

Commercial viability of natural dyes

Heena, Harda, Catechu and Babool for textile dyeing

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Introduction

The traditional cultivation of plants was labour intensive, as was the processing and the resulting gross margin was small. Higher yielding varieties, modern production and processing techniques which have been developed recently would definitely increase the gross margin for the dyers. Investigation has been carried out to standardize the condition of dyeing with four dyes, Heena, Harda, Catechu and Babool specifically focussing for commercialization by increasing natural dyes market share which demands the following:

- Improve dye extraction from these targeted botanicals.
- Establish long-term sustainability and dye yielding sources using plant parts which are reproduced.
- Increase technical ratings, lower costs and improve reproducibility for the textile markets.
- Develop a full spectrum of quality natural dye extracts along with the best application technology and ecological processes.
- Develop the necessary technology to apply natural dyes to textiles, such as cotton, wool and silk and particularly for value added products.
- To educate the consumer on the economic, ecological, aesthetic and

social advantages of these natural dyes, which are readily and abundantly available in India.

India figures prominently in the art of natural dyeing and also because of their low labour rates it will help offset the higher costs of the natural dyeing process. In addition, our country already has long traditions of natural dye use, process and a constant supply of raw materials to extract dyes. Natural-dyed products thus represent a good opportunity for value-added exports from our country that already is world leader in cotton textile manufacturing, but on the whole the natural dye market does not show signs of much expansion, as industrial dye manufacturers fight to secure a growing market share for their organic substitutes. Colorant-containing plants are unlikely to be available as fresh material through out year but have a seasonal production cycle. But in the case, where focus is being given on the barks and leaves, it is possible to preserve the material and retain the colorant easily.

In order to revive the natural dyeing tradition newer sources of natural dyes are also being trapped for this purpose. Any part of any plant which yields

dye from 1-4 % can be considered as a potential source of natural dye. These dyes are known as mordant dyes as they require the inclusion of one or more metallic salts of aluminium, iron, stannous and stannic salts and other for ensuring reasonable fastness of the colour to sunlight and washing. These metallic salts are added to the dyestuff for producing dye aggregates which can not be removed from the cloth easily.

We tried to look into the commercial aspect of colouring capacity of brightly coloured plant product for value addition products. Hence, commercial viability of Natural dyes—Heena, Harda, Catechu and Babool for textile dyeing is presented in this review.

Heena (*Lawsonia inermis* Linn.), belonging to the family *Lythraceae* is a shrub 3-5 m in height and bearing green, ovate-lanceolate leaves and small white sweet smelling flowers. It thrives in hot dry climates. Powdered (young) leaves of the plant have been used from ancient times in Middle East and Southern Asian countries for dyeing hair and nails. The dyeing process is a chemical property of a brown tannin like resinoid substance called hennotannic

acid. The main colourant in the plant is lawsone, an alpha naphthaquinone hydroxy derivative. It produces yellowish green tones.

Harda (Chebulic Myrobalan) is obtained from the fruits of *Terminalia chebula* Retz. It belongs to family *Combretaceae* and is a small to medium sized tree. The fruit is obovoid or ellipsoidal and glabrous. It contains 30-32% natural tannins. It is used both for dyeing as well as auxiliary for



Terminalia chebula Retz.

dyeing. The chemical constituents of the fruits are anthraquinones, chebulic acid and hydrolysable tannins. The main two hydrolysable tannins are gallotannins and ellagitannins.

Catechu, also known as Cutch or Katha is obtained from *Acacia catechu* Willd. which belongs to the family *Mimosaceae*. It is a moderate sized deciduous tree with rough, dark grayish brown bark. It is a native of Central and East Africa, Southern Asia, Bhutan, Burma, China, India, Myanmar, Nepal and Pakistan. The plant is used for fodder, fuel and Katha paste. Cutch is a very easy dye to work with. It shows

excellent fastness on cotton and silks. It produces brown tones. The dyeing process is a

chemical property of a brown tannin called catechu-tannic acid. The main colourant in Catechu is catechin which is not soluble in cold water. When pure, it forms minute, colourless crystals,

which are acted on by alkalies, causing them to absorb oxygen, giving a yellow, then red, and finally a black colour.

Babool [*Acacia nilotica* (Linn.) Delile subsp. *indica* (Benth.) Brenan syn. *Acacia arabica* Willd.] is a shrub belonging to the family *Mimosaceae*. It is primarily used for fuel-wood, timber, agro-forestry and for vegetable tanning. Bark is grey to brownish black, rough and longitudinally fissured. Ten year old trees yields about 35-40 kg of bark. The bark powder is astringent in nature and there is only one report where *Acacia* has been used as dye in Nigeria. Gum Arabic is a by-product of this tree, which is used in calico printing and dyeing. The Babool bark primarily consists of tannins of two types- Hydrolyzable tannins and Proanthocyanidins.

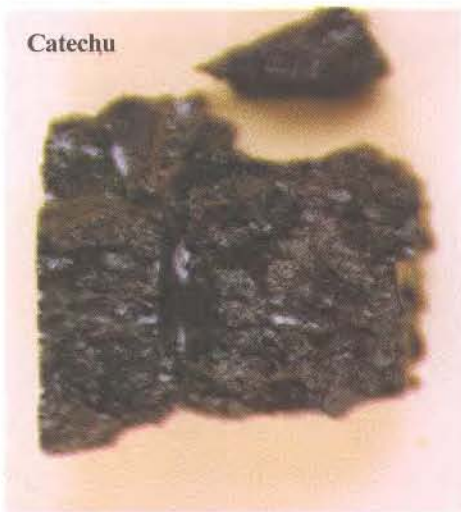
Colour spectrum from these dyes

In the case of **Heena** colour ranges was from yellow to green to brown with different mordants. The acidic dye extract was lighter shade of orange-brown as compared to neutral medium. Basic extract of the dye showed darker yellow colour. **Catechu** colour ranges from light brown to dark brown with different mordants. The dye extract gave brown. **Harda**, the colour ranges from ivory to cream to brown with different mordants. It was observed that dyeing with **Babool** bark powder the colour range varies from skin colour in the case of stannous chloride to dark brown in the case of ferrous sulphate.

Dyeing cost

The price of a natural dye would be set by the prices commanded by the synthetic dyes, but the cost would have to take into account the generally lesser tinctorial strength compared to synthetic dyes and relatively low yield of dyes in plant material plus any processing costs. Metal contamination of effluent from mordants used in processing with natural dyes, using current technology of sonicator dyeing has brought the discharge to sewers in acceptable levels. We have re-engineered the process to reduce contamination levels in each case. Economical usage of mordants (4-5 %) has been found to be optimum. While evaluating the commercial viability of any of the natural dyes mentioned above, it is important to consider the costs of dyestuff and processing together. **Heena** is readily available at Rs 100 per kg, **Catechu** at Rs 375 per kg, **Babool** for Rs 200 per kg and **Harda** for Rs 250 per kg. Cost of mordants are: alum -Rs 208, stannic chloride-Rs 4150 per litre, stannous chloride-Rs 1120 and ferrous sulphate-Rs 146 per litre. The cost for

Catechu



Babool bark

dyeing is marginally high as compared with synthetic substitutes because standardisation and re-dyeing is necessary for proper shade matching. Although for some natural dyes, the use of mordant, extraction of dye from raw material, low colour value and lengthy dyeing procedures add to the cost of dyeing but with these 4 dyes it is not the case. Very attractive shades are obtained with these dyes having excellent fastness properties. Soaking and extraction of natural dye in sonicator on large scale is easy, not only results in low investment cost but also a reduction in natural contaminants. Such an extraction provides scope without further purification of the dyes using the dye at low cost. One sonicator machine can be used for dual purpose-for extraction as well as dyeing.

Conclusion

Commercialization of natural dyes can be done successfully by a systematic and scientific approach to extraction, purification and use of natural dyes. Optimisation of extraction conditions is must to minimise the investment cost and to avoid discrepancy in the dyed shade quality. Thus we can conclude that **Heena** shows colour range from dark orange-brown to yellowish brown and greenish brown to dark brown in different mediums. Basic medium show darker shades in all the cases. The washing and light fastness are fairly good. Since the leaves grow in abundance **Heena** can be a potentially good source of natural colorant for textiles on industrial scale.

Catechu shows colour range from skin colour to dark brown, giving different tones of brown. The washing and light fastness are very good. Since the tree grows in abundance it can be a potentially good source of natural colorant for cotton fabric on industrial scale. Catechu will certainly find its place in textile dyeing as a natural colorant on commercial scale.

Harda shows colour range from ivory to cream to yellow. The washing and light fastness are fairly good. Since the tree grow in abundance in Tarai region above 1000 m altitude, it is abundantly available and is a potentially good source of natural colourant for cotton fabric on industrial scale. Myrobalan already established as leather tanning agent will certainly find its place in textile dyeing as a natural colourant on commercial scale.

Babool bark dyeing can be industrially very economical and useful. These dye powders are readily available in the crude form as well as refined dye is available with several natural dye dealers such as Rohini Herbals, Indore, Alps Industries, Ghaziabad and Delux Dyes, Chennai. Its commercial use shall the health hazards caused by the use of synthetic dyes. We can thus conclude that these natural dyes will occupy a larger market and such market will be driven by consumer demand and the legislation for eco-friendly textiles.

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