Dimensional Stability of Modal Fibre Fabric during Processing on a Jigger

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Review of Literature

Modal is new regenerated cellulosic fibre. When dyeing modulated viscose-containing fabrics, it is essential that aesthetic properties are preserved or even enhanced by the dyeing process used. Dyes whose application procedures are prone to reprocessing due to unlevelness or poor shade reproducibility will inevitably have an adverse effect on the physical properties of the fabric1,2. Liquid-ammonia treatment of lyocell has been reported3 but NH3 treatment of lyocell is not said to be effective for the improvement of 'hand'. The production of easy-care Tencel fabrics by liquid-ammonia treatment and silicone finishing has been discussed in one publication10. However, in order to diversify the market, there is a need to develop a piece-dyeing process in open-width form, with high degree of fabric-rope orientation, to avoid damages due to rope marks, creases, shrinkage and fibrillation. Dress material made of the will have high export potential. Little work has been reported in the area of processing of modal from this point of view.

Abstract

Among the various man-made regenerated cellulosic fibres, modal has achieved a prominent place. Fabrics woven from viscose fibres have always been a fashion designer's delight, due to their excellent drape, lustre, softness, absorbency and colour brilliance. But the technology for chemical processing of modal-based fabrics is not well established at the shop floor. In our preliminary study of the processing of modal fabrics by conventional techniques, including the tapela process as well as the long-tube soft-flow process, we found that, as modal fibres swell to a higher extent, the fabric movement in rope form as well as package form was difficult. The crease marks were predominant and uneven shrinkage was to the extent of 8 to 11%. Therefore, in the present study, process was optimized on a jigger in open-width form. Dimensional stability of modal fabrics in terms of residual shrinkage was 3.1% and 2.8%, warp as weft-wise, respectively.

Experimental

Material

Modal fabric from the market was procured. The greige fabric specifications are as follows:

Fabric type:	Woven
Material:	1/40s (100% Modal)
EPI:	119
PPI:	76
GSM:	130
Greige width:	161
GLM:	209.3
Weave:	Dobby
Dimensional stability:	12%

Methods

The potential shrinkage of above greige fabrics was determined using the ISI-1299 method. The laboratory-scale and pilot scale trials were conducted as described in **Table 1** and after chemical finishing the fabrics were again tested for potential shrinkage using the ISI- 1299 method, and the residual shrinkage was adjusted by mechanical finishing, using sanforising.

Table 1: Methods and parameters/recipes used in processing of modal fabric at pilot scale

	Process Route	Processing Condition	Jigger machine
1	Singeing	Speed 70mpm two rounds.	Singeing
2	Desizing (if needed)	Desizing Enzyme: 1.5gpl Wetting agent: 02gpl Glauber salt: 03gpl Batching time is 8-10 hrs	Singeing machine + rotating station
3	Washing	First a boil wash at 90°C, 2 ends Sample check for desizing	Jigger
4	Caustic treatment	Caustic flakes - 45gpl run at RT 2 ends	Jigger
5	Washing	First a boil wash at 90°C, 2 ends	Jigger
6	Scouring	Soda Ash – 2gpl Soap – 2gpl Run at 80°C, 2 ends	Jigger
7	Washing	Hot wash at 80°C, 2 ends Cold wash at 50°C, 2 ends, followed by Neutralizing with 1gpl acetic acid at 50°C for 2 ends	Jigger
8	Bleaching/Dyeing (Piece dyeing) in case of yarn dyed sorts this step to be omitted	Bleaching as A Dyeing as per B	Jigger
9	Drying	At 120°C	Stenter
10	Chemical finishing	Resin required – 70gpl Softener as per requirement Binder as per requirement $MgCl_2$ – 14gpl Acid – 0.5gpl Dry at 120°C and cure at 170°C Contact time 40 sec.	Stenter
11	Sanforising	Belt pressure – 2kg Speed – 13mpm	Sanforising machine

A		Soda ash – 0.6gpl H2O2 – 2gpl OBA – 0.6gpl G. Salt – 1gpl Stabilizer – 0.5gpl	Jigger
B		Soda ash – 0.6gpl H2O2 – 2gpl OBA – 0.6gpl G. Salt – 1gpl Stabilizer – 0.5gpl	Jigger

Results and Discussion

The dimensional and physical properties/utility performance of processed modal fabric is shown in **Table 2**. Dimensional stability of HWM fabrics in terms of % residual shrinkage was 3.1 and 2.8 warp and weft-wise respectively. As regards tearing strength, results obtained were 10.2N and 9.4N, warp and weft-wise, respectively.

Table 2: Dimensional and physical properties/utility performance of processed modal fabric

Fabric description	Application		Jigger process (open width)			
	Composition		HWM x HWM fabric			
	Counts		1/40s x 1.40s (100% Modal woven)			
	Weave		Dobby			
Particulars			**Unit**	**Fabric Norms**		**Method**
Dimensions	Greige EPI x PPI		--	± 3%	119 x 76	IS 1963-1981
	Finished EPI x PPI		--	± 3%	134 x 90	IS 1963-1981
	Greige GSM Finished GSM		Gm/m2 Gm/m2	± 5% ± 5%	130 148	ISO 3801-1977 ISO 3801-1977
	Greige width		cm	Actual	161	IS 1954-1990
	Finished width		cm	Actual	141	IS 1954-1990
Physical properties/ Utility Performance	Tearing strength	Warp	Newtons	8.8	10.2	IS 6489-1993
		Weft	Newtons	8.8	9.4	
	Dimensional stability	Warp	%	3.5%± 0.5	3.1	IS 1299-1984
		Weft	%	3.5%± 0.5	2.8	
	Abrasion resistance					
	(wt. loss after 2000 rev. at 9kpa load)		%	<2.5%	0.02	IS 12673-1989
	Pilling		Rating	>4	4.5	IS 10971-1984
	Fastness to wash					
	Change in shade/staining on cotton		Rating	4 (for dk 3-4)	4	IS 764-1979
	Fastness to Rubbing	Dry	Rating	4	.4 - 5	IS 766-1988

		Wet		3	4	
	Bursting strength		Kg/cm2	2.5	NA	IS 1966-1975
	Seam slippage	Warp	mm	<6 mm	.5 - 2	IS 3320-1970
		Weft	mm	<6 mm	.5 - 4	
	Perspiration fastness		Rating		4	AATCC-15

Conclusion and Recommendations

Based on our bulk-scale study we suggest the following:
1. Fabric loading should be in warm water along with a good lubricating agent.
2. No cold wash should be given below 45°C.
3. A boiling-water shrinkage test prior to processing should be done. Width and overfeed setting on stenter should be decided as per the result of the boil test.
4. HE/ME reactive dyestuffs are suitable for getting good dyeing results in terms of levelness and fastness.
5. Due to the high affinity for dyestuff of viscose, it is recommended to follow slow dosing of dyes.
6. Sufficient lubricant should be added to avoid crease formation at every stage.
7. Drying should be below 130°C.

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