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, eco-friendly 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

Batik 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, eco-friendly 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.

<table>
<thead>
<tr>
<th>Material</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soap</td>
<td>5g / 1</td>
</tr>
<tr>
<td>Sodium carbonate</td>
<td>2g / 1</td>
</tr>
<tr>
<td>Temperature</td>
<td>60ºC</td>
</tr>
<tr>
<td>Time</td>
<td>30 minutes</td>
</tr>
<tr>
<td>m:l</td>
<td>1 : 30</td>
</tr>
</tbody>
</table>

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:

<table>
<thead>
<tr>
<th></th>
<th>Bath I</th>
<th>Bath II</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.T.</td>
<td>-2%</td>
<td>Blue B. Salt</td>
</tr>
<tr>
<td>Caustic Soda</td>
<td>-2%</td>
<td>Common salt</td>
</tr>
<tr>
<td>(NaOH)</td>
<td></td>
<td>(NaCl)</td>
</tr>
<tr>
<td>Turkey Red.</td>
<td>enough to move</td>
<td>m;l</td>
</tr>
<tr>
<td>Oil (TRO)</td>
<td>form a paste</td>
<td></td>
</tr>
</tbody>
</table>

(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.

<table>
<thead>
<tr>
<th></th>
<th>Excellent</th>
<th>Very Good</th>
<th>Good</th>
<th>Fair</th>
<th>Below Average</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Consistency</th>
<th>POP to water ratio (g:ml)</th>
<th>Ease of Application</th>
<th>Ease of Removal</th>
<th>Resist Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Thick</td>
<td>5:3</td>
<td>3.0</td>
<td>2.0</td>
<td>2.0</td>
</tr>
<tr>
<td>2.</td>
<td>Medium</td>
<td>5:4</td>
<td>1.0</td>
<td>1.0</td>
<td>2.0</td>
</tr>
<tr>
<td>3.</td>
<td>Thin</td>
<td>5:5</td>
<td>2.0</td>
<td>3.0</td>
<td>2.0</td>
</tr>
</tbody>
</table>

*Suitable consistency

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

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Consistency</th>
<th>Ease of Application</th>
<th>Ranks</th>
<th>Resist Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Single side</td>
<td>1.0</td>
<td>1.0</td>
<td>2.0</td>
</tr>
<tr>
<td>2.</td>
<td>Double side</td>
<td>2.0</td>
<td>2.0</td>
<td>1.0</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Time of immersion (min)</th>
<th>Total time of immersion (min)</th>
<th>Rank in (resist effect)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>10</td>
<td>20</td>
<td>2.0</td>
</tr>
<tr>
<td>2.</td>
<td>20</td>
<td>40</td>
<td>2.0</td>
</tr>
<tr>
<td>3.</td>
<td>30</td>
<td>60</td>
<td>2.0</td>
</tr>
</tbody>
</table>

Performance of different thicknesses of resist paste layer: 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

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Thickness</th>
<th>Numerical Measure (mm)</th>
<th>Ease of Application</th>
<th>Ease of Removal</th>
<th>Resist Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Thin</td>
<td>0.97</td>
<td>4.0</td>
<td>2.5</td>
<td>4.0</td>
</tr>
<tr>
<td>2.</td>
<td>Medium</td>
<td>1.23</td>
<td>1.0</td>
<td>2.5</td>
<td>2.0</td>
</tr>
<tr>
<td>3.</td>
<td>Thick</td>
<td>1.48</td>
<td>2.0</td>
<td>2.5</td>
<td>2.0</td>
</tr>
<tr>
<td>4.</td>
<td>Very Thick</td>
<td>1.67</td>
<td>3.0</td>
<td>2.5</td>
<td>2.0</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Type of application</th>
<th>Consumers response towards POP resist effect</th>
<th>Total Scores and Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Single side</td>
<td>5 = Excellent, 4 = Very Good, 3 = Good, 2 = Fair, 1 = Below Average</td>
<td>5.27**</td>
</tr>
<tr>
<td>2.</td>
<td>Double side</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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.

REFERENCES