



Medicinal Properties of Natural Colourants/Dyes from Plants

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ABSTRACT: Now a days worldwide demand for natural dyes has increased due to the awareness and beneficial properties of natural dyes. The medicinal plants are widely used for curing various types of diseases. The natural dyes from these plants having several applications in textiles, cosmetics, inks, pharmaceutical paper industries etc. The natural dyes existing different shades of colours depends on metabolic functional groups. The present review, describes the information regarding the basic chemistry of plant pigments in relation to medicinal properties which may be useful to further development of pharmaceutical formulations.

Keywords: Alkaloids; Natural dyes; Pigments and Medicinal value.

INTRODUCTION: In nature many plants show medicinal properties. Some of them give natural colourants by extraction process. Pomegranate contains large quantity of tannin which shows antimicrobial activity. Some other plants like heena, alkanet and walnut show antifungal and antibacterial properties. The antimicrobial activity was observed in dye powder of *Rubia cordi* and *Kerria lacca* plants. It was proved that some natural dyes show medicinal properties. In watermelon lycopene pigment gives red colour. Lycopene pigment is also observed in tomatoes and carrots. In food industries lycopene pigment is very important in colouring food material. It has great demand in food formulation. In recent years special attention is given on prevention of chronic diseases like cancer.

The epidemiological studies proved that the use of lycopene containing tomatoes in food causes low risk of cancer. Fruit of pomegranate uses as natural colourant and also shows medicinal importance. From the research data it was proved that fruit of pomegranate contains anticarcinogenic anti-microbial and antiviral compounds. Due to the presence of pigments in above mentioned plants, a spectrum of beautiful colours is observed. Spectrum colour starting from yellow to black and observed in 400 to 800 nm visible region because of absorption of light. This absorption depends on the basis of structure and chromophores present in pigments.

Consumers are avoiding the use of synthetic colorants containing foods. Now a day food industries preferred only natural pigments for colouring the food. Natural colours are made from renewable sources. They are

extracted from plant material, insects, algae, cyanobacteria and fungi. Now a day natural colourants are formulated in various types of drinks and food. Legislation restricts on use of colorants are allowed, as well as sources used for that particular colorant. It also restricts on which solvents may be used for extraction and purification of colourants. Most of the pharmacological studies were preliminary, carried out in animals and are not sufficient for the development of a pharmaceutical product.

Natural dyes have a great scope. In the present scenario, it has been seen that due to the excellent advantages of natural colorants or dyes, they became attractive and alternative option for the synthetic dyes. The natural dyes have some properties due to which they are accepted as alternatives for synthetic dyes. Natural dyes are biodegradable in nature. They are non-toxic and environment beneficial and ecofriendly. They are aesthetically attractive and results in employment generation as well as useful in the wasteland utilization. Natural dyes can be easily extracted for their pigments. It includes the boiling of flowers, fruits and leaves, barks, roots and whole plant in water as solvent.

The utilization of natural resources and use of extracted pigments from the plants is significantly focused in various fields like pharmaceuticals, food stuffs, paper and textiles. It has been observed use of natural dyes is since long decades and the trend continues which aims towards the safety and protection of human health. Various research fields has proved that natural dyes have similar properties when compared with synthetic one hence, natural dyes can be commercial-

ized for their desired properties and need to conform to the standards.

Now a days all the natural dyes seem to be vanished as the synthetic colouring agents have replaced them. The ancient art of our country includes the use of variety of natural colouring pigments in the form of crafts, sarees, handmade articles, decorative frames, show piece etc. The famous examples are Bandhani Sarees in Rajasthan and Orissa. In Rajasthan Multani sarees are also famous whereas Kalamkari designs are popular in Andhra Pradesh and Bihar.

The modern era needs a technically advanced technology which can be efficiently utilized for the extraction of natural dyes qualitatively and quantitatively. As the more benefits of using natural pigments are scientifically proven, natural products are on great demand thus has become the center of research.

SOME NATURAL COLOURING AGENTS FROM PLANTS:

1. Annatto: In nature different kinds of colourant obtained from plants. Annatto is one of them. Beautiful red and orange colourants can be extracted from this plant. The seed of annatto contains pigment called as carotenoid over the present bixin. C₂₄ apocarotenoid like methyl ester is present. After the removal of the ester group formation of the dicarboxylic acid and norbixin occurs. It forms the annatto dyes. In food industry annatto dye is very useful. In Pharmaceutical companies the dosage are prepared by using solid bixin¹.



Image of annatto

Chemistry of pigments and medicinal use: It is medicinally very important. The seed of Annatto used as anti pruritic and purgative²⁻⁴

2. Termeric rhizomes: Termeric rhizomes are used from the ancient time in the treatment of healing wound. It is use as spice in cooking vegetables because of its aroma and test. Common name of turmeric is Indian saffron. It has a also great importance in medicine. It is commonly known as Indiansaffron. It consists of fresh rhizomes and dried plant curcuma longa Linn. Curcumin is principal colour present in rhizomes. It imparts flavor as well as colours to the food

product.



A. Termeric rhizome; B. powder of turmeric

Pigments in Termeric: Curcuminoids pigment is present in turmeric which imparts colour. Curcumin is a main constituent present in pigment. It is also contains volatile oil and starch. curcumine pigment impart the yellow colour to turmeric⁵. It possess various properties including anticancer activity, anti inflammatory and antioxidant properties. Curcuminoids shows some pharmacological activities because of its molecular structure which is very unique. In Alzheimer's ailment curcumin colourant is very useful.

It has anti-inflammatory effects in arthritis and inflammation. It has medicinal importance because of anti bacterial and antifungal properties.

3. Saffron: Saffron is very attractive coloured flower plant. The common name is crocus. People used stigmas and styles in dried form which imparts colour. Its having a enormous demand in cosmetics and food industry because of its attractive colour and pleasant aroma.



Pigments in saffron: Main content of saffrons are alpha crocin, pricrocosin and safranal. crocin, crocetin, picrocrocetin and safranal. Carotenoid is also very important pigment present in saffron which impart orange and yellowish golden colour.⁶ The saffron's flavor is due to bitter glycosides. Safranal gives fragrance to the saffron⁷. It is known for its medicinal properties saffron has antispasmodic, sedative, anticatarrhal, nerve sedative, eupeptic, gingival carminative, diaphoretic, expectorant, stimulant, stomachic, aphrodisiac and emmenagogue medicinal properties Crocetin shows antiparkinsonian effect. It is helpful in preventing Parkinsonism.

4. Paprika: Paprika pigment is present in chilli seeds. Red carotenoids principles, capsanthin and capsorubin are present in dried fruits of chilli. Paprika pigment is extracted from dry capsicum fruits. Paprika possess many medicinal properties like antibacterial, anti-inflammatory and antioxidant. It help to control and slow down the growth of the bacteria like E.coli and salmonella. It has a rich source of vitamins A and E which neutralises the free radicals and shows its antioxidant effect. When capsaicin use to apply externally as a pain reliever. It is used in many ointments and creams which helpful for headaches, and arthritis. It is also used as stimulant because it stimulate production of saliva and stomach acid which improve digestion it is used as a counter irritant in the treatment of lumbago rheumatism and neuralgia⁸.

Chemistry of pigment: Paprika contains capsorubin and capsanthin components in the form of carotenoids which causes red colour in paprika. The red carotenoid principle of paprika is permitted colouring agent for food pharmaceutical, preparation of cosmetics, beverages and juices.



Image of dry paprika

5. Tomato: Red colour tomatoes are very popular for taste as vegetables. It has effective anticancer and antioxidant properties. Tomatoes are used in preparation delicious food. Different types of pigment and colourants are present tomatoes.

Pigments in tomatoes: Tomatoes are very attractive fruit in vegetable. In food recipe it has importance. It is popular for its taste. The main constituents of the tomato are lycopene, β -carotene, β -cryptoxanthin, lutein and zeaxanthin. Lycopene and carotenoid present in tomatoes which are responsible for red colour of the fruit. Lycopene shows several health benefits. Serum and tissue levels of lycopene were shown to be inversely associated with the risk of breast cancer and prostate cancer. It is also useful to prevent different types of cancers⁹. Lycopene is efficient antioxidant among carotenoids. For the rich source of Vitamin A tomatoes are used.



Image of Tomato fruit

1.6. Marigold or Tagetes: Tagetes is commonly called as marigold. These flowers are very attractive in colours. The flowers of marigold used for the decoration and making for garland. It contains carotenoid pigments. From ancient time it is useful in culture event for decoration and in food coloring. Marigold is well known for its medicinal activities. The reddish and yellow coloured flowers consist of the xanthophylls pigment which is called as lutein. It is used as an additive of chicken feed to give colour to egg yolks.



Image of Merigold

Pigments in tagetes: Marigold contains lutein pigment which impart attractive colour to the flowers. It gives orange and yellow colours because of presence of carotenoid. Some other compounds like carotene and galenine are also present in marigold. Lutein is

present in marigold flower petals which act as antioxidant. These easily react with metal mordants to reduce free radicals. It protects skin and eyes from harmful damage because it filters blue ultraviolet light spectrum

CHALCONE COLOURANTS:

7. Safflower: Safflower (*Carthamus tinctorius*) gives carthamin red dye. This red dye has demand in textile industry for coloring fabrics. In agriculture it is used for production of oil from seeds. Now a day it is applicable in food and pharmaceutical also.

Pigments in safflower: Carthamin and carthamidin are present in this plant¹⁰. Some other constituents of these plants are steroids, polyacetylene, flavonoids, and carthamin. In water carthamin gives red colour and carthamid gives yellow colour which is soluble in water. The use of carthamin in the treatment for circulatory system related diseases¹¹. The petals of safflower are in treatment of many chronic diseases like hypertension, male and female fertility problems, coronary heart ailments, and rheumatism¹². In urethra stimulation treatment carthamin is very useful. It also has some medicinal properties like cytotoxic, antigenic and anti-platelet activities.

ANTHRACHINONE AND CHINONE COLOURANTS:

8. Henna Herb: The botanical name of heena is *Lawsonia inermis Lam.* Heena has a great importance in cosmetics because of its colouring property from ancient time. Fresh and dried leaves of heena can be used for colouring because of its dyeing property. It also has some medicinal use. The leaves paste is applied on palm and for hair colouring.



Image of Heena

Pigments in Heena: In the cosmetic industry Henna is widely used as a dyeing agent. It consists of fresh or dried leaves of the plant *Lawsonia inermis Lam.* It has medicinal as well as dyeing properties. Its natural orange dye is used to dye protein fiber. It has been used as a sunscreen agent and in conjunction with dihydroxyacetone. Lawsone (0.5-1.0%) is the active constituent of the leaf which is generally extracted from

the leaves of the plant using sodium bicarbonate. The Lawson present in leaves of henna is responsible for the colouring property¹³. It is worldwide known as anticarcinogenic, analgesic and antipyretic and anti-inflammatory properties. The alcoholic extract of heena leaves shows antibacterial property.

9. Pomegranate: Pomegranate is a very famous fruit in India. Most of the people like to eat this fruit because of its beneficial properties. Botanical name of this plant is *Punica granatum*. It has medicinal value. People use fresh and dried fruits as medicine. Now a day it is used in the colouring industry because of its colouring property. In various fields of dyeing the use of pomegranate is very popular.

Pigments in pomegranate: In pomegranate attractive anthocyanin is present, which is water soluble. From this fruit, red and purple colourants are obtained¹⁴. It consists of punicalin, punicalagin, gallic and ellagic acids, isopelletierine alkaloids. Dyes from *Punica granatum* have a potent antimicrobial nature. Pomegranate fruit used as a natural dye with traditional medicinal value. It shows many medicinal properties like that the fruit contains anti-microbial¹⁵ anti-viral compounds and anti-carcinogenic¹⁶. It also reduces blood pressure and reduces LDL oxidation.

10. Beet Root: The botanical name of the red beet root is *Beta Vulgaris*. It is a herbaceous flowering shrub and plant from the subfamily Chenopodiaceae of the beet root and family Amaranthaceae.

It consists of a group of plant pigments. The yellow xanthophylls and red betacyanins which are collectively described as betalains. Indole colourant is obtained from beet root.

Pigments in Beet root: The dried beet root powder can be used for the preparation of the dye; it contains a glycoside betanin, which on hydrolysis yields the income betanidine and glucose. The dye is heat sensitive with certain limitations on their use as food dye in food coloring. Red dye from beet root is widely used as a food colourant and pharmaceutical colorant.



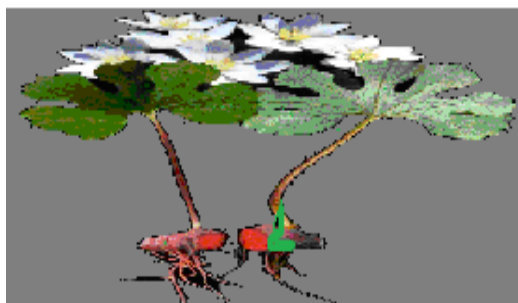
Image of Beet Root

INDOLE COLOURANT:

ISOQUINOLINE COLOURANTS

11. Blood Root: The botanical name of blood root is *Sanguinaria Canadensis*. Isoquinoline alkaloids are the active components of bloodroot. These components have antimicrobial, expectorant, antibacterial and antiseptic properties. Alkaloids named as sanguinarine has reported for the ability to destroy bacteria in dental plaque gum disease like gingivitis. Due to bacteria-inhibiting properties and pain-relieving character. This alkaloid used in toothpastes and mouthwashes for oral hygiene. Bloodroot also used for making gargle in sore throat. Large quality dose of blood root may be causes harmful effect as it prescribes as poisonous. It is also used for to remove warts and some extra grow on body. In many pharmaceutical and homeopathic remedies ingredients of bloodroot are used.

This plant is very famous for extracting pink, red and orange colours. From rhizome of blood root, red juice is obtained which is use as colour.



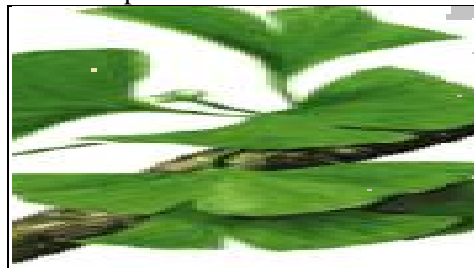
Structure of Berberine and Sanguinarine

Pigments in Blood root: Isoquinoline and berberine alkaloids are present in blood root. Berberine alkaloid produces yellow and orange colours which are very useful colouring of fabrics.

PYRAN COLOURANTS:

12. Ginkgo biloba: It is very ancient plant which is use as a drug and well researched herbs in the world. The extract of the plant frequently suggested ton account of diabetes, vertigo, short-term memory loss, depression, nerve damage, blood circulation, allergies, , headache, atherosclerosis, tinnitus, deafness and macular degeneration. The plant contains flavonoids and terpenoids which possess the defense against the damage of \ oxidative cell from destructive free radicals. It has therapeutic application. It prevents bed wetting problems and increases sexual energy. It's also used for the treatment of intestinal worms. In ancient china it was first time used as a medicine. They claimed the experimental profit and to mitigate symptoms of asthma. Long of chain alkyl phenols are

present in leaves of Ginkgo which are highly allergenic and avoided in case of some people who are allergic to poison ivy and some other plant in which alkylphenols are present.



Ginkgo biloba

Pigments in Ginkgo biloba: Orange and yellow colourants are obtained from quercitrin compound which was extracted from this plant. Quercitrin is a yellow-orange colour is isolated from Ginkgo biloba.

Cornflower: *Centaurea cyanus* is also called as cornflower and used for coloring of sugar and confections. It is annual flowering plants which are found in Asteraceae family. It is used as important ingredients in tea. The petals of cornflower are used for making salad and for garnishing of food and making cornbread muffins. It is traditionally use as for the treatment of indigestion, gallbladder, regulation of kidney and livers. In the regulation of menstrual disorder, cleaning wounds and increasing immunity. In the treatment of mouth ulcer, constipation and bleeding of gums its use is very beneficial. It shows many medicinal properties like astringent, antioxidant and antibacterial. Because of these properties it is used in the treatment of inflammation of skin and irritation of skin. It has important role in cosmetics and hair products. The petals with distilled water are useful in the treatment of conjunctivitis and weak eyes in human. From the petals of flower of plant, dark blue dye is obtained which is used for the coloration of fabrics.

Grapes vitacea: This plant contains important ingredients like, fructose, potassium, anthocyanins, glucose calcium, tartaric acid, malic acid, tannins. In the history it was reported that the red dye obtained from the grape fruit is used to paint feathers and skin. Due to the presence of anthocyanins, red to purple color is appeared in this plant. The grapes having some medicinal properties and cure the diseases like hemorrhoid, varicose veins, heart and blood vessels, swelling in surgery. It is helpful to prevent the heart attack. In the treatment of diabetes, eyes, nerve problems, wound healing, tooth decay, liver disorders, poor vision in night, grape seeds are very useful. It also prevents cancer like diseases.

Monascus purpureus: It is fungus from which red pigment is obtained which was traditionally used from

the ancient time in oriental countries like Japan. It is used in decreasing the level of cholesterol. It has importance in the food as additives. The use of this additive in food is not regulated in other countries like Taiwan, Brazil, Philippines and unitedstates. But Japan is using this dye from many decades in candies as it is water soluble pigment. It is used as red pigment in wine of red rice.

Beeta vulgaris: The natural dyes like betalains or betanines which can be extracted from Beeta vulgaris. The main use of these dyes in food products like ice

cream, yogurts and some other food products. Now a day it has been proved that that betanines possess some medicinal properties like antimicrobial, antioxidant, antiviral activity.

Plants from the nature contain different types of pigments or colourants are obtained, which are applicable in various fields. According to FD and C some certified colourants are shown in Table.2.3 and on the basis of chemical structure the natural colouring agents are shown in Table.2.4

Table 2.3 FD and C certified colourants (Mendes et al., ;1989)

Chemical Classifications	Colors	Common Names
Flavone dyes	Brown and yellow colour	Merigold plant and cutch
Naphthochinone dyes	Brown and Purple Grey	Henna, Walnut, Alkanet, Pitti
Chromene dyes	Orange-Yellow	Kamala
Iso-quinoline dyes Polyene colorants Pyran colorants	Yellow	Barberry, β-carotene, lycopene gentisin
Indigoid Dyes and Indole colorants	Blue	Indigo
Chinone and Anthrachinone dyes	Red	Lac, Chromene dyes Cochineal, Madder (Majithro) Santalin
Benzophyrone dyes	purple and Black	Logwood
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Chinone and Anthrachinone dyes	Red	Lac, Chromene dyes Cochineal, Madder (Majithro) Santalin
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CONCLUSION: Natural colours are made from renewable sources. They are extracted from plant material, insects, algae, cyanobacteria and fungi. Now a day natural colourants are formulated in various types of drinks and food. Legislation restricts on use of colorants are allowed, as well as sources used for that particular colorant. It also restricts on which solvents may be used for extraction and purification of colourants. Most of the pharmacological studies were preliminary, carried out in animals and are not sufficient for the development of a pharmaceutical product.

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