



## RESEARCH ARTICLE

# Eco-friendly natural dyes and their application on printing graphics

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## Abstract

Natural dyes, which have been pushed to the background by synthetic colors over the past sixty years, have suddenly resurfaced as a source of consumer interest. This is because of the familiarity with potential dangers during the innovation of engineered colors, including the utilization of petrochemical-based unrefined components and the brutal substance responses for their combination. The production of engineered colors is energy concentrated with an unfriendly effect on climate, adding to its contamination. Many of these colors, particularly the azo-based ones, are considered cancer-causing. A brief examination of natural colorants derived from plant sources, their sequence, and the component ingredients responsible for diverse shadings is provided in this foundation, its exercises and the impact of various mordants on the tone is talked about. Various classes of mordants utilized for the obsession of regular coloration on materials substrated, its instrument and plant sources are likewise examined.

**Keywords:** Natural dyes, Natural mordants, Textiles, Sources.

## Introduction

Professionals in the field of graphic design develop visual content to convey messages. Originators utilize typography and graphics to satisfy customers' specific needs by using visual progression and page format processes, and they focus on the rationale of exhibiting components in sensible plans to improve the client experience. Visual depiction requires basic reasoning and exhaustive perception to recognize and break down an issue. It's here to satisfy the eye, yet to likewise think of the most viable arrangement (Mehta, 2013). The work job of Style Visual Architects' obligations likewise includes: investigating style, new color and print procedures, sourcing prints and supporting strike offs for the design retail organization.

It is an interdisciplinary part of a plan whose establishments and targets rotate around the meaning

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of issues and the assurance of destinations for dynamic, through innovativeness, development, and parallel intuition alongside computerized instruments, changing them for legitimate understanding. This trend contributes to the improvement of realistic correspondences. The procedure is turning out to be increasingly more fundamental for viable visual depiction.

The procedure is turning out to be increasingly more fundamental for viable visual depiction. The fundamental qualification among style and climate is that visual communication takes care of an issue just as being tastefully satisfying. The point at which methodology enters the picture is at this point of equilibrium. Both Planning designs and imprinting on the garments are related. Printing is a cycle for mass replicating text and pictures utilizing an expert structure or layout. Printmaking is the method involved with making craftsmanship by imprinting on paper and different materials or surfaces. The cycle is set up to produce prints, which are products of a comparable piece of labor. Each print is distinctive; they are called impressions (Shahidullah et al., 2008). Prepress is the place where all the plan work is deciphered from a record on the PC before you put into a structure that can be 'imprinted' onto a given surface.

## Toxins in Dyes

Did you know that your skin helps you stay healthy by releasing up to 1 pound of pollutants per day? Toxin release is slowed by petrochemical fibres such as nylon,

polyester, acrylic, acetate, and triacetate. Popular marketing buzzwords like “sweat-wicking” and “performance textiles” (Mehta, 2013) should not be taken lightly. These opulent claims imply a high synthetic fibre content that suffocates your skin. Synthetic textiles can cause everything from headaches and nausea to skin rashes and breathing problems. One of the most common components of our clothing is chemicals. They’re used in every one of our units for fibre manufacturing, dyeing, bleaching, and wet processing. Most of these synthetic compounds are found in the material business’s colors and m A portion of these substances can be perilous and can be delivered into the climate through the creation, utilization, and removal of textures, influencing the climate and individuals’ wellbeing. The perilous synthetics found in the material business incorporate weighty metals, alkylphenols (utilized during washing and coloring), phthalates (connected to the utilization of PVC in prints, for instance), or perfluorinated substances (utilized in conclusive medicines like an enemy of stain or waterproofing)” (Yeomans, 2018).

### **Textile Toxicity**

A few organizations have focused on progressively disposing of the utilization of certain harmful synthetics from their creation interaction, yet not all which makes it progressively important to see clothing names to perceive what an article of clothing is made of and acquire data on its tendency and how the crude material was dealt with.

“Undyed regular natural textures are awesome for our genuine feelings of serenity. Dim or splendid shadings demonstrate the utilization of substantial metals. As purchasers, we can ask producers and look for general data in web journals or distributions on maintainable design that show us manageability”. Despite the fact that there are at present no particular certificates that report solely on the poisonous synthetic compounds contained in dress, there are a few affirmations that ensure manageability in specific cycles inside the creation chain like Blue Sign, Textile Exchange, or GOTS, among others, with the first being the most explicit concerning the guideline of destructive substances (McGwin, Lienert & Kennedy, 2010).

### **Impact of Dyes**

Azo colors, which make up 60–80% of all colorants, are what give many textiles, especially clothes, their distinct shadings. Azo colors can, without much of a stretch falloff texture and can separate to deliver synthetic compounds called fragrant amines, some of which have been accounted for to cause malignancy. The most well-known colors that can cause contact dermatitis are scatter blue 106 and scatter blue 124. The EU prohibited the use of azo colors in 2003 that could release at least one of the 22 most dangerous smelling amines; Only the state of California in the United States has restrictions on these colors. Given the variety in

the guideline of these colors universally, free accreditation norms have arisen as a superb component for capable makers to guarantee that their items meet the most elevated necessities as far as shopper wellbeing (Deshmukh and Bedre, 2015).

### **Impact of Coloured Dyes in Printing**

Textile printing is a vital part of the textile processing sector that employs millions of people. It is said that this sector has developed as a major water polluter, playing with the health of the population live in and near them, due to improper processing processes, unsafe labor habits, and a lack of care for environmental protection. Toxic chemicals used in printing units pose a concern to the manpower working in such facilities, resulting in occupational health hazards (Kale, Naik & Gaikwad, 2009). Because a worker spends so much of his time at work, the need to be concerned about health issues and the causes that cause them becomes a critical area of research. Any fabric’s greatest attraction is its colour. Thus, the manufacture and application of synthetic dyes for fabric dyeing has developed into a multibillion-dollar industry.

Coloring agents, sometimes known as inks, come in a variety of forms. Unfortunately, all synthetic ingredients, such as pigments, fixers, binders, solvents, and other commonly used chemicals, can cause skin irritations, allergies, and even respiratory, reproductive, and carcinogenic effects. Chemical agents are used in the fabric’s first dyeing, which may harm human health and the environment.

### **Then vs Now**

Textile printing used to be done with environmentally friendly materials. Indian fabrics have lost their soft delicacy and harmony of natural colors, giving way to dazzling tints generated by synthetic dyes. Imported synthetic dyes were found to be less expensive to employ by Indian dyers and printers, owing to the easier application method, ease of obtaining them in standard forms, and a wider range of hues with superior wash fastness. The liquid waste discharged after printing, on the other hand, contained extremely hazardous dyes, bleaching agents, salts, acids, and alkalis. In dye effluents, cadmium, copper, zinc, chromium, iron, and other heavy metals have also been found. Poor health, safety, and waste management rules can put the health of textile workers at serious danger since they cannot control how often or for how long they are exposed to these conditions (Bahtiyari, Benli, and Yavas, 2013).

### **Ecology**

Textile ecology, which encompasses textile production, human, and waste ecology, aims to safeguard the environment and people throughout the textile manufacturing process, from fabric to garment fabrication. Textiles go through a number of processes before they are finished. We plan to investigate all aspects of fabric and



Figure 1: Developed design

garment manufacture, including the procedures employed and the materials and chemicals used. The textile industry's contamination chain extends to the remaining consumers. Consumer-purchased and used apparel products include chemicals that are detrimental to human health, and the environmental impact of these products is unavoidable after washing (Miles, 1994). Products are inevitable (Miles, 1994).

### **Natural Fabric Dyes**

Plants, animals, fruits, insects, and minerals, among other things, provide natural hues. Natural dyes are becoming increasingly used in commercial textile dyeing. Natural dyes have occupied a significant place in human life for thousands of years, serving both artistic and practical purposes. Indigo is the oldest and most widely used dye, having been used in countries for over four thousand years. Natural dyes are pigments that come from fruits, plants, animals, or minerals. Furthermore, organic substances such as vegetables and mildews are abundant in natural dye creation. Natural dyes were once common for humans, but they quickly fell out of favor due to synthetic colors' convenience and random nature. Indigo dye is a biological substance that has a distinctive blue color. Indigo is a natural dye extracted from plants, and the process is carried out with caution because blue colors were historically rare. Indigo dyeing is based on vegetables, and these colors have some positive environmental effects.

### **Natural Dyes Are Enjoying Some Innate Benefits:**

- No wellbeing danger
- Simple extraction and cleansing
- No profluent age
- Exceptionally high manageability
- Gentle coloring conditions
- Inexhaustible sources.

### **Rhubarb Root Powder**

Himalayan Rhubarb extract is a natural dye from the Himalayan regions of India and Bhutan. The plant can be found at elevations ranging from 3 to 5000 metres. It yields a profound, brilliant yellow tone from its rhizomes with a severe. Changes in pH will make more yellow or almost block red tones. The color is fragrant and gritty smelling

and makes a magnificent Bright Olive green when joined with Saxon Blue in the color pot. Use it at 1-10% on the heaviness of the fiber and shift its pH with mordants (Shahid and Shahid-ul-Islam, 2013). The foundations of the normal palatable rhubarb, like those of decorative assortments, produce lightfast shades of yellow and orange. The roots are a significant wellspring of color in Nepal and Tibet. Rhubarb leaves can also be used as a mordant.

## **Methodology**

### **Selection of Design**

Graphics have been developed for a kids T-shirt using the software shown in Figure 1.

### **Selection of the Fabric**

Pure cotton knit T-shirt have been used for printing graphics.

### **Selection of Dye and Mordant**

#### *Himalayan Rhubarb Root Dye Powder*

The underlying foundations of the common edible rhubarb, like those of decorative assortments, produce lightfast shades of yellow and orange. The roots are a significant wellspring of color in Nepal and Tibet. The leaves of rhubarb can likewise be utilized as a mordant.

#### **Mordant**

##### *Aloe vera*

Aloe vera is a plant that belongs to the Aloe genus. It is an evergreen perennial that originates in the Arabian Peninsula but spreads wild in hot and humid climates all over the world, where it is cultivated for horticultural and restorative purposes. It can be found in a variety of customer items such as beverages, skin creams, cosmetic care products, and treatments for small sunburns. In material coloring, aloe vera gel is used as a mordant.

##### *Pomegranate Rind Powder*

Pomegranate peels contain yellow tannins, commonly known as ellagic tannins. This indicates that when applied as a pre-treatment for a texture, it produces a thin yellowish base that impacts the color shading outcome.

### **Selection of Thickener**

#### *Azadirachtaindica Gum*

The characteristic of neem gum is separated from the neem tree by intentional or repeated harm. Neem gum is a transparent, beautiful substance with a golden tint that doesn't taste bad and dissolves in cool water. It is used for food preparation for certain purposes and as a building specialist (those for diabetics). Neem gum is used in medications as a tablet cover, a thickening agent, a slow-discharge agent, and a film coating. There is likewise some utilization for upgrading solvency.

**Table 1:** Print paste preparation for method 1

Materials used for making printing paste	Quantity
dye concentration	30g
Mango kernel starch	40g
Pomegranate rind powder	5g
Water	10ml
Soymilk	15ml

#### *Mango Kernel Starch*

Mango kernel starch is lost from mango handling plants; yet they contain important supplements. Generally, accessible at summer and mature organic mango products part was gathered from neighborhood pickle making market, where portion was tossed. The bit was washed completely, ground in engine pestle after plate drying, and additionally processed to powder. It is employed in sizing processes in the textile and apparel industries, laundry, adhesives, paper, and fermentation. (Storey, 1974).

#### **Selection of Binder**

##### *Soymilk*

Soy milk is a binder. It makes cellulose fibres act more like protein fibres and enhances the color uptake.

#### **Preparation of Print Paste**

##### *Method 1*

The printing paste is created with the quantity specified from the above Table 1. The print paste can then be printed onto the fabric once it has been combined.

#### **Printing**

##### *Printing Technique*

The graphics are printed using the block printing technique. Block printing is a technique that involves using carved wooden blocks to produce designs. It is the most precise, easiest, and slowest of all textile printing procedures.

#### **Outcome of the Samples**

Sample 1 (dye + neem gum + aloe vera + Walnut powder + Soymilk)

Sample 2 (dye + mango kernel starch + Pomegranate rind powder + Soymilk)

Figure 1 representing sample 1 and figure 2 is representing sample 2

#### **Results and Discussion**

##### **Testing**

##### *Colour Fastness to Washing*

The resistance of an in any of its color features to washing with household detergent is referred to as color fastness to washing. The samples were subjected to this test, and the results were obtained.



**Figure 2:** Printed sample 1



**Figure 3:** Printed sample 2

Sample 1 (dye + neem gum + aloe vera + Walnut powder + Soymilk)

The rating scale indicates the change in color of the printed graphics. Change in shade: 3-4

Sample 2 (dye + mango kernel starch + Pomegranate rind powder + Soymilk)

The rating scale indicates the change in color of the printed graphics. Change in shade: 4

Where, 5-Excellent, 4- Good, 3-Fair, 2-Poor, 1-Very Poor.

##### *Colour Fastness to Crocking*

How much colour is transmitted from the surface of colored textile materials to other surfaces when they are rubbed together is measured by a test called color fastness to crocking. The color fastness to crocking rating scale is indicated in the results.

Sample 1 (dye + neem gum + aloe vera + Walnut powder + Soymilk)

Dry Staining: 3-4

Wet Staining: 2-3

Sample 2 (dye + mango kernel starch + Pomegranate rind powder + Soymilk)

Dry Staining: 3-4

Wet Staining: 2-3

Where, 5-Excellent, 4- Good, 3-Fair, 2-Poor, 1-Very Poor.

Natural dyes have arisen as prime colorants for materials universally. Researchers in related fields are fostering advancements for extraction and coloring with natural dyes. Natural dyeing can influence the actual properties of the texture. So the examination on the actual properties of colored textures is likewise performed.

Eco-accommodating part of this color utilized in the printing cycle would prompt far and wide acknowledgment of the use of cotton, silk and fleece coloring. It won't just fill in as a color yet offer other wellbeing components like enemy of microbial properties, detoxifying specialist and treatment for different skin problems.

From the two samples obtained, Sample 1 is darker in shade when compared to Sample 2 (Figures 2 and 3). Sample 1 gives a dark brown shade when the print paste is made with Rhubarb dye powder, neem gum, aloe vera, walnut powder and soymilk. Sample 2 gives a copper brown shade when the print paste is made with rhubarb dye powder, mango kernel starch, pomegranate rind powder and soymilk. Varying mordants resulted in different color yields, and the color fastness results were all split between light and dark colors. Rhubarb was used to study the presence of a mordant in the printing paste, and different mordants may be used to produce a range of different colors.

### Conclusion

The chance of utilizing rhubarb in powder form in printing normal textures printing method has been examined. In the current universe of quick style, there is an expanded concern universally toward the utilization of unsafe and cancer-causing engineered colors like azo and benzidine; these colors affect nature and humankind. The developing mindfulness about supportability and climate well-disposed colors has made a fundamental stage for youthful scientists to resuscitate and try different things with customary methodology of material coloring and printing. Natural dyes have consistently been liked for its mitigating tones; with the examination and results got, it tends to be seen that the printing utilizing Himalayan rhubarb root color powder has brought about promising tones and furthermore can be considered as the recommendable option in contrast to unsafe engineered colours.

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