



A Review on natural colour yielding Plants

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Abstract

The demand for natural dyes has increased globally due to the awareness regarding the therapeutic properties of natural dyes in public. Sources such as plants, insects, animals and minerals serve for the purpose of natural dyes. Among all plant-based pigments serve as a wider source of natural colours and besides this, they also have wide range of medicinal values. Synthetic colours have been banned due to allergic and carcinogenic symptoms caused by them. People are preferring natural colours nowadays. Although plants have been known for a long time for dyeing as well as medicinal properties, the detailed study and the knowledge of the chemical constituents which are responsible for imparting the colour have been recognized only in the recent past. Many of the plants used for obtaining colours are grown on large scale as they are known for various other therapeutic benefits. The present review, describes the detail information about some plants possessing colour imparting chemical constituents.

Keywords: dyes, medicinal value, natural dyes, pigments, plants

Introduction

Naturally occurring sources such as plants (e.g., henna and turmeric); insects (e.g., cochineal beetles and lac insects); animals (e.g., some species of mollusks or shellfish); and minerals (e.g., Calamine and clay) without any chemical treatment^[1]. A spectrum of beautiful natural colours ranging from yellow to black exists in the above sources. These colours are exhibited by various organic and inorganic molecules (pigments) and their mixtures are due to the absorption of light in the visible region of 400-800 nm. Light absorption depends on the structure of the basic constituents of the colouring pigment/ molecules possessing various chromophores present in the dye yielding plant to display the plethora of colours^[2]. The uses of natural products together with their therapeutic properties is as ancient as human civilization and it has been mentioned in the ancient texts about mineral, plant and animal products as the main sources of drugs^[3]. Several synthetic colorants have been banned because they cause allergy-like symptoms or are carcinogens. The current preference for naturally derived colorants is due to their healthfulness and excellent performance. Nowadays, natural dyes are commonly used in the cosmetic industry due to no side effects, UV protection and anti-aging properties. Plant dye yielding plants which are cultivated in India are more than 450 in number. They are used as dyes as well as for other medicinal purposes. Natural dyes are ecofriendly as well as user friendly as for example, turmeric, the brightest of naturally occurring yellow dyes is a powerful antiseptic which revitalizes the skin, while indigo gives a cooling sensation^[4]. Plants which are being used to obtain natural colours are used as antimicrobial agents. For eg; Pomegranate. Acacia catechu also serves for the same property due to the presence of tannins in them. Several other sources of plant dyes rich in naphthoquinones such as lawsone from *Lawsonia inermis* L. (henna) exhibit antibacterial and antifungal activity^[5]. Some of the natural colour yielding plants are discussed as follows:

Acacia Catechu

Acacia catechu wild belonging to Family: Fabaceae and subfamily: Mimosoideae. The generic name, 'acacia', comes from the Greek word 'akis', meaning a point. Flavanoids: Catechin, (-) epicatechin, epigallocatechin, epicatechin gallate, epigallocatechin gallate, rocatechin, phloroglucinol, procatechuic acid, catecutannic acid, quercetin, quercitrin. Heartwood Alkaloids: Kaempferol, dihydrokaempferol, taxifolin, (+)-afzelchin gum. Leaves Glycosides: Poriferasterol, poriferasterol acylglucosides Tannins: Gallic acid, phlobatannins. Bark Sugars: D-galactose, d-rhamnose and l-arabinose^[6,7].

Lawsonia Inermis

Commonly known as Henna, belong to the Lythraceae family. It is indigenous to Africa. The active constituent of the leaf is Lawsone. Other constituents present are gallic acid, resins, sugars, tannins and xanthenes. Lawsone the main colouring constituent is said to be the degradation product of primary glycosides Henniside A, B, C. It is used as a favourite hair dye either alone or in combination for the treatment of gray hair. Henna imparts orange-red colour, which is stable in acidic medium^[8].

Bixa orellana

It is the plant also known as lipstick pods, belonging to the family Bixaceae. It is grown commercially as a dye. Annato seeds contain bixin dye. Bixin is the main constituent of the colouring pigment. It is a carotenoid carboxylic acid and is responsible for the yellow colour. Annato extracts are the potassium salts of norbixin. Bixin is antioxidant, hepatoprotective. Annato is used as colouring agent for foods, cosmetics, alcoholic and non-alcoholic beverages, dairy desserts etc.^[8]

Crocus sativus

Crocus sativus or kesar, belonging to the family Iridaceae is

used as a colouring and flavouring agent for food stuffs. Saffron contains red colouring matter known as Crocin and crocetin, bitter principle picrocrocin and traces of volatile oil. Protocrocin is a carotenoid glycoside. Crocins give blue colour in acidic medium. Saffron imparts yellowish brown colour to water. Crocus is also used as an antispasmodic and stimulant [8].

Pomegranate

It consists of fresh and dried fruits of the plant *Punica granatum*. Anthocyanins are water-soluble pigments primarily responsible for the attractive red–purple colour of pomegranate juice [9]. It contains chief constituents such as punicalagin, punicalin, gallic and ellagic acids [10]. It also contains alkaloids like isopelletierine [11]. *Punica granatum* dye and many other common natural dyes are reported as potent antimicrobial agents owing to the presence of a large amount of tannins [12]. Pomegranate fruit not only used as natural dye it also having traditional medicinal value is now supported by data obtained from modern science showing that the fruit contains anticarcinogenic agent [13, 14].

Tomato

It is widely used in worldwide food industry and it has potent anti-cancer property. It consists of fresh ripen fruits of plant *Solanum lycopersicum*. The major constituents of the tomato are lycopene, α and β -carotene, lutein, zeaxanthin and b-cryptoxanthin. Lycopene is a carotenoid that is present in tomatoes is responsible red colour of the fruit. It constitutes about 80–90% of the total carotenoid content of redripe tomatoes. carotene, the yellow pigment of the carrot is the isomer of lycopene [15]. In recent studies serum and tissue levels of lycopene were shown to be inversely associated with the risk of breast cancer and prostate cancer and also it is used to prevent all types of cancers in the body [16]. Lycopene is the most efficient antioxidant among carotenoids through its quenching activity of singlet oxygen and scavenging of peroxy radicals. Tomatoes are also used for the rich source of Vitamin-A [17].

Safflower

Safflower (*Carthamus tinctorius* L.) has a long history of cultivation as an oilseed crop and as a source of red dye (Carthamin). The main constituents of the safflower are carthamin and carthamidin [18] and other constituents are safflor yellow, arctigenin, tacheloside, N-feruloyl tryptamine, N-feruloylserotonin, steroids, flavonoids, polyacetylenes [19]. Carthamin is responsible for to produce water-insoluble red dye and carthamidin for water-soluble yellow colour dye [18]. Carthamin is extracted from its flowers and it is used for treatment in the form of infusion for circulatory system related diseases [20]. In addition to the colouring properties, safflower petals are used for curing several chronic diseases such as hypertension, coronary heart ailments, rheumatism, male and female fertility problems [21, 22].

Tagetes

Tagetes is popularly known as marigold, it contains carotenoid pigments from *Tagetes erecta* are useful in food coloring and it has medicinal activities. The principle colouring component of marigold flower is lutein, a fat-soluble carotenoid, which is responsible for the yellow to

orange colour of the dye [23]. It also contains galenine, lycopene, α -carotene, β -carotene and ν -carotene [24]. The whole herb is anthelmintic, aromatic, digestive, diuretic, emmenagogue, sedative and stomachic [25, 26]. It is used internally in the treatment of indigestion, colic, severe constipation 60, coughs and dysentery 61. Externally, it is used to treat sores, ulcers, eczema, sore eyes and rheumatism. The carotenoid extracts are acceptable for use in foods, pharmaceuticals and cosmetics [27].

Paprika

Paprika is obtained from the fruits of selectively bred varieties of 'sweet peppers', *Capsicum annum* L. The fruits are large, fleshy with an intense red colour and it has many medicinal uses. The pigments present in paprika are a mixture of carotenoids, in which capsanthin and capsorubin are the main compounds responsible for the red colour of the dye. The pungent compounds of the *Capsicum* fruit are called capsaicinoids such as capsaicin and its analogs [28]. It has a long history as a source of biologically active compounds, such as flavonoids, phenols, carotenoids, capsaicinoids and vitamins. *Capsicum* fruits contain colouring pigments, pungent principles, resins, protein, cellulose, pentosans, mineral elements and very little volatile oil, while seeds contain fixed (non-volatile) oil. Paprika is employed in medicine, in combination with *Cinchona* in intermittent and lethargic affections, and also in atonic gout, dyspepsia accompanied by flatulence, tympanitis, paralysis etc. It is used as a carminative, an appetizer, stomachic and also used in spices. Externally it is used as a counter irritant in the treatment of rheumatism, umbago and neuralgia [29].

Turmeric

Turmeric is commonly known as Indian saffron. It consists of dried, as well as fresh rhizomes of the plant *Curcuma longa* Linn. umbago and neuralgia. Turmeric contains about 5% of volatile oil, resin and yellow colouring substances known as curcuminoids. The chief component of curcuminoids is known as "curcumin". Chemically curcuma species contain volatile oils, starch and curcumin (50 – 60 %). Curcumin and other related curcuminoids are reported to be responsible for yellow colour of the dye.⁸ Curcumin from *Curcuma longa* has antioxidant, anti-inflammatory, anti-cancer and hepatoprotective. The pharmacological activities of curcuminoids are due to unique molecular structure. The phenolic yellow curry pigment curcumin used in the Alzheimer's disease, it involves amyloid (A β) accumulation, oxidative damage and inflammation potent [30]. It has anti-inflammatory effects in arthritis, possibly inhibits prostaglandin synthesis pathway of Cox-2 without causing ulcers in the GI tract [31]. Finally it has anti-platelet, anti-viral, anti-fungal, anti-bacterial effects (inhibits *Helicobacter Pylori*) and powerful antiseptic agent [32].

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