



## A Short Observation on the Printing Cotton Fabric using Some Technique

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**N**OWADAYS, the effects of environmental awareness, organic products, and the tendency toward healthy lifestyle also reflect on the textile sector. Disagreements on the risks of the usage of synthetic dyestuffs and increasing environmental awareness result in an enhanced interest in natural resources, environmentally friendly products, and new strategies. That is one of the reasons why the use of natural dyes came back to the agenda due to an increased ecological and sustainable awareness. Unlike non-renewable raw materials of synthetic dyes, natural dyes are mostly renewable and sustainable so in this review show using some nature materials in printing cotton fabric and application in different technique to print cotton as direct printing with nature dyes as madder ink jet printing using reactive dye and discharge, resist printing.

**Keyword:** Environmental; Eco friendly; Nature and reactive dye; Inkjet, Discharge and resist printing.

### Introduction

The printing textile coloration is a wet process consists of water, dye or pigment, thickening agent and other textile auxiliary agents for the printing of the paste. Therefore, the textile effluent has been highly polluted by unfixed colour, or along with the washed-off elements used in the printing paste. Environmental awareness of textile printing has increased as new processes are developed, chemical replacement is developed or new technologies are used [1, 2]

The textiles and clothing industries address environmental issues due to their characteristics of rapid reaction. Quality is more prominent when it comes to water and energy-saving functions.

In continuation of our interest in the green coloration of cotton fabric with natural dyes, the

newly green pretreated cotton fabric [3] of this work was printed with madder natural dye (CI Natural Red 9). Madder natural dye was selected in this study as it contains carboxylic and acid hydroxyl groups Thus [4], a novel and simple printing paste formulations containing madder natural dye and different thickeners without binder or other conventional printing paste chemicals such as urea and ammonium sulfate are presented.

The feasibility of using an alternative to urea for cotton fabrics can be studied in reactive dye print pastes. The prints obtained have a strong shad depth, print quality with considerable dye-stuff performance, which eco-print cotton with reactive dyes and thus avoid printed effluents. This reduces the load of wastewater. A move ahead for safer garment manufacturing technologies [5, 6] researchers have been at the forefront of advancement of modern cotton coloring technology with a low dye use and low chemical use

such as digital inkjet printing. Compared with traditional screen printing, digital inkjet printing was seen as breakthrough technology showing various features and advantages such as non-Contact printing, no printing screen, excellent image quality, artistic design, flexible output, low electrolyte use, etc.

**Discharge printing** In discharge printing, the fabric is first dyed to a solid shade and then printed with a paste containing chemicals able of destroying the color could be achieved during the next steaming process. This allows printing of white designs on a ground color could be achieved. If the paste contains dyes resistant to the discharging agent used, these dyes, named as illuminating colors, will color the printed areas. **Resist printing** Resist printing block color absorption during fabric dyeing or during color application, the fabric is treated first with a composition that resists both dye penetration and fixation. During dyeing process, the areas free of resisting agent could be colored.

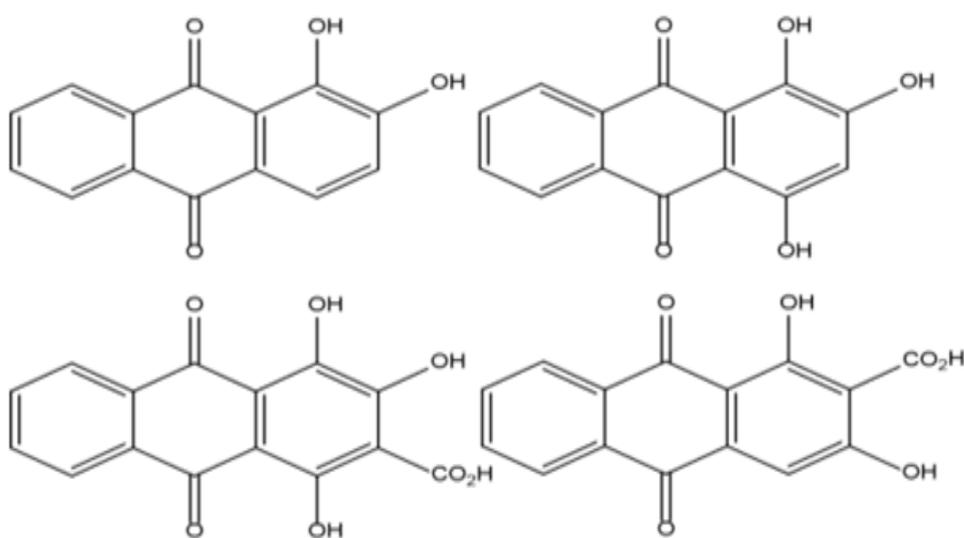
*Printing cotton fabric with nature dye (madder) and (bio-mordant)*

Gelatine-tannic acid (bio-mordant) treated cotton fabric was printed with natural and synthetic thickeners. Different factors such as pH, steaming temperatures, time, auxiliaries (urea, salt, and binder) were investigated. The data indicated good quality prints using natural thickener and without Auxiliaries compared with the synthetic one.

Following on our concern for the green colouring of natural cotton fabrics. Madder natural dye has been chosen for its carboxylic and hydroxylic acid groups in this analysis.

Therefore, a fresh, simple formulation of printing paste containing natural madder dye and different thickeners is given, without binder or other traditional printing pastes, such as urea and ammonium sulfate. Comparison output in various printing conditions was examined for the im-  
printability of cotton fabrics. In addition, the total fastness properties of the printed textiles were assessed. [1]

The dye used was madder (Natural dyes; CI Natural Red 9) and the color solution was achieved by soaking 10 g of natural dye powder in 100 ml of distilled water at room temperature and stirring for 30 minutes. A mesh cloth with squeezing has filtered the mixture. [1] Then, urea and diammonium sulfate by the amount mentioned above was dissolved in 50 ml dye solution(A). Thickener solution (B) was made by dissolving the amount mentioned in 50 ml distilled water. The print paste was then made by mixing A and B together with a 12 ml binder with stirring at room temperature for 10 min. Finally, the pH of the paste was adjusted to the desired pH by adding drops of glacial acetic acid. This procedure was followed except adding auxiliaries for making the print paste without auxiliaries.



**Fig. 1. Chemical structure of madder natural dye [1]**

### *Print paste formulations*

The printing paste formulations were made for printing the cotton fabrics with natural dyes in the presence and absence of printing auxiliaries as follow:

#### *Print paste with auxiliaries*

Natural dye solution (50 ml, 10% w/v) + thickener (50 ml, x% w/v) + 4 g urea + 1.25 g diammonium sulphate + binder BD (liquid) 12 ml. X=8% for meypro gum; 4% for sodium alginate, 3% for synthetic thickener; and 4% for CMC.

#### *Print paste without auxiliaries*

Natural dye solution (50 ml, 10% w/v) + thickener (50 ml, x% w/v). X=16% for meypro gum; 8% for sodium alginate, 6% for synthetic thickener; and 8% for CMC.

## **Results**

The effect of the formulation of print paste with a madder natural dye on the imprintability of cotton (bio-mordant samples) fabrics. The color strength value for both printed formulations is increased by the bio-mordant process, which shows that the biological mording process has produced additional binding places for fixation of the dye. However, in bio-mordant samples, the enhanced value of color intensity achieved with the print paste (535%) is much higher than those obtained from a print paste using auxiliary products (27 percent).

The result shows that the printing mechanism with the printed paste containing auxiliary components will adopt a pigment fixing mechanism for the sample and ionization control and biomordant sample ionization mechanisms. This is supported by the enormously improved color intensity value of the bio-mordanted samples with the printing paste without auxiliary material relative to control paste, which indicates an ionic mechanism between the dye (negative charged) and the material (positively charged) was the best among all thickeners, and the data obtained follows the following order. Meypro gum (non-ionic)>CMC (anionic)>synthetic thickener (anionic) >sodium alginate (anionic). This result might be attributed to the charge of the thickener as the more the negative charge in the surface of the thickener, the lower will be the dye uptake by the fabric. Interestingly, control cotton fabric showed low printability data and irresponsible with the thickener used, indicating

the absence of a chemical bond. However, biomordanted samples were responsive to the thickener used.

### *Substitute for urea $CO(NH_2)_2$ in the conventional reactive dye print pastes*

Urea reduction or removal of reactive dye print pastes is of ecological concern. Use of urea raises ecological issues associated with the high nitrogen content of the printing effluent. Various approaches were documented in cellulose printing on the removal or substitution of urea. A use of organic compounds from the inorganic salt has been shown to be an efficient solution. These compounds decrease the effluent load, since most of these are tending to be biodegradable[5]. The amount of inorganic salt was decreased by Betaine, an organic compound[6].

### *Different factors which can influence the printability of cotton*

The dye fixation, urea, dye, absence, or appearance of alkalis and the time of vapour in prints. The dye penetration, levelling and fastness characteristics. [6]

### *Steps of preparing printing paste*

Overnight, sodium alginate had been soaked. Dye paste with warm water Added to the dyer solution and stirred Sodium Acetate instead of urea. Added and fully mixed resistant salt and sodium carbonate. To this formulated dye paste, then addition sodium alginate gum.

### *Steaming condition*

Print cotton samples in various cotton colours, with superheat steam at 100 C for five minutes, were dried in air at room temperature for 24 hours and installed in a superheated steamer.

## **Results**

Except Urea treated Green printed cotton samples (Table 1a), rest all samples indicated greater values of colour strength (K/S). Whereas except Green, other printed samples showed lower values of reflectance (RFL). Blue attained least Total colour difference. Use of organic salt, which is stable and non-toxic, to replace urea in reactive dye-pastes and is feasible for dye-fiber fixation. Color losses in black were highest.

The result reveals that organic salts/alkali had the most effective effects as opposed to traditional printing of urea/alkali[5]. In addition to the low cost of organic salts and its use in reactive dyes cotton printing, the obtained prints

have high quality, outlines sharp, low penetration with substantial dyestuff savings, and thus low demands on the printing process of washing clothes resulting in a decreased wastewater load. This work represents a step forward towards cleaner textile development[6].

#### *Inkjet printing of cotton fabrics using reactive dye*

Digital (ink jet) printing uses micro droplets of colored liquid ink on the surface of accurate points by use of small nozzles. Computers check the precise colored ink jet, ink quantity and tiny droplets position. Four fundamental hues (yellow, magenta, Cyan and black)) work in digital printers that present unique color mixing challenges for textiles. Digital printers include numerous kinds, including continuous ink jet (CIJ) and fall on demand (DOD). [7, 8]

In recent decades researchers have been at the forefront of advancement of modern cotton coloring technology with a low dye use and low chemical use such as digital inkjet printing. Compared with traditional screen printing, digital inkjet printing was seen as breakthrough technology showing various features and advantages such as non-Contact printing, no printing screen, excellent image quality, artistic design, flexible output, low electrolyte use, etc[9-11].

Though digital inkjet printing can to some degree increase dyes and chemicals performance,[8] the issue of dye was not effectively resolved with the high use of water and electricity.

Theoretically, the restrictions of inkjet digital printing in cotton printing derive from the reactive coloring process. Briefly, a lot of thickeners (for example, sodium alginate), urea (approximately 100 g/L) 12, sodium carbonate ( $\text{Na}_2\text{CO}_3$ , about 25 g/L) and sodium bicarbonate ( $\text{NaHCO}_3$ , approx. 25 g/L) must be applied to pre-treatment to encourage the diffusion and attachment of reaction dyes to cotton fibres . Besides, steaming[9].

Digital textile inkjet printing has major benefits such as high quality and scalable processing, but challenge such as the possibility that dyes and chemicals will cause major environmental issues remain the focus of attention[12].

In the answer to this problem a new kind of cationic poly(styrene-butyl acrylate-vinylbenzyl trimethylammonium chloride) (PSBV)

nanosphere was prepared by adsorption of C. I. Reactive Red 218 dyes (RR218) and applied in inkjet printing on woven cotton fiber, in order to address the issue.[13] The results demonstrate the homogeneous size and strong stability in the RR218@PSBV nanosphere primed for ink preparation. The color depth of printed RR218@PSBV material has improved by 1.4 times compared to the dye RR218 solution, and printing effluent dye residues have been decreased by approximately 45%. Meantime in traditional inkjet prints sodium carbonate and urea intake have been decreased by approximately 3.3 mg/cm<sup>2</sup> and 22.8 mg/cm<sup>2</sup>, respectively, and a 30% energy saving printing process has been streamlined. Work, the color enhancement process was studied, which showed an improvement in the absorption coefficient and a reduction in the dispersion coefficient by nanosphere RR218@PSBV. [13]

#### *Discharge Printing Recipe on Cotton Fabric Dyed with Eco-Friendly Reactive Dye*

Discharge printing is one of the printing styles, in which a previously dyed textile is printed, commonly referred to as the "ground" shadow. Through the use of an appropriate printer paste, the coloration of the dyed cloth should always be locally decolorized to produce a "White" patterned appearance. The dyes should be carefully selected. The unload print can produce shiny and transparent designs with a delicate touch on dark textiles. Unloading style transfers the patterns of the material to the printed areas through the chemically destroyed original color. In the context of this study, an effort has been made to enhance the discharge printing recipe via optimizing the concentration of the dye and discharging agent, the physical and colored features of printing examples for cotton fabric dyed with environment-friendly reactive dye.

#### *Reactive dye*

Reactive dye was utilized in cotton fabric printing, as it is environmentally benign, simple to discharge and beneficial for the fabric cellulose and is easy to discharge.

#### *Pre- treatments of the fabrics*

Before dyeing, the whole length of the cloth has been soaked in water overnight to eliminate the natural impurities which could prevent dyeing and printing from happening. In the appropriate amount of soft water, the detergent

and sodium hydroxide were added to the ratio of 1:30. The tissue was submerged in the solution, boiling occasionally over 1 to 2 hours. It was then carefully cleaned and rinsed. The cloth was afterwards partially dried in shade and ironed when it was half wet. The tissue was ultimately prepared for dyeing.

#### *Optimization of dye concentration*

Scoured fabric was dyed with reactive dye using the recipe given

Reactive dye = 1, 2, 3, 4, % (o.w.f)

Urea = 50 % (o.w.f)

Glauber's salt = 10 % (o.w.f)

Sodium carbonate = 10 % (o.w.f)

A small amount of water was used to produce the paste for the needed amount of colour. The paste containing the substance to the 1:30 liquor ratio was made using Lukewarm water. In this solution, urea and glauber salt were introduced at 50°C and maintained at 100°C for boiling. The textiles were added and stored for 10 minutes to be stirred. In the dye bath sodium carbonate was added and half an hour was added. The fabric were taken out of the dye liquor and completely washed with running water when the dye bath reached the boiling point. The cloth was then placed in shade to dry. On the basis of visual assessment and color speed of the dye was picked one best concentration of dyed samples.

#### *Optimization of concentration of Rangolit C*

For the preparation of discharge printing paste by using Rongalite C a discharging agent the following recipe as given was used

Rongalite C = 5, 10, 15, 20g

Gum Tragacanth (paste form) = 50g

Zinc Oxide = 10g

Egg Albumin = 5g

The paste was made by thoroughly mixing all the components and then the paste using screen printing method was printed on the cloth dyed with reactive colors readily loadable. For 10 minutes the printed fabric was kept dry. steamed in a steamer at 100-102°C for 5 minutes. Finally, the sample was washed to remove the thickener, the remaining chemicals and the dyes. Based on clarity of design (strength and purity) and whiteness index the best concentration of Rongalite C was chosen.

## **Results**

#### *Optimized concentration of thickener*

In order to prepare discharge paste for application on cotton samples that were previously dyed with 2 percent reactive dye, gum tragacanth at varying levels, i.e. 15g, 20g, 25g, 30g and 35G, were selected individually. With these pastes all samples had been discharged and the optimal concentration of gum tragacanth for the manufacture of discharge paste had to be visually assessed. Table 1 shows the results. The optimum choice for reactive colors was determined to be the printed sample with a 25g thickening.

The optimal concentration for discharge of samples has been selected 20 five grs of gum tragacanth as gum tragacanth is totally dissolved by employing this concentration, resulting in a thick and smooth paste. It makes it possible to keep the paste on the cloth surface and to fill between the warp and the yarn. Smooth and sharp prints are also produced.

#### *Optimized concentration of dye*

The different dye solutions were produced using standardized recipe, i.e. 1, 2, 3, 4% for each dye concentration. The cotton samples were dyed with each solution and printed in an optimum concentration of gum tragacanth with discharge paste. The findings. The results are assessed aesthetically and for color speed for best concentration and selection. It has been discovered that samples with a 3% reactive colouring have been chosen to be the best for 25g of gum tragacanth, given that the coloring level affects the evenness of the colour.

#### *Optimized concentration of Rongalite C (discharging agent)*

In order to prepare the discharge printing paste for cotton sample, Rongalite C with different concentrations (i.e., 5g, 10g, 15g and 20 g) were obtained individually. In order to identify the optimal Rongalite C concentration for eco-friendlies reactive dye, all samples were visually evaluated. Table 3 shows the results. The chart shows that the greatest average concentration of rongalite C was 20g. It has thus been recognized as the finest for unloaded cotton printing.[14]

#### *Effect of chitosan on resist printing of cotton fabrics with reactive dyes*

Chitosan is a cationic natural biopolymer obtained by alkaline N-deacetylation of chitin the most abundant natural polymer after cellulose. It includes glucosamine and N-acetyl glucosamine  
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copolymers and exhibits many unique properties such as non-toxicity, biocompatibility and biodegradability. Chitosan was used as the resist printing agent. The usage of chitosan in acetic acid chitosan works as a high coverage insoluble membrane and is an outstanding resistance to chemicals.

The concentration of chitosan, resistance agent kinds, cure temperature and cure duration were diverse in order to assess its impact on resistant cotton textiles. The best resistance effect on imprinted cotton textiles was the optimum chitosan content of 1.6 percent. A 6:4 citric acid chitosan and 8:2 tartaric acid combination were used in mixtures: chitosan had the highest resistor effects. For 180s the curing temperature was ideal at 150°C.

#### *Procedure for printing*

A 200 mesh screen was taken in screen printing. The resistor paste is used by a flat screen printing process on samples of cotton fabric by squeegee. The samples were then dried pre-dried for 3 minutes at 80°C to prevent the migration of paste.

The samples were then fixed for varied periods with thermosol at different temperatures (130, 140, 150, 160 and 170°C) (120, 150, 180, 210 and 240 s). For 15 minutes, the printed material is washed with cold water at 90°C and with NP-9 solution at 80°C for 10 minutes. The samples were cleaned and dried after soaping.

An extra resistant print paste with a consistent 1.6 percent chitosan content and mixed separately with citric acid and tartaric acid was made for comparison (10:0, 8:2, 6:4, 4:6, 2:8 and 0:10).

#### **Results**

The inclusion of chitosan in the paper resistant paste improved the resistant printing of processed cotton fabrics. The resistance-printing impact was non-linear with the concentration of chitosan and was excellent at 1.6 percent chitosan. The technique was optimized using tartaric acid printing agents which had a higher impact than that achieved independently with each agent. The uniformity of resistance printing was typically satisfactory in processed cotton textiles. Furthermore, a variable quantity of tartaric acid washes quickly processed cotton

products: chitosan can achieve Grade 4. The dry rubbing speed of the manufactured cotton textiles can approach grade 4 and wet rubbing fastness can reach up to grade 3 to 4 [15].

#### **Conclusion**

The present ecological dyeing approach of cotton fabric with natural dyes would further inspire scientists for more environmentally friendly successful work ahead in the field of textile coloration.

The effect of the formulation of print paste with a madder natural dye on the imprintability of cotton (bio-mordant samples) fabrics. The color strength value for both printed formulations is increased by the bio-mordant process. The result reveals that organic salts/alkali had the most effective effects as opposed to traditional printing of urea/alkali. In addition to the low cost of organic salts and its use in reactive dyes cotton printing, the obtained prints have high quality, outlines sharp, low penetration with substantial dyestuff savings, and thus low demands on the printing process of washing clothes resulting in a decreased wastewater load. This work represents a step forward towards cleaner textile development.

Digital textile inkjet printing has major benefits such as high quality and scalable processing. With using the color depth of printed RR218@PSBV material has improved by 1.4 times compared to the dye RR218 solution, and printing effluent dye residues have been decreased by approximately 45%. Meantime in traditional inkjet prints sodium carbonate and urea intake have been decreased by approximately 3.3 mg/cm<sup>2</sup> and 22.8 mg/cm<sup>2</sup>, respectively, and a 30% energy saving printing process has been streamlined.

Discharge printing in cotton fabric with optimum recipe 3% eco-friendly reactive dye. 25% gum tragacanth 20% rongalite C.

Resist printing of processed cotton fabrics was enhanced by the inclusion of chitosan in the resist-printing paste. The resist-printing effect exhibited a nonlinear relationship with chitosan concentration and was optimal at 1.6% chitosan. The process was optimized with a tartaric acid printing agents yielded an effect superior to that obtained with each agent separately.

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### ملاحظة قصيرة على طباعة الأقمشة القطنية باستخدام بعض الأساليب

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في الوقت الحاضر ، تنعكس آثار الوعي البيئي والمنتجات العضوية والميل نحو نمط حياة صحي أيضًا على قطاع النسيج. تؤدي الخلافات حول مخاطر استخدام الأصباغ الاصطناعية وزيادة الوعي البيئي إلى زيادة الاهتمام بالموارد الطبيعية والمنتجات الصديقة للبيئة والاستراتيجيات الجديدة. هذا هو أحد أسباب عودة استخدام الأصباغ الطبيعية إلى جدول الأعمال بسبب زيادة الوعي البيئي والمستدام. على عكس المواد الخام غير المتجددة للأصباغ الاصطناعية ، فإن الأصباغ الطبيعية غالبًا ما تكون متجددة ومستدامة ، لذا في هذه المراجعة تظهر استخدام بعض المواد الطبيعية في طباعة الأقمشة القطنية والتطبيق بتقنية مختلفة لطباعة القطن كطباعة مباشرة مع الأصباغ الطبيعية مثل الطباعة النفائثة للحبر باستخدام القوة. صبغ رد الفعل و charge ، مقاومة الطباعة.

**الكلمات الرئيسية:** البيئة ، صديقة للبيئة الطبيعية ، صبغة رد الفعل ، نفث الحبر والتفريغ ومقاومة الطباعة.