Appraisal of Kiss-Roll (Triatex-MA) limited application technique for textile finishing

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One of the limited application techniques, viz. Kiss-Roll (Triatex-MA) system, has been evaluated with a view to provide first hand report to Indian textile industry. Two aspects, viz. uniformity of application at lowest possible wet pick-up (WPU) and projected savings in chemical cost in resin finishing, have been looked into critically. It has been found that 35% WPU with 1 h batching or 45% WPU without batching results in uniform application on cotton poplin fabric. Savings in chemicals in resin finishing are expected to be 10-15%. Considering the high cost of the equipment ( ~ Rs 30 lacs) and the operating cost, the technique is uneconomical. The payback period can be brought down to about 3 years if the equipment is available indigenously at about Rs 10 lacs.

Keywords: Kiss-Roll (Triatex-MA) system, Textile finishing, Wet pick-up

1 Introduction

The importance to conserve energy needs no emphasis. In chemical processing of textiles, the drying operations at various stages consume a very large amount of thermal energy. If the textiles carry less water before drying, a less amount of energy will be needed to evaporate it. Several techniques have been developed to reduce the moisture content of textiles before drying. They can be classified broadly into following three categories:

A—Saturation and expression techniques
B—Topical techniques
C—Foam application

A detailed description of these techniques is available in the literature. Some of these, pertinent to our industry, have been discussed elsewhere. One of the techniques in category A, viz. vacuum extraction, finds special treatment. Work has also been carried out at ATIRA on foam application and loop transfer padding. Having worked on these three techniques, it was considered worthwhile to examine the unexplored but important technique, viz. topical application. This paper reports the work that has been carried out using one such system, Kiss-Roller technique.

The equipment employing Kiss-Roller technique is marketed by the Triatex International AG, Switzerland, under the brand name Triatex-MA system. ATIRA received a laboratory model of Triatex-MA system sometime ago. The system has been evaluated comprehensively for the lowest WPU possible and its performance in resin finishing. The techno-economics have also been worked out.

1.1 Triatex-MA System

The Triatex-MA equipment consists of a Kiss-Roller which dips into the liquor bath and the film of the liquor is formed on this roller (Fig. 1). The film from the roller gets transferred onto the fabric when it comes in contact with the roller and breaks into small droplets, the size of which is determined by the film thickness and the surface characteristics of the fabric. For uniform application, these droplets must distribute themselves throughout the thickness and area of the fabric. For successful application of the technique, it is essential that the finish formulation produces a film of uniform thickness across the width of the roller.

The speed of the applicator (roller) and the fabric is controlled independently and the differential in
the speed enables in obtaining the wet pick-up (WPU) to the adjusted level. The evenness in the WPU is maintained with the help of β-gauges—one on the entry side and the other on the exit side of the fabric. These continuously monitor the mass of the textile material both before and after the application of the liquor, and thus control the WPU irrespective of the fabric weight.

One critical requirement of the fabric for successful working on Triatex-MA is its water absorptivity. The absorbency should be very good and uniform. One side application of finishes on dense and heavy weight fabrics to produce face-back effect is possible with this system. The other advantages claimed are: simple operation, energy conservation, easy recipe conversion, no contamination of the mix, savings in chemical cost, and no extra/skilled manpower.

2 Materials and Methods

2.1 Finishing of Cotton Fabric Using Triatex-MA

Cotton poplin fabric was finished with dimethyloldihydroxyethylene urea (DMDHEU) at four levels (1, 2, 3 and 4%) of resin add-on on 100% solid basis. The recipe contained:

- **DMDHEU : X**
- **MgCl₂ : 30% of X**
- **Polyethylene emulsion : 40 g/l**

The resin application was carried out at 35% (with batching for 1 h), 45% and 55% WPU on Triatex-MA system. Simultaneously, the treatments were carried out on a mangle at 55% and 70% WPU. The recipe ingredients were adjusted accordingly. The samples were dried, cured and washed as usual.

2.2 Physical Properties of Resin-Treated Fabric

The following tests were performed on the treated fabrics:

1. Dry crease recovery (DCR)
2. Tensile strength
3. Tear strength
4. Abrasion resistance (weight loss method)
5. Wash-n-wear rating

2.3 Uniformity of Resin Finishing

To check the uniformity of resin finishing, the fabrics were dyed with a direct dye, Chlorantine Fast Green BLL (Ciba-Geigy). Dyeing was carried out at boil for 20 min in a bath containing 2% (owf) dye and 20 gpl sodium chloride. It was then given a cold wash.

3 Results and Discussion

3.1 Attaining Uniform Treatment

3.1.1 Wetting Agent

A wetting agent is inevitably incorporated in the finish recipe so as to achieve satisfactory performance. It is, therefore, essential to determine the effect of varying concentrations of suitable wetting agents on WPU and uniformity. For this purpose, treatments were carried out from a bath containing water and wetting agent. The results (Fig. 2) show that 0.5 gpl concentration is the most effective. In further experiments, this level was maintained. It may be noted that without any wetting agent the water did not form a uniform film on the applicator roller.

3.1.2 Lowest Wet Pick-up

In the rest of the experiments, the fabric speed was kept fixed at 1 m/min and the applicator speed was varied to obtain the different levels of WPU. At this speed, WPU around 45% gave uniform application on adequately prepared cotton poplin (Fig. 3). This was confirmed by first treating the fabric with the crosslinking agent and then dyeing the treated fabric with Chlorantine Green BLL. With this dye the surface of the cloth that is crosslinked dyes pale, whereas at the sites, where crosslinking does not take place, dark spots are formed. Fig. 4 shows that...
at about 45% WPU a completely uniform distribution of resin could be achieved whereas at 35% WPU spotty appearance was obtained. The latter could be improved by batching the fabric for 1 h after the application of the liquor (Fig. 5). Batching between 10 min and 1 h showed intermediate degree of uniformity at 35% WPU. Thus, satisfactory conditions for uniform application are: 45% WPU without batching or 35% WPU with 45-60 min of batching.

3.2 Dry Crease Recovery

Fig. 6 shows that improvement in the crease recovery with increasing add-on of the resin is the same at 55% WPU, irrespective of the treatment method, i.e., whether on a padding mangle or on the Triatex-MA system. Fig. 7 shows the effect of WPU on dry crease recovery (DCR) at various levels of resin add-on represented as % N. It is observed that at low pick-up (35% and 45%), DCR is higher than at high pick-up (55%) for the equivalent % N. This can be attributed to reduced migration of resin at low pick-up, resulting in its more efficient usage. It has been estimated that at this level of WPU, the resin concentration can be reduced by about 10-15% while finishing on Triatex-MA in comparison to that when finishing is carried out by conventional padding. This figure is considerably lower than that claimed in the literature, which is about 30%. The anomaly can be resolved by referring to Fig. 8. It is clear that the experimental results match well with those reported in the literature. The gain of 30% is obtained only when the performance at 70% WPU is compared with that at 10% WPU. However, when
comparison is made at 70% and 35% WPU, improvement in the performance, i.e., crease recovery, would be 10-15% only. This has a significant bearing on the techno-economics of the process, as discussed later.

3.3 Tensile and Tear Strengths

Fig. 9 shows that the dry crease recovery-tensile strength relationship remains almost the same, irrespective of WPU or the method of application. Although lower WPU helps in reducing the migration, it does not help much in controlling the tensile strength loss corresponding to the high level of crease recovery angles.

\[ \text{Table I—Data on tear strength} \]

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<th>% Resin add-on</th>
<th>Tear strength, g</th>
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<td>Triatex-MA</td>
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<td>35 W</td>
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a—% WPU; W—warp; F—Weft
Data on tear strength (Table 1) show a general trend. As the WPU increases from 35% to 55%, the tear strength also increases. Though marginal, the increase in tear strength indicates a trend. Between Triatex-MA and mangle, at the equivalent WPU (55%), the tear strength of fabrics treated with different concentrations of resin does not differ. Therefore, it can be inferred that the tear strength of the fabrics treated on Triatex-MA do not bear any advantage over those treated by the conventional pad-squeeze method.

3.4 Abrasion Resistance

The abrasion resistance was measured in terms of % weight loss on an accelerator. Higher the weight loss, inferior is the resistance and vice-a-versa. The data are given in Table 2. The analysis of the data reveals that lower the WPU, lower is the % weight loss for a given resin add-on. At 55% WPU, the Triatex-MA system and the mangle perform in almost similar manner.

3.5 Handle of Treated Fabrics

The fabrics finished on both the systems were evaluated subjectively for the handle. The fabrics finished on Triatex-MA feel fuller and also the body is better than the ones finished on a mangle. This is expected as the application of the finish in Triatex-MA is on the surface. The finish is not forced into the yarn structure as in the case of mangle.

3.6 Wash-n-Wear Rating

Wash-n-wear ratings (Table 3) were found to be almost same irrespective of the technique employed or WPU. Also, the ratings levelled off at about 3% resin add-on.

4 Economic Considerations

The technical performance definitely favours installation of Triatex-MA for fabric finishing, as is evident from the preceding discussion, but an overriding factor is the high capital investment (about Rs 30 lacs at present). It is, therefore, necessary to assess objectively the comparative cost of production. For this purpose, the following cost factors have been considered: (1) Venture cost—this converts the capital cost into equivalent revenue expenditure, (2) wages, (3) electricity, (4) steam, and (5) savings in chemicals in Triatex-MA.

Table 4 gives the cost for finishing 50,000 m (5000 kg) fabric per day on both the systems. The payback period for Triatex-MA works out to be about 9½ years, which is certainly unattractive. However, if the machine is available indigenously at a cost of about Rs 10 lacs, the techno-economics will be favourable, since the payback period will be approximately 3 years.

5 Limitations of Triatex-MA

Unlike expression techniques, Triatex-MA can be put to use only in finishing of textiles and this is a major limitation. It can help in saving thermal energy only in one of the several dryings that the textiles undergo. Another aspect is the nature of chemicals used in finishing in India. For cotton, mostly starch based recipes are employed and such finishes may not work smoothly on Triatex-MA. However, the recent shift to what is termed as 'pure finishes' mitigates this limitation to a considerable extent.
6 Conclusions

Technically, Triatex-MA exhibits superior performance to mangles which are normally employed for the finishing of fabrics. But the economic considerations do not favour the adoption of this technology in India at present. Installation will be favourable only if the equipment is available indigenously for about Rs 10 lacs. Triatex-MA also scores poorly in its versatility as it can be used only in finishing. On the other hand, vacuum extraction is economical and can be employed at all the stages of drying of textiles.

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References