

Natural Dyes and its classifications

P.S. Devanand*, B. Sivakumar, K. Sivakumar, N. Raja, K. Hemaprabha, K. B. Sujatha, S. Utharasu, K. Kumar, R. Revathi

Faculties, Forest College and Research Institute, Mettupalayam 641301

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India has a rich plant biodiversity which is ranked 11th as biggest biodiversity in the world. It has approximately 4,90,000 plant species and there is no doubt that the plant kingdom is a treasure-house of diverse natural products. There are several plants / plant parts that provide natural dyes which are used in the textile industry. In many of the world's developing countries, however, natural dyes can offer not only a rich and varied source of dyestuff, but also the possibility of income through sustainable harvest and sale of these dye plants. Many dyes are available from tree waste or can be easily grown in market gardens. Recently, interest in the use of natural dyes has been growing rapidly due to the result of stringent environmental standards imposed by environmental board and pollution control board of many countries in response to toxic and allergic reactions associated with synthetic dyes.

Classification of Natural Dyes

Padma S Vankar has proved that dyes are classified based on their structure, source, method of application, color, etc. Two types of classifications are described below.

(a) Based on Chemical Structures

(i) Indigo dyes

This is perhaps the most important group of natural dyes, obtained from *Indigoferatinctoria* (Fig. 2.1).

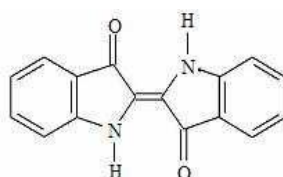


Fig. 2.1: Structure of indigo

(ii) Anthraquinone dyes

Some of the most important red dyes are based on the anthraquinone structure (Fig. 2.2). They are obtained both from plants and insects. These dyes are characterized by good fastness to light. They form complexes with metal salts and the resultant metal-complex dyes have good wash fastness.

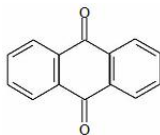


Fig. 2.2: Structure of anthraquinone

(iii) Alpha-hydroxy-naphthoquinones

The most prominent member of this class of dyes is lawsone or henna, obtained from *Lawsoniainermis* (Fig. 2.3). Another similar dye is juglone, obtained from the shells of unripe walnuts. These dyes are generally dispersing dyes and give shades of orange.

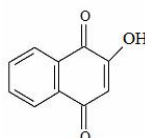


Fig. 2.3: Structure of alpha-hydroxy-naphthoquinone

(iv) Flavones

Flavones (Fig. 2.4) are colourless organic compounds. Most of the natural yellows are derivatives of hydroxyl and methoxy substituted flavones and isoflavones. Common example is weld (containing luteolin pigment) giving brilliant and fast colours on both wool and silk.

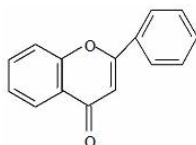


Fig. 2.4: Structure of flavone

(v) Dihydropyrans

Closely related in chemical structure to the flavones are substituted di-hydropyrans, *viz* (Fig. 2.5). haematin and its leuco form, haematoxylin. These are important natural dyes for dark shades on silk, wool and cotton. Logwood, Brazil wood and Sappan-wood are the common example.

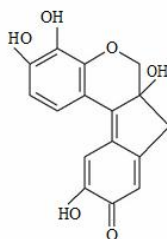


Fig. 2.5: Structure of dihydropyran

(vi) Anthocyanidins

The naturally occurring member of this class includes carajurin, a direct orange dye for wool and cotton. It is obtained from the leaves of *bignonia chica* (Fig. 2.6).

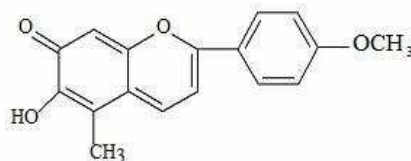


Fig. 2.6: Structure of anthocyanidin

(vii) Carotenoids

The class name carotene (Fig. 2.7) is derived from the orange pigment found in carrots. In this color is due to the presence of long conjugated double bonds. Example: Annatto and saffron.

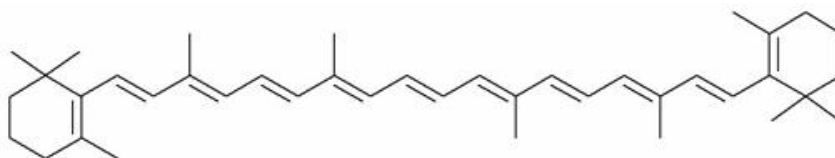


Fig. 2.7: Structure of carotene

(b) Based on color

Various natural dyes are present in all the colors of the visible spectrum. The natural color and hue of a dye can be altered by treating with metal salts. If the dye is of plant origin, the color may vary depending on the soil properties, part of the plant, season of harvesting, cultivation practices, etc.

(i) Blue dye

The only viable choice among the blue natural dyes is indigo. Natural indigo is obtained by fermenting the leaves of various species of *Indigofera*, running off the liquor to precipitate the dye. Woad (*Isatis tinctoria*) is another important source of indigo.

(ii) Red color

Most red dyes are found in roots or barks of plants or camouflaged in the bodies of dull grey insects. The sources of red color are limited. Cochineal is an important red dye and it is the brightest of all the available natural red dyes.

Examples

- (i) Manjith and Kusumbar among the vegetable sources.
- (ii) Lac and Kermiz among the animal sources.

(iii) Yellow color

Yellow is the most common color in the natural dyes. However, most of the yellow colorants are fugitive. Some of the important yellow dyes are obtained from Barberry (*Berberis aristata*), Tesu flowers (*Butea frondosa, monosperma*) and Kamala (*Mollotus philippensis*).



Utilization Of Natural Dyes

Gulragani *et al.*, has shown that classification of natural dyes based on applications. These are:

(a) Substantive Dyes (or) Non-mordant Dyes

This is a first group of natural dyes, which produce a fast color on textile materials directly by boiling.

Example

Indigo, Orchil, Turmeric, etc.

(b) Adjective (or) Mordant Dyes

This is a second group of natural dyes, which needs an additional chemical (mordant) to make the permanent color, is termed as adjective or mordant dyes. In pure state these dyes are generally slightly colored and when used alone give poor dyeing.

