

## Application of Plaster of Paris as a Resist Material in Dyeing-Small Scale Industry in Rural Areas

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### ABSTRACT

*Batik is one of the oldest means of embellishing fabrics. Although this is often molten wax, it may also be any other dye proof substance like starch, clay and paste. Efforts have been directed towards developing techniques, easy to understand, easy to apply, ecofriendly and involving use of easily available materials. Out of the tried resist pastes, plaster of paris (POP) results were found to be the best so further experimentation was done with plaster of paris. Experiments were done to see the performance of plaster of paris by varying the thickness of layer, single/double side application, immersion time and to select the consistency of the paste. It was found that there was no effect of time of immersion on resist effect and 5:4 consistencies was found to be the best. The resist effect of double side application was found to be more satisfactory and the medium thickness of resist layer was found to be a wiser choice. Thus, it was concluded that resist paste was cheaper, safer to use, easier to apply and remove than wax so it can be used in small scale industries in rural areas to empower the rural people.*

**Key words:** Batik; Molten wax; Paris plaster

**B**atik is one of the oldest means of embellishing fabrics. It is a traditional Javanese resist style in which design is drawn out onto the cloth in wax or a wax mixture. Although this is often molten wax, it may also be any other dye proof substance like starch, clay and paste; when applied substance hardens it resists dyes and when it is removed, the design of the reserved area remains, showing a light pattern against the dyed background. Resist application is repeated as many times as the number of colours required in the pattern, in order to produce very rich and striking effects.

The art of batik can be exploited to its fullest extent for the craftsman with a little more imagination and experimentation. Efforts have been directed towards developing techniques, easy to understand, easy to apply, ecofriendly and involving use of easily available materials.

Wax is the most widely used resist material in Batik, but it has some disadvantages too. Use of wax in batik has many times led to accidents. It is quite costly. Its method of application and its removal is difficult and lengthy. It also causes air pollution as fumes are released during heating.

Thus, studies were carried out on non-wax batik which included the use of various starches, gums, clays fevicol etc. (Gogoi et al., 1998 and Shahidulla et al., 1994). Out of the tried resist pastes, plaster of paris (POP) results were found to be the best. It gave perfect

white resist, it didn't need reapplication, no cooking was involved, was cheaper, gave finest crack effect and produced greatest aesthetic appeal and sharpness of outline (Parul, 2002). Therefore, the present study was conducted to further experiment with plaster of paris (POP) as a resist material.

### METHODOLOGY

*Preparation of fabric:* The textile material used was cambric whose thread count was 124 x 112 per square inch, thickness 0.32 mm and weight was 3.63 ounces per square yard. The fabric was scoured using the following recipe.

Soap	- 5g / 1
Sodium carbonate	- 2g / 1
Temperature	- 60°C
Time	-30 minutes
m:l	-1 : 30

After scouring the fabric was rinsed in clean water and dried under shade and ironed to remove all the creases.

*Preparation of POP resist paste:* The desired amount of POP was weighed and taken in a bowl. Required amount of water was added and simultaneously mixing was done to form a smooth paste which could be applied easily.

*Application of the resist paste:* A Scoured fabric piece of

size 6 × 6 inches was mounted on an embroidery frame with outlines of the motif traced on it. The prepared resist paste was then applied within the outlines of the motif with the help of a painting brush.

*Application of azoic dyes:*

(a) *Preparation of dye bath :* The fabric samples were weighed and then amounts of following chemicals were calculated over the weight of fabric as given below:

Bath I		Bath II	
A.T.	-2%	Blue B. Salt	-4%
Caustic Soda (NaOH)	-2%	Common salt (NaCl)	-4%
Turkey Red.	-enough to	m:l	-1 : 30
Oil (TRO)	form a paste		

(i) *Preparation of base solution:* A paste of A.T. and TRO was prepared in a beaker. Little amount of boiling water was added in the paste and it was mixed thoroughly. The solution was allowed to cool and then caustic soda pellets were added. The base solution was stirred until caustic soda gets completely dissolved, giving a transparent solution. This solution was sieved through a cloth-piece into the tray containing plain water.

(ii) *Preparation of colour salt solution:* The colour salt and common salt were taken in a piece of cloth and tied. It was moved in a tray containing water till it got completely dissolved in the water.

(b) *Dyeing*

(i) *Treatment of fabric in the base solution:* The fabric was wetted in water at room temperature and then entered in the base solution. It was moved gently in the bath for uniform colour. The cloth was allowed to remain in this bath for five minutes so that it gets completely saturated. It was then taken out and placed on the blotting paper to remove the excess liquid.

(ii) *Treatment of fabric in the colour salt solution:* The base treated sample was dipped in the colour salt solution and moved gently to obtain even results. The fabric was removed from the bath after five minutes. The process of dyeing was repeated for getting desired shade of the colour.

(c) *Rinsing:* After dyeing, the fabric was gently rinsed in cold water. The rinsed fabric was dried under shade.

*Removal of resist paste:* After complete drying of the sample, the resist paste was removed by peeling off and rubbing. The left over resist material was removed by washing in plain water. Then the samples were allowed to dry under shade. Finally, the samples were ironed to remove the creases.

*Experiments*

(a) *Selection of consistency of the POP resist paste:* The resist paste was prepared in three different consistencies i.e. 5:3,5:4 and 5:5(POP: Water).One consistency was selected out of these on the basis of ease of application, ease of removal and resist effect.

(b) *Performance of the single side and double side*

*application of POP paste on the fabric:* The resist paste of the selected consistency was prepared and applied in the form of a motif on two different samples, one with single side application and the other with double side application. Then the samples were dried, dyed, again dried and the paste was removed. The samples were evaluated on the basis of ease of application, ease of removal and resist effect.

(c) *Effect of immersion time on resist performance:* The resist paste of the selected consistencies was applied in the form of a motif on six different samples, three with single side application and three with both side application. The immersion time for each sample was 10,20 and 30 minutes in each bath. Hence, the total immersion time was 20,40 and 60 minutes. Then the samples were dried, dyed, again dried and the paste was removed. The samples were evaluated on the basis of resist effect.

(d) *Performance of different thicknesses of resist paste application:* The resist paste of selected consistency was applied in the form of a motif on four different samples, on single side only in four thicknesses i.e. 0.97, 1.23, 1.48 and 1.67 mm. Then, the samples were dried, dyed, again dried and the paste was removed. The samples were evaluated on the basis of ease of application, ease of removal and resist effect.

*Evaluation of dyed samples:* The ease of application, ease of removal and resist effect of the resist paste in all the samples were judged by the researchers. The final samples prepared using optimum conditions were evaluated by 30 judges – 10 Lecturers and 20 PG students of Clothing and Textiles.

The judges rated the samples on a five point scale presented below.

Excellent	Very Good	Good	Fair	Below Average
5	4	3	2	1

To check the significance of difference in single and double side application the paired t test was used.

**RESULTS AND DISCUSSION**

*Performance of different consistencies of the resist paste:* It is evident from the Table 1 that the medium consistency was found to be the best as its application and removal were easier. Application and removal of the thick consistency were little difficult than the medium consistency. The thin consistency was ranked least satisfactory as its application and removal both were difficult than the other two. The resist effect was found to be the same with all the consistencies.

*Performance of single side and double side application of the resist paste:* The performance ranks of single and both sides application of the resist paste on the fabric have been presented in the Table 2. It was found that the application and removal of single side application was

easier than that of the both side application. Resist effect of single side application was also comparable to that of both side application but a slight tint of colour could be seen due to colour on the back portion of the resist area. Both side applications gave a perfect white area. So, POP can be used with single as well as double side application according to the resist affect required.

Table 1. Performance of different consistencies of the resist paste

S. No.	Consistency	POP to water ratio (g:ml)	Ranks		Resist Effect
			Ease Appl-ication	Ease Rem-oval	
1.	Thick	5:3	3.0	2.0	2.0
2.	Medium	5:4	1.0	1.0	2.0
3.	Thin	5:5	2.0	3.0	2.0

\*Suitable consistency

Table 2. Performance of single side and double side application of the resist paste

S. No.	Consistency	Ease Appl-ication	Ranks		Resist Effect
			Ease Rem-oval		
1.	Single side	1.0	1.0		2.0
2.	Double side	2.0	2.0		1.0

*Effect of immersion time on resist performance:* The Table 3 shows that the increase of immersion time upto 60 minutes didn't affect the resist performance of the paste. All the samples showed equally white resist areas.

Table 3. Effect of immersion time on resist Performance

S.No.	Time of immersion each bath (min)	Total time of immersion (min)	Rank in (resist effect)
1.	10	20	2.0
2.	20	40	2.0
3.	30	60	2.0

*Performance of different thicknesses of resist paste laye:*

Table 4 indicates that the application of medium thickness was found to be easiest, followed by thicker applications. Removal of the medium and thicker application. Removal of the medium and thicker consistencies was easier than the thin application. The resist effects of all the thicknesses were found to be the same. Application of thick layers would be wastage of POP, therefore, the

medium thickness would be a wiser choice while applying with a painting brush.

Table 4. Performance of different thicknesses of resist layer

S. No.	Thickness	Numerical Measure (mm)	Ranks		Resist Effect
			Ease Appl-ication	Ease Rem-oval	
1.	Thin	0.97	4.0	2.5	4.0
2.	Medium	1.23	1.0	2.5	2.0
3.	Thick	1.48	2.0	2.5	2.0
4.	Very Thick	1.67	3.0	2.5	2.0

*Evaluation of final samples:* It is clear from table 5 that the judges also found the resist effect to be more satisfactory with the both side application as compared to the single side application.

Table 5. Ranks for single and double side application of resist paste

S. No.	Type of application	Consumers response towards POP resist effect					Total Scores and Rank
		5	4	3	2	1	
1.	Single side	2	7	13	7	1	II (92)
2.	Double side	13	12	4	1	-	I (127)
t						5.27**	

5 = Excellent, 4 = Very Good, 3 = Good, 2 = Fair

1 = Below Average

Figures in parentheses indicate weighted scores

\*\*Significant at 0.01 level of significance.

The value of t (5.27) is highly significant ( $P < 0.01$ ). It means that the average score given for POP application on two sides is significantly more than the average score given for POP application on one side. It is also apparent that majority of the judges rated both the sample from good to excellent.

## CONCLUSION

It can be concluded from the study that POP has a great potential as a resist material in dyeing. Its resist power is comparable to that of wax and the results were liked much by the respondents. Thus, plaster of paris can be used as an additional or alternative resist material with effectiveness similar to that of wax due to this it can be used in small scale industries in rural areas to empower the rural people.

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