

# Improved Wet Rub Fastness of Dyed Fabrics

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**R**ecent years have witnessed a drastic change in the textile processing industry, with greater awareness and consumer demand for better quality textile fabrics and better performance in garments.

To survive in this competitive arena, the processor has no other options but to meet the demanded quality standards, particularly the higher rating in wet fastness and, specifically, wet rub fastness. Export obligations also include high standards of wet rub fastness for formal and informal wear.

Under certain conditions, such as during home laundering or wearing of garments with white, adjacent white material may be stained and light-coloured material may acquire colour due to the transfer of dye from the original dyed material. This is generally described as 'staining' or 'marking off'. The 'colour-fastness' of a textile is therefore defined as its resistance to these changes when subjected to a particular set of conditions. Hence, colourfastness needs to be specified in terms of these changes and expressed in terms of magnitude.

Previous investigators have observed that, for dyed cellulosic fabrics, proper washing-off of unfixed dye can improve the wash fastness of dark shades to an extent of rating 5 but corresponding improvement in wet rub fastness is not achieved. Through microscopic examination it has been established that,

under wet rubbing tests, samples get damaged and microscopically small dye particles stain to adjacent white fabric. Staining is more prominent for emerised or micro-sanded dark shades of cotton bottom weight.

Wet rub fastness for dark shades of dyed/ printed cotton and P/C blended fabric would depend upon following factors.

- Nature of dye/pigment used for coloration and its particle size
- Depth of shade
- Type of the substrate
- Efficiency of fixation
- Efficiency of washing-off of unfixed colour
- Efficiency of after-treatment to fix unfixed dye

Though both dry and wet rub fastness tests are conducted in a similar manner, in the case of wet rubbing, crocking cloth is in a wet condition. Invariably, in all cases, moisture introduced into wet crocking cloth deteriorates wet rub fastness in comparison with dry rubbing. The effect of moisture in crocking cloth influences the wet rubbing in two ways. Firstly, it has a dissolving action on the dye present in the test specimen (valid for water soluble dyes), as well as changing the coefficient of friction, which leads to bleeding of dye from the test specimen, resulting in staining of crocking white cloth. Also, dyes from the damaged fibres can get deposited in a similar manner. Due to the moisture

present in the crocking cloth, the coefficient of friction in wet rubbing is nearly double that in dry rubbing tests. Further, crocking cloth, which is a scoured and bleached cotton fabric, is free from primary wall, is extremely sensitive to rubbing in wet state and gets stained easily.

Herlinger et al<sup>1</sup> have shown that application of various resin finishes did not result in improvement of wet rubbing with water-soluble dyes. Also, attempts to improve rubbing fastness through application of softeners did not give positive results. These investigators observed that hydrophobic treatments did not result in much improvement in rubbing fastness, concluded that no aftertreatment would bring about significant change and emphasized that improvement in wet rub fastness is not possible.

G.N. Sheth et al<sup>2</sup> have shown that corduroy-drill types of fabric show a poorer wet rub fastness than rubia, poplin and satin types of fabric. Also, they have shown that different types of finishing treatment, viz. polyethylene emulsion, amino silicone, zirconium compounds, fluorocarbon, chitosan and cellulase enzyme, when applied to dyed fabrics, do not show improvement in wet rub fastness.

## Sarex Solution

We at Sarex tried to tackle this problem in a scientific way. Improvement in wet rub

Table 1: Wet rub fastness of self shades finished with Sarafinish RFI + Sarafinish X (Poplin fabric without and with soaping)

Dyed Fabric	Wet rub fastness		Wash fastness test, staining of cotton (ISO 105 C03)		Colour fastness to water, staining on cotton (ISO 105 E01)			
	Unfinished		Finished with 30g/l Sarafinish RFI + 10g/l Sarafinish X		Unfinished	Finished with 30g/l Sarafinish RFI + 10g/l Sarafinish X	Unfinished	Finished with 30g/l Sarafinish RFI + 10g/l Sarafinish X
	Without soaping	With soaping	Without soaping	With soaping				
5% Sumifix Yellow EXF	2	2	3	3	3-4	4	3	4-5
6% Reactive Orange ME2RL	1-2	1-2	3	3	2	3	2	4-5
5% Sumifix Red EXF	1-2	1-2	3	3	2-3	4-5	3	4-5
6% Sumifix Red HE8B	1-2	1-2	2-3	2-3	2	4	2	4-5
8% Reactive Turq Blue H2GP	1-2	1-2	2-3	2-3	2	2-3	2	4-5
5% SFS Blue EXF	2	2	3	3	4	4-5	3	4
Green (1.8% - Sumifix Yellow EXF + 1.2% Sumifix Navy Blue EXF)	2-3	2-3	3	3	4	4-5	3-4	4-5
Maroon (3% Sumifix Yellow EXF + 1.9% Sumifix Red EXF + 0.9% Sumifix Navy Blue EXF)	3	3	3-4	3-4	4	4-5	3-4	4-5

fastness can be achieved either by improving the abrasion resistance of the fabric or by reduction in the friction coefficient of rubbing. Based on the above principle, a speciality finish, viz. a combination of (i) Sarafinish RFI + Sarafinish X, was developed. We found that this finish combination improves abrasion resistance of fabric by half a unit when compared with unfinished fabric, as studied by Martindale abrasion resistance, and also reduces friction during wet rubbing.

A combination recipe of Sarafinish RFI + Sarafinish X not only improves wet rub fastness from rating 1 to 3, but it also improves wash fastness, even if any unfixed dye remains on the fabric. Also, these finishes improve wet rub fastness of pigment dyed/printed fabric, which we noticed in an initial study. Given below are details of our experimental work and our findings.

The following fabrics were used to study wet rub fastness after application of:

#### Sarafinish RFI + Sarafinish X by pad-dry method

- Dark self shades, dyed with reactive

on poplin. Two sets of fabrics prepared, one before soaping and another after soaping

- Combination shade dyed on poplin (after soaping)
- Dark shades dyed on cotton bottom weight with combination shades of reactivities (after soaping)

#### Application:

30g/l Sarafinish RFI + 10g/l Sarafinish X pH -5.5 with acetic acid, pad with 60-65% pickup, dry at 150°C, 2 min

Evaluation of fastness properties carried out of finished fabrics for:

- Wash fastness ISO 105 C03 (600C)
- Contact water fastness ISO 105 E01
- Rubbing fastness ISO 105X12

Results are given in Tables 1-2 and

Table 2: Wet rub fastness of various fabrics dyed with combination shade finished with Sarafinish RFI + Sarafinish X

Dyed Fabric (Bottom weight fabric)	Wet rub fastness	
	Unfinished	Finished with 30g/l Sarafinish RFI + 10g/l Sarafinish X
Red	1-2	3
Green	1-2	3-4
Black	1	3
Black	1-2	2-3
Greyish black	1-2	2-3
Bottle green	2	3
Peacock Green	1-2	2-3
Olive Green	1-2	3
Medium Olive Green	2-3	3-4
Grey	2-3	3

Illustrations 1-3

#### Observation

Finishing carried out with a combination recipe, 30g/l Sarafinish RFI + 10g/l Sarafinish X, showed improvement in washing fastness, contact water fastness as well as wet rubbing fastness for both

poplin and cotton bottom weight, dyed either in self shades with reactive dyes or in combination shades. Even material without soaping, when finished with the above recipe, showed improvement in wet rubbing fastness. Finishing with this combination did not lead to any harshness or any shade change when evaluated visually.

Conclusions

Improvement in wet fastness properties is possible with a Sarafinish RFI + Sarafinish X combination recipe. However, for best results, material should be free from any unfixed dyestuffs and finishing is to be carried out on unfinished fabric and not for correction of finished fabric.

References

1. Herlinger H and Schutz G., Melliand Textilber., 71, 125 (1990) E 57.  
2. G.N. Sheth, A.A.Musale and M.M Moni, BTRA scan, XXIX (4), (1995) pp 5.

IMPROVEMENT IN WET RUB FASTNESS			
SUBSTRATE	WET RUBBING FASTNESS		
	ORIGINAL	Finished with 30 g/l sarafinish RFI +10 g/l Sarafinish X	
		Finished without soaping	Finished after soaping
5% SFS Yellow EXF			
5% Orange ME2RL			
5% Red EXF			
5% Red HE8B			
5% Turq. Blue H2GP			
5% SFS Blue EXF			
Green shade			
Maroon shade			

Illustration 1

COLORFASTNESS (Staining on cotton)			
Colorfastness to water (ISO105 E01)		Color fastness to Washing (ISO 105 C03)	
original	finished with 30g/l Sarafinish RFI + 10g/l Sarafinish X	original	finished with 30g/l Sarafinish RFI + 10g/l Sarafinish X
5% SFS Yellow EXF			
6% Orange ME2RL			
5% Red EXF			
6% Red HE8B			
8% Turq. Blue H2GP			
5% SFS Blue EXF			
Green shade			
Maroon shade			

Illustration 2

IMPROVEMENT IN WET RUB FASTNESS		
SUBSTRATE	WET RUBBING FASTNESS	
	Original	Finished With 30 g/l Sarafinish RFI + 10 g/l Sarafinish X
Red		
Green		
Black		
Black		
Black		
Grayish Black		
Bottle Green		
Peacock Green		
Olive Green		
Medium Olive Green		
Grey		

Illustration 3