



# Discharge Printing with Natural Dyes

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## ABSTRACT

Natural color dyeing and printing has acquired a good demand especially in foreign market and in indigenous, too. This is only due to its heritage importance along with its eco-friendliness as well as environ-friendliness. Use of herbal wastes and renewable sources is its one aim when further generation of different vegetable sources is another one that will help the greenhouse richer directly or indirectly benefiting the animal world. But the use of any chemical in connection with natural dyes must be non-toxic and also within the permissible limit. This work has been done to avoid Sodium sulphonylate formaldehyde which has been successfully replaced by oxalic acid in discharge printing of natural color products.

### Introduction:-

Discharge printing with natural dyes has good demand in the market, but no suitable method has yet been established till date. Sodium sulphonylate formaldehyde is the strongest reducing agent commonly used for discharge printing. That can also be used for natural color discharge printing, but it is not well accepted due to the nature of the compound liberating formaldehyde that causes pollution in the environment while steaming. Also the result of white discharge is not so satisfactory as the lake forming metal atoms can not be replaced easily by the reducing hydrogen atoms from this reducing agent. Other strong reducing agent namely Sodium hydrosulphite is quite unsuitable for using in printing paste due to its instability as it loses its action gradually in exposure to air. Sodium bisulphite along with zinc dust is another reducing agent which is also not sufficiently strong to discharge the natural color ground. Moreover zinc being a heavy metal should not be used for natural dyes. The phenomenon behind discharging a color is to destroy the chromophore by producing a leucophore. As color is obtained from natural dyes by formation of lakes with dyes and metal ions, mild reducing agents are incapable to replace the metal ions from the dyes. The project work is based on finding out a suitable non-harming reducing agent which has also a capacity to detach metal ions from the lakes easily to facilitate further reduction of the dye and to create white discharge effect on the dyed ground. The whiteness obtained in the discharged area cannot be compared with that obtained from Sodium sulphonylate formaldehyde applied on reactive dyes of vinyl sulphone group, but it will be much more pronounced if compared with other reducing agents applied on natural mordant class of dyes.

### Aim of the project:-

The main object of the project is to find out a suitable process of discharge printing on natural color avoiding harmful chemicals along with minimum effort and maximum advantage. To obtain effects of special beauty, intermediate steaming process has been adopted in some cases. The selection of thickener is another object to make the process quite suitable for printing in commercial scale.

### Materials and Methods

#### Materials:-

The entire project work has been carried out with the following raw materials, natural dyes, mordanting metallic salts and chemicals.

#### Raw materials:-

100% handloom woven grey cotton fabric of width 36 inch, e.p.i.72, p.p.i.42, warp count 2/80s, weft count 2/60s and gsm 94 has been used.

#### Natural dyes:-

Four different natural dyes of Eco-N-Viron Product namely Terbula (Harda extract), Alcipa (Onion skin extract), Rubitin (Manjit extract) and Curlonga (Modified turmeric extract) have been used. Green cocoon shells are also taken for fresh extraction of color and used for

dyeing as an additional dye.

#### Mordanting salts:-

Only Aluminium sulphate and Ferrous sulphate of commercial grade have been used according to international acceptance.

#### Thickeners used:-

Gum Indulka and Sodium alginate both of commercial grade have been used as thickeners for printing paste.

#### Re agents used:-

Ammonium hydroxide, Oxalic acid and Ammonium oxalate (all of commercial grade) have been used as discharging agents.

#### Equipments:-

Wooden blocks and Nylon Screen engraved with different design have been used for printing.

#### Methods:-

The grey cotton fabric is taken in some useable lengths of 2.5 and 3.00 mt and given a combined scouring and bleaching process in a standard method to make them suitable for further dyeing and printing processes. To beautify the fabric, Bandhni process has been adopted during dyeing of a few fabric pieces before going for discharge printing. Other pieces were first dyed in light shades and then printed with deep and medium shades of natural dyes using suitable blocks before going for discharge printing on them. In such case, intermediate steaming and washing is done to fix the color and to remove the gum from the cloth surface. After discharge printing, the fabric pieces are all steamed at a temperature of 100-1020C for 30 minutes followed by aftertreatment with 2g/l non-ionic detergent.

#### Dyeing methods:-

The scoured and bleached fabrics are first dyed with natural dyes at 700C for 45 min in exhaustion method, mordanted with salts at 700C for 20 min, aftertreated with 2g/l non-ionic detergent at 600C for 10 min, cold rinsed and dried in shade. The recipes used for dyeing are given below for different tests on different samples.

#### Mode of operation:-

Small swatches are first dyed with different natural dyes and post mordanted with different salts to get desired effects. They are afterwards printed with different discharging agents to observe the results so that final products can be obtained with the best recipe on the color ground or overprinted ground to achieve the best effect. The following recipes are taken for experimental procedure.

#### Sample No.1

The ground is first dyed with fresh extraction of green cocoon shells cut into small pieces. It was then mordanted with ferrous sulphate solution to get a light grey shade, aftertreated and dried. The fabric is

then tied and dyed with Terbula (Harda extract) dye solution followed by mordanting with ferrous sulphate to get black bandhni effect on grey ground. Before untying, the fabric is well aftertreated with non-ionic detergent and washed to avoid spoiling of design and then dried.

#### Sample No. 2

The ground is first dyed with Curlonga followed by mordanting with Aluminium sulphate to obtain a yellow ground. It is then tied and dyed again with Terbula dye solution followed by mordanting with ferrous sulphate and aftertreated with non-ionic detergent in the standard method. Deep green bandhni effect is obtained on deep yellow ground.

#### Sample No. 3

The third piece of fabric is dyed with Rubitin followed by mordanting with Aluminium sulphate to obtain a pink ground and then printed with a prelake prepared from combination of Alcipa and ferrous sulphate by blank wooden blocks to get greenish brown design on which final discharge printing is to be done. Before that, it was steamed and cold rinsed just to fix the printed areas and to remove gum to facilitate further printing on them.

#### Sample No. 4

The fourth piece is dyed with Alcipa and postmordanted with Aluminium sulphate. That fabric was again printed by small blank blocks with a prelake of Alcipa and Ferrous sulphate for printing on those areas. Hence steaming and cold rinsing was followed.

#### Discharge printing:-

All the fabrics are now printed with hand screen and hand blocks by using different thickener and discharging agents to observe the effects and advantages. At first two gum thickeners namely 10% Gum Indulka and 10% Sodium Alginate gum thickener are prepared with the help of a stirrer. All the four sample swatches are then printed using the four recipes (i) Ammonium hydroxide 10 parts, Oxalic acid 10 parts, water 20 parts and 10% Gum Indulka 60 parts (ii) Ammonium oxalate 15 parts, water 25 parts and 10% Gum Indulka 60 parts (iii) Ammonium hydroxide 10 parts, Oxalic acid 10 parts, water 20 parts and 10% Sodium Alginate 60 parts (iv) Ammonium oxalate 15 parts, water 25 parts and 10% Sodium Alginate 60 parts. All the sample swatches are then steamed at 1020C for 15-20 minutes, cold rinsed and aftertreated with 2g/l non-ionic detergent at 500C for 10 minutes, cold washed and dried.

#### Observation from the experiments:-

It is seen that use of self Ammonium oxalate or combination of Oxalic acid and Ammonium hydroxide make no difference in discharging effect, but use of Gum Indulka as thickener creates problem of being gelatinous within a short time during printing. Whereas, use of Sodium alginate thickener is quite compatible with both the combinations of discharging agents and no problem of coagulation arises during printing. It is further noted that discharging action is much pronounced on natural dyes mordanted with ferrous salt. Another phenomenon has been noticed that color of Curlonga, which is a modified natural dye for increasing light and washing fastness, is not dischargeable. This has become an advantage for creating color discharge effect.

#### Product development:-

Taking the above observation in consideration, only 10% Sodium alginate thickener has been taken for development of useable products. Ammonium oxalate self or combination of Ammonium hydroxide and Oxalic acid are also applied as and when intended. The other processes of dyeing and intermediate printing or bandhni dyeing processes have been followed as are done in cases of sample swatches. After completion of discharge printing, fabrics are steamed at 1020C for 30 minutes followed by aftertreatment in 2g/l non-ionic detergent solution at 500C for 15 minutes and subsequent cold wash. All the fabrics are dried in shade to avoid sunlight fading.

#### Mechanism of the process:-

The mechanism behind the process is to utilize the reducing power of oxalic acid which has two carboxyl groups and has high affinity towards metal atoms to form metallic oxalates which become soluble in water during washing. Due to further reduction, the dye molecule first comes to its original position with phenolic hydroxyl groups and ultimately turns to leucophor during steaming. These molecules are

removed by aftertreatment to give white areas. Some of the dye molecule structure being complex, the color may be sometimes partly dischargeable or non-dischargeable.

#### Conclusion:-

It is a successful achievement towards diversification of natural color products mainly suitable for cottage scale industries. It is seen from the work that grey and black shades derived from ferrous metal give best discharge effect. Other shades require steaming to get the optimum result. It is also observed that the fabrics are kept in air for twenty four hours after discharge printing, discharge effects become pronounced without steaming. This is another achievement of the work for them who have no proper steaming infrastructure and it is having also a fuel saving aspect.