvedic literature also describes the "cooling" properties of *raktha chandana*.

CHEMISTRY

The principal red pigments in red sandal heartwood are santalin A and B, and these are soluble in organic solvents and alkalis, but not in water.



RH = OH … santalin A
R = OMe … santalin B

Red sandalwood extract was found to be stable when tested for color stability as 1% solution in Ethanol

Red sandalwood extract in solution…

COSMECEUTICAL AND NUTRICOSMETIC APPLICATIONS

Red sandal has been traditionally used with fish products in Europe and more recent applications include the coloring of seafood sauces, meat products, breadcrumbs and alcoholic drinks. In India, it has played a traditional role in medicine as an astringent, and for the treatment of gastric and skin disorders. Red sandalwood was employed in the past for dyeing wool, cotton and leather and for wood staining.

The extract can be used as a natural color in various nutricosmetic and cosmetic preparations with the added benefit of antioxidant potential. In traditional "cosmeceutical" use, raktha chandana is ground to a paste with water or honey, and applied topically as a popular home remedy used in southern India, for lightening post-acne and other facial scars. Its antioxidant, anti-inflammatory and hepatoprotective effects are reported in literature. The extract was found to facilitate wound healing in a preliminary clinical study.

Since this extract is stable in alkaline medium, it can be conveniently used in soaps for its gorgeous deep purplish rose color. Similarly red sandalwood extract can be added to lipstick, and color cosmetic compositions to impart color and a healthy glow to the skin.

The use of Sappanwood and red sandalwood in food applications historically is best illustrated with the example below of naturally colored Easter eggs.

Easter Eggs dyed with various Natural Dyes

(Egg 14 is coated with sappanwood extract, Egg 15 is coated with red sandalwood extract)

(http://www.gallowglass.org/jadwiga/SCA/eggs/eggdyes.html)

Therefore red sandalwood extract is a potentially healthful colorant for nutricosmetic formulations, as well.

CONCLUSIONS

This overview presents three natural alternatives to synthetic dyes for creative use in cosmetics and nutricosmetics. Offering benefits far beyond colorant properties, these extracts add to the healthful image of such compositions. Contact Sabinsa Corporation for further information on other stable and versatile natural colorants.

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