**Textile Chemistry** 

## **Research Paper**



# Aspects of Fluorescent Pigment Printing on Cotton

## \* Chintan R. Madhu \*\* Dr. Bipin J. Agrawal

\* Lecturer, Textile Processing Department, R. C. Technical, Institue, Sola, Ahmedabad – 380060

\*\* Associate Professor, Textile Chemistry Department, Faculty Of Technology & Engineering, The M. S. University Of Baroda

#### ABSTRACT

The present study deals with the application of fluorescent pigments into one natural textile fibre (cotton). The study has been undertaken to visualize the printing performance of these pigments. For printing of fluorescent pigments, a comparative study of various thickeners used in preparing the printing paste is studied by direct printing style. Discharge and resist printing also studied.

### Keywords : Printing, Discharge Printing, Resist Printing, Flourescent Pigments, Cotton Printing

#### Aspects of Fluorescent Pigment Printing on Cotton

Materials:- Cotton fabric, use for the present investigation was procured from the market which was plain weave, 60 X 80 with 142 g/ sq.m. weight. Fluorescent pigments which are used shown in Table-I.



#### Table – I Characteristic feature of various fluorescent pigments

**Method:-** Scouring of cotton was carried out with 5 gpl soap solution and 3 gpl sodium carbonate for 1 hour at boil, keeping the liquor ration 50:1. Then the fabric was washed thoroughly with water and treated with an optical brightening agent at 45°C for 15 minutes to obtain desired whiteness.

Direct Printing:- The printing of fluorescent pigments was carried out by direct style on cotton. Four different thickeners were used for study. Printing paste was prepared as follows:-

2 Parts Fluorescent Pigment 5 Parts Acetic acid 5 Parts Glycerine 79 Parts Guar gum/Gum Arabic/Gum Indalca paste 2 Parts Diammonium hydrogen Phosphate 7 Parts Water

100 Parts The paste was uniformly mixed with an electric stirrer.

The fabric sample was printed with above paste using screen printing method, dried and then cured at temperature  $105^{\circ}C$  for 5 minutes. The sample was then washed, soaped at  $60^{\circ}C$ 

for 10 minutes, washed and dried another samples were steamed at 102°C for 30 minutes at 25 psi pressure.

Another paste was made using binder and synthetic thickener.

Stock thickening:-10 parts Binder 85 parts Water 05 parts Synthetic Thickener 100 parts

Printing paste was prepared as follows:-2 parts Fluorescent Pigment 5 parts Binder 87 parts Stock thickening 5 parts Urea 1 parts Diammonium hydrogen phosphate 00 parts

The fabric sample was printed with above paste, dried at  $60^{\circ}$ C and cured at  $150^{\circ}$ C for 5 minutes. Finally, the sample was washed, soaped at  $60^{\circ}$ C for 10 minutes and dried. Other samples were steamed at  $102^{\circ}$ C for 30 minutes at 25 psi pressure.

**Discharge printing:-** The discharge printing consists in producing white or coloured patterns or a fabric dyed in dark colour. In the first case, printing is done with substance which destroys the colour of the ground and in the second case with the same substance in mixture with dyes which are resistant to their action.

The cloth dyed for producing discharge effect by following dye bath:-

3 parts Fluorescent pigment 1 parts Dispersing agent

- 5 parts Acetic acid
- 0.5 parts Guar gum
- 100 parts adjusting by adding water

Fabric is padded through the length using two bowl padding mangle, dried at 60-70  $^\circ\text{C}$  and then printed with following paste:-

White Discharge using Stannous Chloride 12 parts Stannous Chloride 5 parts Hydrochloric acid 2 parts Urea 2 parts Sodium acetate 74 parts Guar gum paste 100 parts

White Discharge using Zinc Sulphoxylate Formaldehyde 15 parts Zinc Sulphoxylate Formaldehyde 0 parts Sodium hydroxide 2 parts Urea 2 parts Sodium acetate 71 parts Sodium alginate paste 100 parts

# Vat Colour Discharge using Stannous Chloride

7 parts Vat Dye 10 parts Glycerine 53 parts Guar gum paste 10 parts Stannous Chloride 5 parts Hydrochloric acid 100 parts

#### Vat Colour Discharge using Zinc Sulphoxylate Formaldehyde

7 parts Vat Dye 10 parts Glycerine 53 parts Gum Arabic paste 10 parts Zinc Sulphoxylate Formaldehyde 8 parts Pottasium Carbonate 100 parts

Print the fabric and dry at  $60^{\circ}$ C then the samples were steamed at  $102^{\circ}$ C for 30 minutes at 25 psi pressure. Finally, the samples were washed, so soaped at  $60^{\circ}$ C for 10 minutes, washed and dried.

**Resist Printing:-** In resist style of printing as compared to discharge printing cloth is printed with white and coloured resist and subsequently dyed to get white and coloured effect at the printed places.

The fabric samples were first printed with following paste:-

#### For White Resist

10 parts Chalk powder
4 parts T.R. oil
8 parts Sodium hydroxide
10 parts Water
67 parts Sodium alginate paste
100 parts

For Colour Resist 10 parts Vat dye 5 parts T.R. oil 50 parts Gum Arabic paste 7 parts Sodium hydroxide 10 parts Zinc Sulphoxylate Formaldehyde 15 parts Water 3 parts Urea 100 parts

After printing, samples are dried at  $60^\circ\text{C}$  and then padded through the solution containing:-

3 parts Fluorescent pigment 1 parts Dispersing agent 5 parts Acetic acid 0.5 parts Guar gum 100 parts adjusting by adding water

Pad the fabric and dry at  $60^{\circ}$ C then samples were steamed at  $102^{\circ}$ C for 30 minutes at 25 psi pressure. Finally, the samples were washed, soaped at  $60^{\circ}$ C for 10 minutes, washed and dried.

The samples which were printed by using three basic styles of printing compared for their tone and colour strength and grades were allotted from five different viewers.

#### Results

The printing performance (judged by five different viewers) of fluorescent pigments on cotton substrate using various thickeners, viz. Guar gum, Gum Arabic, Gum Indalca and Binder paste is shown in Table – II.

								Vie	Viewer's		Grades		for	Differents		Thickeners									
Fluorescent		Gι	Jar	Gur	n Tl	nickei	ner	Gι	ım l	nda	lca <sup>·</sup>	Thicke	ner	Gu	m A	rabio	c Th	ickei	ner	Bir	der	Thi	cker	ner	
Pigment		1	2	3	4	5	Avg.	1	2	3	4	5	Avg.	1	2	3	4	5	Avg.	1	2	3	4	5	Avg.
Fluorescent	С	4	3	3	4	3	3.5	2	1	2	2	2	2	4	3	3	3	3	3	5	5	5	5	4	5
Green B	s	3	2	2	3	3	2.5	1	2	1	1	2	1.5	3	2	3	3	2	2.5	5	5	4	4	5	4.5
Fluorescent	С	2	1	2	2	2	2	3	3	4	3	3	3	3	2	3	3	2	2.5	5	4	5	5	5	5
German Red	s	3	3	3	2	2	2.5	2	2	1	1	1	1.5	2	2	1	2	2	2	4	4	4	5	5	4.5
Fluorescent	С	4	4	4	3	4	4	3	4	4	4	4	4	4	3	4	3	3	3.5	5	5	4	5	5	5
Violet	s	3	4	4	3	4	3.5	3	3	3	4	3	3	3	3	3	2	3	3	5	5	4	5	4	5
	C:-	- Pr	int ·	- Dr	y - (	Cure																			
	S:- -St	:- Print - Dry Steam																							
		Table - II					Printir	ting Perform				се	of	Vai fab	Various Fluorescent Pigments on Cotton fabric										
							using	Diff	ere	nt T	hick	eners	by Direc	t Sty	/le o	f Pri	ntinę	3							

#### C:- Print - Dry - Cure S:- Print - Dry -Steam Table - II Printing Performance of Various Fluorescent Pigments on Cotton fabric using Different Thickeners by Direct Style of Printing

It can been clearly seen from Table – II that binder thickener exhibit the best result out of the four thickeners used, irrespective of the fluorescent pigments selected for printing purpose. The colour value, brightness as well as the sharpness of the print is brilliant when binder thickener is used. The next better printing performance is shown by guar gum thickener. However, in case of Fluorescent German Red pigment, there is change in tone along with somewhat lowering down of the brightness of the prints. The prints obtained when Gum indalca thickener is used for the preparation of printing paste do not exhibit good performance. Gum Arabic shows also good effect on printing but the print obtained with this thickener is somewhat lighter than printing paste using guar gum. Trails have been taken with gum Alginate thickener but there was lump formation in the printing paste itself. So, this particular thickener was not utilized for the present work. In general, binder thickening prepared with binder and synthetic thickener showed an overall best printing performance, in the direct style of printing, for all the fluorescent pigments used for study. This is possible due to good binding and fixation of the pigment at high temperature of curing utilized when binder thickener has been used. In steaming, the tone of all the prints are slightly change, which may be due to instability of these fluorescent pigments during long time temperature application.

The printing performance of discharge and resist printing on fluorescent pigment ground is shown in Table – III and Table – IV.

										Vie	wer's	Grade	s fo	r													
Fluorescent					Whit	e Disch	narge								Col	our	Disch	arge	Э								
Pigment	Using Stannous Chloride						Using Zinc Sulphoxylate							Using Stannous Chloride							Using Zinc Sulphoxyla						
								Formaldehyde												Fo	rma	ldeh	yde				
	1	2	3	4	5	Avg.	1	2	3	4	5	Avg.	1	2	3	4	5	Avg.	1	2	3	4	5	Avg.			
Fluorescent Green B	1	2	1	1	2	1.5	4	5	5	4	4	4.5	1	2	2	2	1	2	4	4	5	5	5	4.5			
Fluorescent German Red	2	1	2	2	2	2	4	3	3	4	3	3.5	2	3	3	2	2	2.5	4	5	5	4	5	4.5			
Fluorescent Violet	1	1	1	1	1	1	3	4	4	3	3	3.5	2	2	1	1	1	1.5	5	5	5	4	4	5			
	Та	ble	-111	Printi	ng Pe	rforma	nce (g	grade	es) of	Vario	ous Fl	uoreso	cent	Pign	nent	s on	Cot	ton Fa	bric	: Us	ing l	Diffe	rent				
		Discharging Agents by Discharge Style of Printing																									

#### Table -III Printing Performance (grades) of Various Fluorescent Pigments on Cotton Fabric Using Different Discharging Agents by Discharge Style of Printing

As seen from Table – III, white discharge on fluorescent colour grounds is not quite prominent when Stannous Chloride was used as the discharging agent. However, when Zinc Sulphoxylate Formaldehyde was used, quite encouraging results are being obtained. In fluorescent Violet and fluorescent German Red pigments, there was tinting on white discharged pattern due to migration of pigments particles to that portion. In Vat colour discharge also Stannous Chloride had not shown good performance, while Zinc Sulphoxylate Formaldehyde gave good results, which indicates that Stannous Chloride is not quite compatible to be used as a discharging agent for fluorescent colour ground.

It is clearly seen from the Table – IV that white resist effect is clearly visible especially with Fluorescent Green B, which shows excellent performance. On the other hand, Fluorescent German Red and Fluorescent Violet pigments, there was tinting on white portion. In Vat colour resist, all the three pigments colours had shown excellent performance for resist effect in the presence of Zinc Sulphoxylate Formaldehyde as the resisting agent.

			Viewer's Grades for																
Fluorescent																			
Pigment		White Resist						Colour Resist											
	1	2	3	4	5	Avg.	1	2	3	4	5	Avg.							
Fluorescent Green B	1	2	1	1	2	1.5	4	5	5	4	4	4.5							
Fluorescent German Red	2	1	2	2	2	2	4	3	3	4	3	3.5							
Fluorescent Violet	1	1	1	1	1	1	3	4	4	3	3	3.5							
	Та	ble ·	-IV	Prin	ting P	erformar	nce (	grad	les)	of \	/ario	us							
			Fl	uore	scent	Pigment													
			Re	esist	Style	of Printii													

#### Table -IV Printing Performance (grades) of Various Fluorescent Pigments on Cotton Fabric by Resist Style of Printing

#### Conclusion

The utilization of suitable thickener is a critical factor for printing of these fluorescent pigments. Among four thickeners used for the study, binder thickener gave the best overall printing performance in the direct style of printing. The shades are quite brilliant and very sharp prints are obtained. Guar gum has given moderate performance. The results obtained with Gum Arabic were also good, but the results obtained with Gum Indalca thickener were not satisfactory. The fixation of pigment was quite good with binder thickening, guar gum and gum Arabic thickening, with no bleeding of the dye from the printed area, whereas with Gum Indalca thickener, comparative low-tone prints are obtained, particularly in Fluorescent German Red pigment.

In discharge and resist printing, the results obtained with Stannous Chloride (in white or vat colour discharges) were not satisfactory, especially in the Fluorescent German Red and Fluorescent Violet pigments. The effects obtained with Zinc Sulphoxylate Formaldehyde were quite brilliant in both white and colour discharges. White resist printing was not effective with fluorescent pigments, but the results of vat colour resist effect were highly prominent under fluorescent pigment grounds.

Thus, by properly selection of suitable thickener for preparing the printing paste, along with suitable discharging and resisting agent for producing discharge and resist effects, successful printing can be achieved with various fluorescent pigments.

### REFERENCES

1. T. C. Patton, Pigment Handbook, John Willey and Sons. Vol. II | 2. A. C. Fox, Journal Society of Dyers and Colourist, 80, 1964,529 | 3. Robert W. Voedisch, Fluorescent Pigment, 1994 | 4. H. Zollinger, Colour Chemistry, 1987 | 5. J. Lunkiewioz, Pigments, 1966, 150 | 6. C. K. Dien, The Chemistry of Synthetic Dyes, 1978, 115. |