

1. Introduction

Consumer products are liked by the buyers based on their appearance and efficiency. Appearances of the products are enhanced by the brilliant colors present in the products. Color of the product is a deciding factor in marketing. The colors are given to products using synthetic and natural methods. Natural color dye yielding sources are given high attention now a days. Getting coloring material or dye suits paintings, wall images, fabrics, or other form of visual arts from natural products are known to the world several thousand years ago. The pre historic temple, cave paintings, art work etc stands an example for this. The color of the wall or other objects in the houses is believed to drive away evil spirits from the houses (Siva, 2007). As natural dyes are safe, non-toxic ecofriendly and pleasing much attention is focused on Natural dyes. There are many plant sources to get natural dyes but they are less explored.

If the natural product derived colors adorns the consumer goods, fabrics, handicraft products and children toy, there will be a good demand. But there is no experimental proof to explain how different colors can be developed by mixing different plant products. Hence in the present study plants available in the South Tamil Nadu are to be tested to derive most suitable color for different products. This natural dye in fabrics can protect the humans from synthetic color induced skin problems like tumour formation (Kumaresan et al., 2011).

Of the different natural dyes, the yellow color yielding turmeric has been studied well (Siva, 2017).

In recent days due to increasing awareness of environmental issues and pollutants produced by the synthetic colorant (Ali and Mohamed , 2011) , plant dyes are given importance. The use of natural plant color for the coloring the cloth has become much attraction due to eco friendly textile production and sales (Samanta and Agarwal, 2009). Eco- friendly mordant is also used in dyeing (salt mordents) (Chariat *et al.*, 2011). Natural mordents are taken from fruits , leaves, seeds, barks etc. Natural mordants are important for natural dyes to increase the fastness property of the textiles and those mordants are also free from toxic and carcinogenic effect (Amita singh and Charu swami, 2016).The natural dyes also play a role in coloring the fibre from the natural plant source that are used in handicrafts, mat weaving and basketry and other craft work. The natural dye has also an application in producing the products used by kids. It can also be used to prepare fabrics, consumer craft materials toys. Some of the natural dyes can be used to replace synthetic dyes in baby food. From the synthetic colored products, the toxic color can enter children body.

Therefore, there is a need to develop suitable coloring material from natural products (Venkatasubramanian *et al.*, 2011).

The present study is focused on 6 dye yielding plants which are less known for dyeing consumer products. The studies also stress the need to conserve of those less known natural dye yielding plants.

2. Materials and Methods

The plant *C.sappan* (wood), *M.champaca* (flower), *N.arbor tristtis* (flower), *R.cordifolia* (stem), *C.longa* (rhizome) and *A.catechu* (cutch) were selected for preparing dyes.

Fibre materials used in dyeing (Consumer Products)

For several consumer goods Sisal fibres are used. The Sisal leaves were collected from Chokkalinga puram, and nearby my village in Tirunelveli district. Then the fibres were separated from the leaves by hand and dried in sunlight before storing in stock rooms.

Banana fibre was collected directly from Marthandam. The Samba grass (reed) was collected from Thangajothi's natural crafts, Punniyadi, Kanyakumari district. The Korai grass was collected from Kanyakumari. The Palm leaf were collected from Tirunelveli district and dried in sunlight before cutting it in to different shape and size material.



Sisal Fibre

Banana Fibre

Sambu Grass

Korai Grass

Palm Leaf

Sisal fibre are used to make twines, ropes and in low-cost special papers, filters, geo textiles, dartboards, carpets, handicrafts, wire, cloth, mattresses, and rope coirs. Sisal fibres are good substitute to plastic (www.worldjute.com/about_jute/sisal.html). Banana fibre is eco friendly and can be easily blended with other fibre such as mestha and jute. Products like, carpets, door mats, bags etc., are produced. (<https://dir.indiamart.com> >Yarns & Threads >Fibres).

Sambu grass - Natural sambu grass fibre are loomed to make yoga mat (www.exportersindia.com/yaazhtex-company4484502/products.htm).Korai grass is used for manufacturing Mats (Pattamadai Pai). The Korai grass mats produced in Tamil Nadu have Korai wefts and cotton warps (www.heartforartonline.com>Products).Palm leaf products are having a lot of applicatios.(Table mat, market bag, waste paper baskets, laundry boxes, Telephone mat, Fruit dishes, etc.) (orissapalmcrafts.com/files/File/Palm%20leaf%20times.pdf).

Mordants

The mordants were prepared from the cost effective easily available sodium hydroxide , sodium bi carbonate (soda salt), lemon fruit juice, tamarind fruit juice, banana stem juice, cashew fruit juice and alum. The prepared mordants were stored in freezer.

Preparation of mordant

The mordant were prepared (5%) for dyeing on fibre materials

Mordant name	Mordant (ml)	Distilled water (ml)
Salt (Sodium hydroxide)	25 ml	475 ml
Sodium bi carbonate		
Lemon fruit juice		
Tamarind fruit juice		
Banana stem juice		
Cashew fruit juice		
Alum		

Vessels

The vessels used are mud pot, silver, aluminum, brass, glass, copper and iron vessels.

Methods of Dyeing on substrate

i) Before dyeing the material were soaked in water for overnight, for enhancing the softness of substrate. Next day the fibres were introduced into 500ml of boiling water vessel and boiled. After cooling 20g of dye extract (powder) was poured in to the vessels. Then temperature is raised to 70 – 80°C. The mordant was added to the vessel. After that the heating process was continued for 5 minutes. Finally the material was taken out from the vessels and washed in running water. The washed material was tested for color fastness properties in light, wash and rub fastness. This procedure was followed for all the dyes prepared from the 6 dye yielding plants using different mordants in different vessels.

Color retaining tests:

The color of the material developed using natural dye should withstand light exposure. The color should not get faded when exposed to sunlight for at least for 12 hrs duration. Further the developed color should not get removed or damaged while washing. So the color retention of the fabric will be tested by using non – ionic soap solution for 3 times (1g/lit). The color retention ability is further tested by doing rub fastness tests. The colored material is rubbed using

hand, sponge, etc to check whether the color is present or not (Kulkarni *et al.*, 2011 and Mishra *et al.*, 2012).

3. Results and Discussion

Coloring Characterized on Fibre materials

The dyes were tested for their retain ability in the fabrics using few tests. The mordants used play a role in coloring. *Caesalpinia sappan* dye produced dark salmon, golden red, brown, black, orange, yellow colours to all the natural fibres selected with addition of the mordants sodium salts, sodium bicarbonate, lemon fruit juice, banana stem juice, cashew fruit juice, tamarind extracts and alum respectively by using seven separate vessels (Fig 1, 2 & 3).

Nyctanthes arbor-tris-tis dye produced yellow, gold, dark orange, sandy brown colours to all natural fibres selected with the addition of the mordants salt, sodium bicarbonate, lemon fruit juice, banana stem juice, cashew fruit juice, tamarind extracts and alum respectively by using seven different vessels (Fig 4 & 5).

Rubia cordifolia dye produced dark, orange, metallic gold, Indian red, brown, black, dark red and brown colours to all natural fibres selected with the addition of the mordants Salt, sodium bicarbonate, lemon fruit juice, banana stem juice, cashew fruit juice, tamarind extracts and alum respectively by using seven different vessels (Fig 6 & 7).

Acacia catechu dye produced pale golden red, dark salmon, sandy brown, brown, black, to all natural fibres selected with the addition of the mordants Salt, sodium bicarbonate, lemon fruit juice, banana stem juice, cashew fruit juice, tamarind extracts and alum respectively by using seven separate vessels (Fig 8 & 9).

Michelia champaca dye produced dark brown, light brown, black, orange, and maroon colours to all natural fibres selected with the addition of the mordants Salt, sodium bicarbonate, lemon fruit juice, banana stem juice, cashew fruit juice, tamarind extracts and alum respectively by using seven different vessels.

Curcuma longa dye produced yellow, gold, light orange, dark orange, sandy brown, dark golden rod and brown, colours to all natural fibres selected with the addition of the mordants Salt, sodium bicarbonate, lemon fruit juice, banana stem juice, cashew fruit juice, tamarind extracts and alum respectively (Fig 10 & 11).

Color Fastness Properties

In the present study 6 plants are used to prepared the dyes. Samanta and Agarwall (2009) reported that the flowers extract used dye is highly promising. The color retention in the fabrics even after repeated washing shows that the dyes have got penetrated into the inner side of the yarns (Joshi. 2008). Usually if the colored fabrics are rubbed against any object the coloration

will be faded. But if the material retains the color even after several rubbing it indicates its good retainability. In this study dyes prepared from *C.sappan*, *N.arbortristis*, *R.cordifolia*, *M.champaca*, *A.catechu*, *C.longa* (Samanta and Agarwal, 2009).

In this experiment it is revealed that the use of different plant dye (color)and mordants can be used to make good looking traditional consumer fibre products. This will give value addition to the handicraft products with antimicrobial potential.

Present finding will be very supportive to the textile industries, traditional consumer product producers, handicraft producers and korai mat producers .Using theh different colours such as *C.sappan* heartwood (dark red, golden red etc), *Nyctanthes arbortris-tis* flower (yellow, dark orange, maroon colour etc), *R.cordifolia* root (brown, dark brown, dark red and black colour ect), *A.catechu* cutch (golden red, saddle brown, black and dark brown etc), *M.champaca* flower (orange, yellow, light golden yellow etc), *C.longa* rhizome (yellow, golden yellow, orange, etc). .From this study it is clear that the dye derived from six plant sources are good and didn't get faded even after washing, exposure to light and rubbing.



Table 1. Dye Yielding plants chosen for the study

Plant	Parts used	Colour obtained	Pigment
<i>Caesalpinia sappan</i>	Heart Wood	Red	Brazilin, Sappan red
<i>Nyctanthes arbortristis</i>	Flower	Yellow	Rengyolone
<i>Rubia cordifolia</i>	Root	Red and brown	Purpurin, Rubiacordone
<i>Accacia catechu</i>	Cutch	Brown/ and black	Catechin, Catechutanic acid
<i>Michelia champaca</i>	Flower	Yellow	Iriodenine
<i>Curcuma longa</i>	Rhizome	Yellow	Curcumin

Table 2. Dye retention potential in the fabrics that were dyed with natural dyes prepared.

Plant	Fastness properties of dyeing fibre		
	Light fastness	Wash fastness	Rub fastness
<i>Caesalpinia sappan</i>	Excellent	Good	Good
<i>Nyctanthes arbortristis</i>	Good	Good	Good
<i>Rubia cordifolia</i>	Good	Good	Good
<i>Accacia catechu</i>	Good	Good	Good
<i>Michelia champaca</i>	Good	Fair	Fair
<i>Curcuma longa</i>	Good	Good	Good

Fig.1.Fibre without dye with different mordant and vessels



Fig. 3. Dyeing the raw material (fibres) using different mordant to produce ornamental products with *Caesalpinia sappan* heart wood dyes

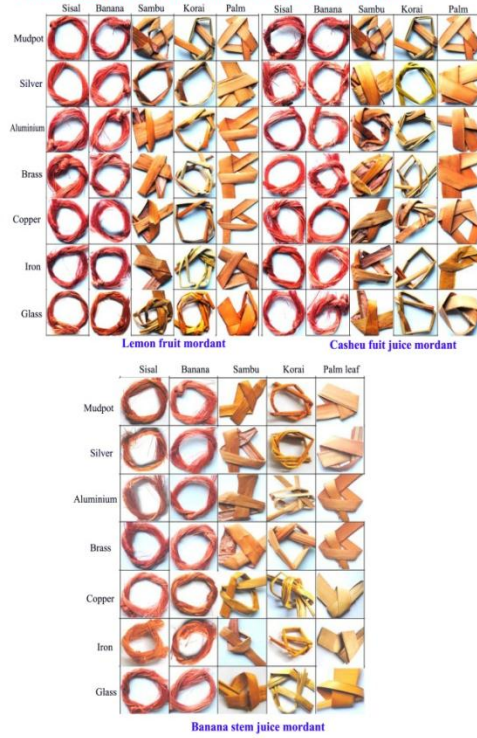


Fig.2. Dyeing the raw material (fibres) using different mordant to produce ornamental products with *Caesalpinia sappan* heart wood dyes

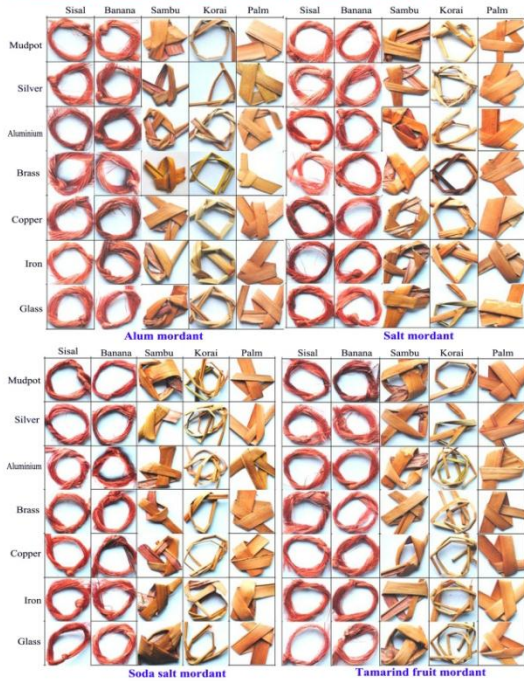
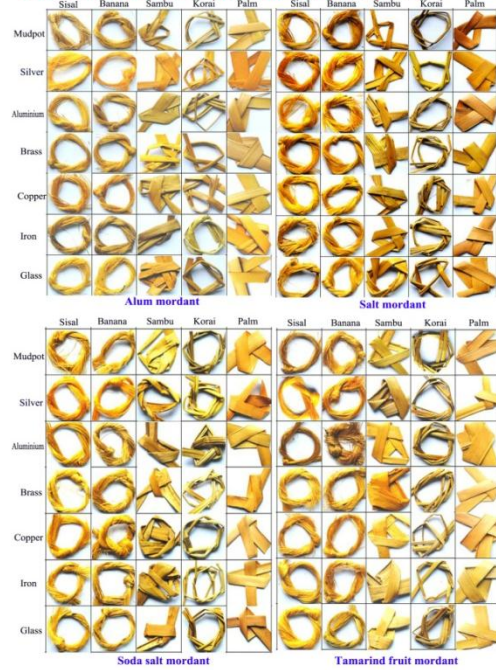


Fig.4. Dyeing the raw material (fibres) using different mordant to produce ornamental products with *Nyctanthes arboris-tis* flower dyes



4. References

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