AgriCos e-Newsletter
ISSN: 2582-7049
AgriCos e-Newsletter
Open Access Multidisciplinary Monthly Online Magazine
Volume: 03 Issue: 12 December 2022 Article No: 03

Natural Dye Yielding Plants - Alternative to Synthetic Colours

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SUMMARY

Natural dyes are known to be used since historic times for colouring food substrate, leather, as well as common textile fibres. However due to the advent of synthetic dyes and their good fastness properties in comparison to natural dyes, the use of natural dyes have suffered drastically. But the safety of products containing synthetic dyes has been a point of debate for decades which have deleterious effect on human health and environment. Recently, the concern for the environment has created an increasing demand for natural dyes. Hence, the use of natural dyes has once again gained the interest.

INTRODUCTION

Natural dyes are dyes or colorants derived from plants, invertebrates or minerals. Majority of natural dyes are of vegetable dyes from plant sources – roots, berries, bark, leaves *etc*. In India more than 450 plants are reported which can yield dyes (Siva 2007). In addition to their dye-yielding characteristics, some of these plants also possess medicinal value.

Advantages of natural dyes

In the present scenario, due to the excelling advantages of natural dyes, it is becoming an enticing option over synthetic dyes. These are as follows:

- Natural dyes are less toxic, less polluting, less health hazardous, non-carcinogenic and non-poisonous.
- They are harmonizing colours, gentle, soft and subtle and create a restful effect.
- They are environment friendly and can be recycled after use.
- Aesthetically appealing resulting in employment generation and utilization of wasteland.
- Easy extraction of colours by boiling the plants, berries, leaves, bark or flower heads in water.
- Focus towards the utilization of the vast diversity of natural resources of colour pigments for their use in food materials, pharmaceuticals and textiles, in place of their synthetic counterpart.

Application of natural dyes

Textile colouration and finishing

The application of these non toxic and eco-friendly natural dyes for textiles and clothing has recently attracted consumers attention, due to the dyes characteristics of being safe, harmless, less toxic, less allergenic and their ability to raise environmental awareness related to natural, sustainable or recyclable materials

- The extract of henna can be used for coloration of cotton and silk fabric which has good exhaustion percentage, wash, rubbing and light fastness
- The application of a used coffee ground resource might help to strengthen long-term economic viability and byproducts and promote suitable environmental management strategies to minimise negative impacts caused by the use of chemical textile dyeing materials.

Food colouration

Colour is a measure of quality and nutrient content of foods. The objective of adding colour to foods is to make them appealing, augment the loss of colour during processing, to improve the quality and also to influence the consumer to buy a product. Lac dye was applied in comminuted meat products to obtain a bright red colour replacing synthetic dyes (Divya *et al*. 2011). Annatto extracts are natural yellowish orange colour obtained from the outer coats of the seeds are commonly used in the dairy industry for coloring cheese and other dairy products. For more than a hundred years annatto extracts have been added to numerous foods such as sweets, ice cream,

dressings, and dairy products to produce an intensive colour. Because of its use in butter, margarine and cheese, annatto was formerly declared as “butter colour” or “cheese colour” (Collins, 1992).

Natural dyes approved by FDA

Colour	Year Approved	Restrictions if any
Annatto extract	1963	-
Dehydrated beets (beet powder)	1967	-
Canthaxanthin	1969	Foods generally, NTE 30 mg/lb of solid or semisolid food or per pint of liquid food
Caramel	1963	Foods generally.
β-Carotene	1964	Foods generally.
Cochineal extract	2009	Food label must use common or usual name "cochineal extract"; effective January 5, 2011
Paprika	1966	-
Paprika oleoresin	1966	-
Riboflavin	1967	-
Saffron	1966	-
Spirulina extract	2014	Candy, chewing gum, confectionery,bakery
Lutein	1968	-
Tomato lycopene extract	2006	-
Turmeric	1966	-
Turmeric oleoresin	1966	-

www.fda.gov

Medicinal properties of natural dye yielding plants (Siva, 2007)

Botanical name	Parts used	Colour	Medicinal uses
Acacia catechu Cutch tree	Bark	Brown/black	For sore throat and cough.
Adathoda vasica Adalsa	Leaf	Yellow	Used in bronchial infection
Butea monosperma Flame of forest	Flower	Yellow, orange	Used for piles, tumour and menstrual disorders
Indigofera tinctoria Indigo	Leaf	Blue	Extract used in epilepsy and other nervous disorders; in the form of ointment used for sores, old ulcers and piles.
Lawsonia inermis Henna	Leaf	Orange, red	Used as prophylactic against skin disorders.
Morinda citrifolia Noni	Root	Red, yellow	Fruits used for spongy gums, throat infection, dysentery, leucorrhoea and sapraemia.

Nerium oleander Nerium	Roots, Barks	Black	As cardiotonic, diuretic
Nyctanthes arbortristis Coral jasmine	Flower	Yellow	Used in rheumatism and fever
Punica granatum Pomegranate	Exocarp	Yellow, Brown	Exocarp; for diarrhea, as anthelmintic Flowers; for hypertension
Rubia tinctoria Madder	Roots	Red	As diuretic, laxative
Crocus sativus Saffron	Stigma	Yellow	Flowers; as sedative, menstrual cycle regulator, appetizer
Caesalpinia sappan Sappanwood	Wood, bark	Red	Decoction provides relief in mild cases of dysentery and diarrhoea
Catharanthus tinctorius Safflower	Flower	Red	Oil applied to sores and rheumatic swelling; also used in case of jaundice.
Jatropha curcas Physic nut	Bark, leaf	Blue	Used in dropsy and paralysis, and externally for skin disorders and rheumatism.

Dye yielding plants in pharmaceutical products

Colouring agents are added to pharmaceutical products for a variety of reasons. They enhance product appearance, aesthetic appeal and product elegance, leading to improved product acceptability by patients. Colorants improve product identification for the manufacturer, healthcare professional and patients. They enhance the stability of photosensitive compounds by providing protection from light. Colouring agents also provide a measure of protection against product counterfeiting. The peculiar intense red pigmentation of *Hibiscus sabdariffa* calyx extract as well as its antioxidant properties has been exploited for various applications in the food industry and medical research. It can be used as potential colourant in three pediatric oral pharmaceutical products, namely; paracetamol syrup, diphenhy dramine syrup and cough linctus.

Natural dye yielding plants in histological staining

Most chemically-synthesized stains used in histological practices are expensive, hazardous to human and animal health, and threatening to the environment. Extraction of natural dye out of local plants have gained global interest and give promising tissue staining when outcomes are investigated. *Curcuma longa* rhizomes are proven to contain curcuminoids that exhibit various medicinal properties, and curcumin the bright yellow component of the plant that is being used as colorant. This natural dye from *C. longa* provides significant alternative as they are safer to use without health hazards, biodegradable, and have easy disposability.

Natural dyes based products at CSIR-NBRI available for commercialization (http://servicemanager.net.in/)

Herbal Gulal – Plant product based dry colour for holi and rangoli. No side effects.

Herbal Sindoor – Non toxic, without heavy metals.

Herbal Hair Colour– Useful as colouring agent for hair without any chemicals.

Herbal Lipstick – Safe and eco-friendly cosmetic composition containing natural colours developed from herbs, fortified with various aromas.

Herbal Lip Care Formulation – Keeps lips hydrated and prevents from cracking.

Natural colours – For application in cosmetics.

Lip Balm – A herbal formulation jointly developed by CSIR-NBRI & CSIR-CIMAP for protection of lips.

CONCLUSION

Non-toxic, non-carcinogenic, bio-degradable and eco-friendly characteristics of natural dyes made their way to reach the hearts of conscious consumers for healthy lifestyle. With increased awareness on the use of eco-friendly materials from sustainable resources, natural dyes attracted researchers to work on their traditional and diversified applications to develop effective eco-friendly products in various sectors.

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