



## **ECO Friendly Dyeing of Natural Fibril Fabric Using Organic Dyes**

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### **ABSTRACT**

Dyeing process for the textiles is practiced by human beings since early ancient time. However, in recent times a lot of attention has put in this process because of the awareness of sustainability and eco-friendly textiles and garments for environmental safety. Particularly organic dyes, have so much importance in human lives for thousands of years as it provides an aesthetic satisfaction and very importantly it is environmental friendly in natural which is bio degradable in soil and does not cause any harm to the environment as it is eco friendly. Organic dyes are dyes which are derived from the plants, animals and mineral sources which does not cause any hazards to the nature and environment. And as it is eco-friendly it does not cause any skin allergies to the humans as it is derived from only natural resources. As natural fabrics already has a very good absorbency and affinities for dyes, by using the organic dyes it also gives an elegant and aesthetic feel. Recently growing awareness among the government and industrial firms has increased the marketing in worldwide for natural fibers. During the synthetic dyeing process approximately 30-50 litres of water are used per kg. Water used in dyeing yarn is at approximately 60 litres per kg of yarn, as so much gallons of water is begin wasted during the synthetic dyeing process which is not eco friendly to the nature. So in this research, have studied about the natural dyeing process using organic dyes extracted from natural resources, which has been dyed on natural fiber yarns.

*Keywords: Eco-friendly, organic dyes, extraction, natural fabric, natural dyeing, biodegradable.*

### **1. INTRODUCTION**

The greatest challenge of the present era is to develop nature friendly sustainable technologies that would make life easy and productive for the current as well as future generations. This provides an opportunity for reintroduction of natural dyes that could be considered as a suitable alternative to synthetic dyes, which have been known to cause health hazards due to their carcinogenic effects. Natural dyes are which very eco-friendly colorants which is extracted from plants, minerals or animals, also to create awareness among wearers about the usage natural fabrics so it is eco-friendly, biodegradable and skin friendly to the user.

By obtaining the natural process of dyeing and usage of organic dye and natural fabric we can give a good environment to the futures. Instead of wasting the peels or skins and leaves we can start creating new techniques in textiles and use it. This eco-friendly process of dyeing can also avoid the extra more wastage of water that is been used while using synthetic dyes for dyeing process, so which saves water for the future use.

#### **1.1 Advantages of organic dye:**

- Organic dyes are biodegradable, non – toxic to nature environment and non – allergic to human kinds.
- They provide distinctive and vibrant shades of color scheme with no staining or bleeding of colors when used.
- By usage of organic dyes, the shades do color pay – off, top achieve the expected color, i.e, if expected to get a pastel shade of dye color organic dye color pay – off of pastel shade color with correct ratio also with the vibrant shades, so organic dye helps to achieve the expected look.
- It gives the enhancement of craft knowledge, as basically natural dyes extraction, fixation are artistry knowledge so in which organic dyeing helps to develop many different recipes by the dyer and use exclusively.
- Organic dyes can give certain particularities to the used base component, is that the organic dye which are obtain from natural resources do have some medicinal values and some repellent properties in it which gives some certain particulars to the base fabric when dyed with source.

### 1.2 Disadvantages of organic dye:

- When comparing to the synthetic dyes, organic dyes require a higher quantity of dye colors for a certain amount of fabric to dye.
- Cost of the organic dye is higher than the synthetic dyes, because larger quantity of dye is required to dye a certain small amount of fabric. So, the using of natural dyes is more expensive than using synthetic dyes.
- The color pay – off from the organic dyes may tend to fade quickly. So the constituent quality of the organic dyes is not better than the quality constituent of the synthetic dyes.
- Even though organic dyes are procured from the natural sources, the sustainability can be still a problem because producing organic dyes will require a vast of area of land.
- Organic dyes also do have harmful effects to some extent when used. As organic dyes are obtained from natural sources some of the ingredients that can have some harmful effects like when inhaled, in touch with sensitive skin which can cause inflammation, irritation when used.

### 1.3 Three different Dye Extraction methods:

- a) Aqueous Extraction –The raw material which are obtained from the natural sources are made to dry in dry form, which are grinded into broken in small pieces of powder and soaked in water to give the dye form by loosening the cell structure of it.
- b) Solvent Extraction –This type of extraction process is efficient than the aqueous extraction method. This gives a good quality of dye in less water at low temperature, in which some oragn solvents are used like ethanol, chloroform, methanol, distilled water.
- c) Supercritical fluid Extraction – This process of extraction consists of contacting in supercritical fluid and the natural resources that obtain in a vessel at a high temperature. The solubility of desired product is obtained in supercritical fluid (CO<sub>2</sub>).

## 2. MATERIALS & METHODS

All the resources that are used for the study is been obtained from the natural sources like plant and food waste which is eco-friendly and biodegradable. The boiling temperature for dye bath is 60°C for which time taken is 1 hour and the water required for dyeing is 1 liter. We can also achieve different intensity of shades of dye by changing the temperature and time by using extra grams of dye powder, can also try using different mordant to achieve different colors of in a same dye powder. The organic dye that extracted from the natural source for the dyeing process is done by aqueous extraction method. The collected garlic skin and teak leaf is dried in a room temperature and crushed into small pieces in mixer, for the extraction process the grinded powder is heated with water at 50°C at 7 pH value for 1 hour. And the extraction is filtered and cooled in a room temperature. The dye extracted at optimum condition was filtered & evaporated using a roto-evaporator and the obtained powder was used for dyeing.

### 2.1 Two different types of dyes extraction from natural resources:

#### a) Garlic Skin Dye


S. No.	Resource type	Local name	Appearance	Botanical name	Family	Colour obtained	Colouring components
1	Spice	Garlic		Allium sativum	Amaryllidaceae	Grey	Thiosulfinates

Table 1

## b) Teak leaf Dye


S. No.	Resource type	Local name	Appearance	Botanical name	Family	Colour obtained	Colouring components
2	Plant	Teak		Tectonagrandis	Verbenaceae	Pink	Tectoleafquinone

Table 2

**2.5 Natural Yarns:**

The yarns which are derived from the natural fibers which are obtained from the natural resources, which are in plant form as cotton or linen, mineral form as mineral wool, protein form from animals as silk, where all the fibril materials are spun into filaments which can be further processed as fabric by weaving technique.

**2.6 Natural Dyeing process:**

Natural dyeing process of yarn or fabric is the process where the extracted dye from the natural sources are in powdered form are heated in a vessel with a required temperature with water and certain mordant to accomplish the required color pigment. And after the boiling temperature, the yarn or fabric is made to soak in the dye color boiling water for about a required amount of time and stir so to get an even shade on the fabric until it reaches the required shade and then finally shade dried. This process of dyeing does not use any chemicals during the dyeing so which does not cause any harm to the environment which is eco-friendly and biodegradable and also which does not cause any harm to the wearer like skin allergies as they are obtained and dyed in natural process, so they are anti-allergic to skin.

There are certain stages of pre-mordanting procedure to be followed like scouring and bleaching before dyeing so where the natural mordant and the organic dye act accordingly and get dyed evenly on the yarn or fabric that is dyed. Scouring is a preparatory process to the fabric which removes the soluble and insoluble impurities in the fabric so suitable for the bleaching of the fabric to be dyed, it is the purifying treatment of textiles. And bleaching is a process of whitening of the fabric by removing the natural color of the fabric to make it suitable for the dyeing process so it intakes the desired color of dye shade rather than mixing with any natural color of the fabric.

**2.6.1 Mordanting:**

Mordanting process is the one most important process of preparing the yarns or fabric to accept and get the desired colors, it is a fixing agent of dyes to the yarns or fabric. Using mordant ensure the durability and long-lasting of shades on the base component. There many different types of mordants are available, by using natural mordant we can make it environmental friendly. Pomegranate rind is one such natural mordanting agent used in a raw or powdered form in the dye bath with the dye base and water in a boiling water of temperature, for dye to get fixed evenly only the yarns or the fabric dyed.



S. No.	Resource which mordant derived	Appearance	Botanical name	Family	Colour of the mordant	Appearance of the mordant
1	Pomegranate rind		Punicagranatum	Punicaceae	Brown	

Table 3

**2.6.2 Process:**

The process of natural dyeing using organic dye of garlic skin extraction and teak leaf extraction is the process where the required amount of dye powder, which was extracted by aqueous extraction method is added to the vessel, required amount of water is added and the natural mordant acquired from the pomegranate peel is added to the dye bath and the water is made to boil in a certain temperature for a certain amount of time, and where the selected

fabric is soaked in the dye bath and stirred well to avoid uneven dyeing. And after as the desired color or shade is obtained, the fabric is removed from the dye bath and made to shade dried. As the fabric is dried thoroughly it is used for further end-use products.

### 3. RESULT

The process of natural dyeing using organic dye on the natural fabric is done using garlic skin dye extraction on the silk fabric to obtain the grey color and teak leaf dye extraction on the cotton fabric to obtain the pink color using certain temperature of boiling water and natural mordant in a vessel.

#### a) Garlic skin dyeing



S. No.	Obtained from	Appearance of dye	Color	Fabric dye applied on	Dyed sample
1	Garlic skin		Grey	Silk	

Table 4

#### b) Teak leaf dyeing



S. No.	Obtained from	Appearance of dye	Color	Fabric dye applied on	Dyed sample
2	Teak leaf		Pink	Cotton	

Table 5

The natural fibril fabric of silk and cotton is dyed using organic dye obtained from garlic skin and teak leaf using natural mordant of pomegranate rind at a certain temperature by achieving and grey and pink shade.

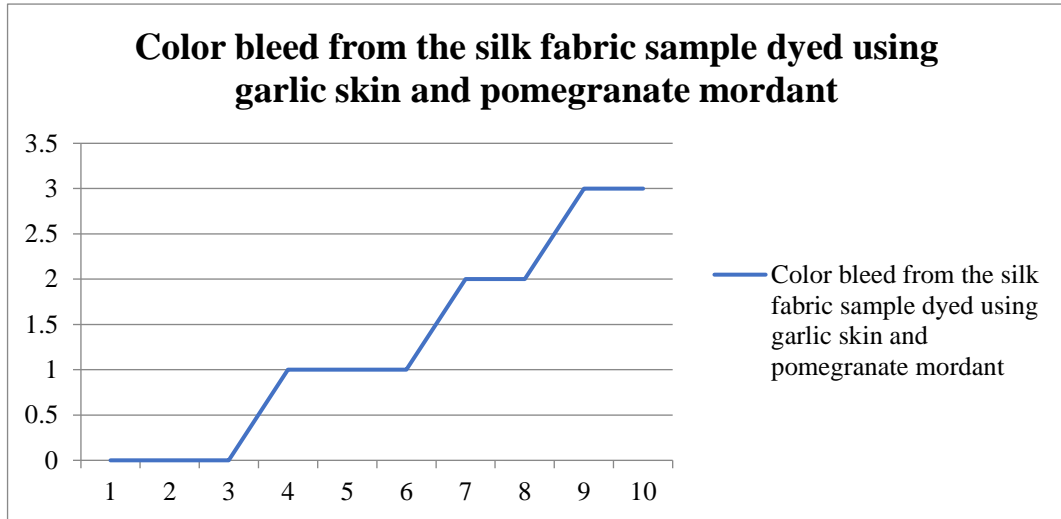
#### 3.1 Wash Test of the organic dyed samples

No change – 0, Mildly color bled – 1, fabric color changed – 2, Full faded – 3.

#### a) Garlic skin dyed sample

No. of Washes	Color bleed from the silk fabric sample dyed using garlic skin and pomegranate mordant
1	0
2	0
3	0
4	1
5	1
6	1
7	2
8	2
9	3
10	3

Table 6



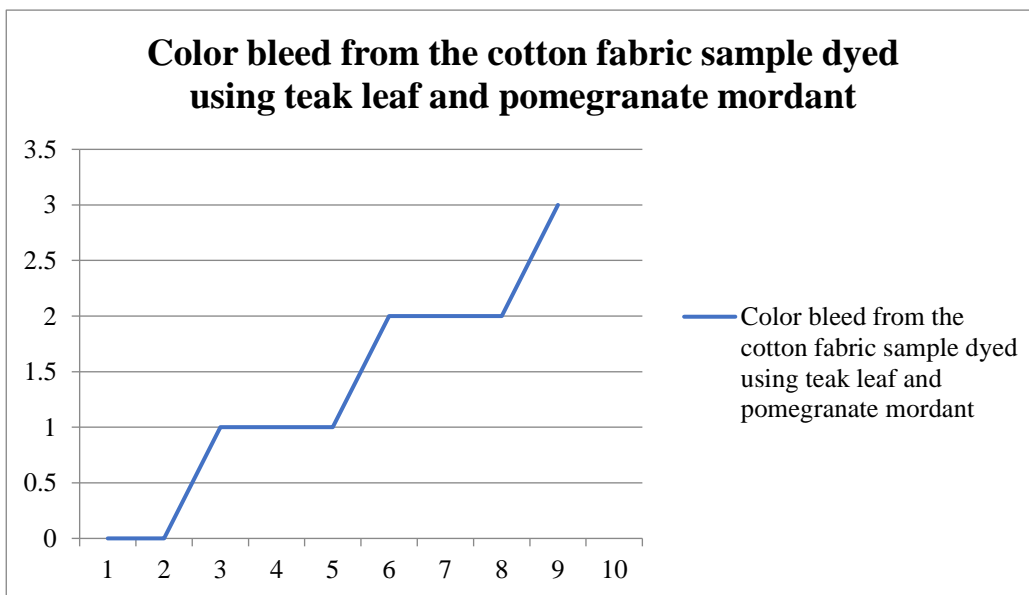
Graph 1

From the above graph, the result shows that the silk fabric dyed with garlic skin and pomegranate rind mordant seems color starts to bleed mildly after 4<sup>th</sup> wash and in 9<sup>th</sup> & 10<sup>th</sup> wash almost it fades and stops bleeding after that.

b) Teak leaf dyeing

No. of Washes	Color bleed from the cotton fabric sample dyed using teak leaf and pomegranate mordant
1	0
2	0
3	1
4	1
5	1
6	2
7	2
8	2
9	3
10	3

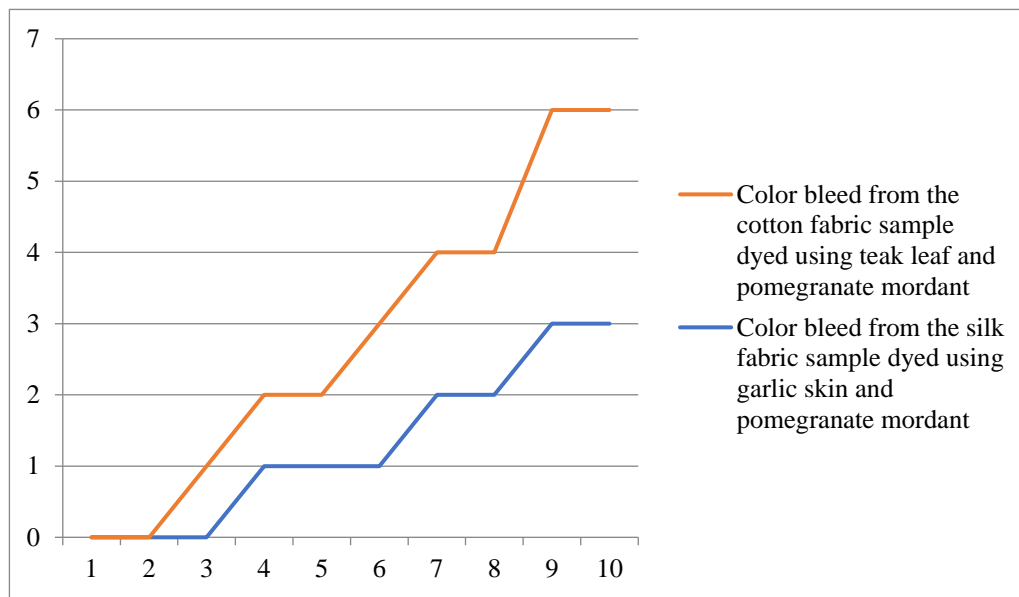
Table 7



Graph 2

From the above graph, the result shows that the cotton fabric dyed with teak leaf and pomegranate rind mordant seems color starts to bleed mildly after 3<sup>rd</sup> wash and in 9<sup>th</sup> & 10<sup>th</sup> wash almost it fades and stops bleeding after that.

Comparative analysis of wash test for two different types of organic dyes used:



Graph 3

So, when comparing the wash test results of both the 2 different fabric with 2 different organic dyes the cotton fabric dyed with teak leaf seems to bleed little faster than the silk fabric dyed with garlic skin.

#### 4. CONCLUSION

Natural dyeing is an eco-friendly process of dyeing which does not cause any harm to the environment and also to humans. Man-kinds are slowly started adapting to this process of dyeing. This type of natural dyeing using organic dyes are started to introduced in the textile market for the use. By instead wasting the food wastes like garlic skin, onion peel, pomegranate peel we can convert it into dye extract and use it, which also allows to explore in natural dye artistries. Usage of natural fibril yarn or fabric is also one such eco-friendly use, where when it is put on the soil it gets biodegraded. So by this natural method of extraction of dye of garlic skin and teak leaf and natural dyeing method and natural mordant of pomegranate rind, the natural fabrics like silk and cotton is dyed and the desired color of grey and pink is obtained. So entirely the process done is eco-friendly and biodegradable.

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