## Remedial Measure to Improve Tear Strength of Cellulosic Material

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The utility function which fabrics should fulfill first of all depends on their end use. The woven / knitted fabrics have a very wide range of applications. Such a wide range of application means that during their life time fabrics undergo actions from different forces and strains depending on their end use. They can be stretched in one direction or many directions torn or compressed.

An important feature of cellulosic fibres is chemical stability, enabling them to withstand degradation with its consequential loss of strength under normal conditions of processing. Even slight deviation in processing may lead to unacceptable loss of strength and other undesirable effects. In general, different treatments that may lead to degradation are:exposer to acids, alkalies, oxidizing agents, resins enzymes, heat and radiation. Under certain circumstances cellulose can also be degraded mechanically.

The degradation of cellulose by aqueous acid results in hydrolysis of glycosidic linkage which varies with acid concentration, temperature and time of treatment. The glycosidic linkages in cellulose can also be attacked during kier boiling where temperature as high as 140°C, and causes a loss of tensile strength. Although, peroxide bleaching is generally regarded as safe but if proper conditions are not maintained, it can damage cellulose in presence of Fe, Mn or Cu. Cellulose can be degraded by heat for longer time in alkaline or acidic medium. Further, cellulose may degrade photochemically. The most important group of photosensitizers includes the yellow, orange and red vat dyes. Also, vat dyes,

sulphur and basic dyes in same colour range with certain metallic oxide can enhance photodegradation.

Exposure of cotton in oxygen atmosphere at different relative humidities in Fadeometer show loss in breaking strength as studied by A.C.Mehta<sup>1</sup>. The loss in strength are as follows.

Relative Humidity	Time of Exposure	Loss in breaking strength
0	0	-
0	23	16
0	46	28
0	85	37
0	177	54
30	0	-
30	23	16
30	46	19
30	85	24
30	177	44
55	0	-
55	23	8
55	46	13
55	85	22
55	177	28

## Breaking strength loss on exposure to Fadeometer at varying humidity

Direction	Time of Exposure, days	Loss in breaking strength, %
Perpandicular	0	-
	7	17
	21	33
	42	50
South	0	-
	7	8
	21	24
	42	44
North	0	-
	7	4
	21	12
	42	22

Effect of Sunlight on totally exposed cotton at different direction are as follows

The mechanical and certain other properties of cellulosic fibres are profoundly affected by cross linking agent and these effects are reflected in the tensile properties. The introduction of covalent cross links into a cellulosic fibre has two important effects. It reduces the ability of the chain molecules (a) to move laterally and (b) to extend longitudinally under stress. The second effect will reduce strength.

Varghese <u>et al</u><sup>2</sup> have shown that desizing operation has no influence on tear strength whereas on scouring there is some losses in tear strength while in bleached fabric there is significant losses in strength around 35%. Further, they have shown that bleached sheeting fabric dyed with 0.5% reactive red 11 and washed with nonionic detergent shows high order of decrease in tear strength

S.M Doshi<sup>3</sup> has shown the decrease in strength loss after treatment with DMDHEU resin with 1.5% mixed catalyst (MgCl<sub>2</sub>. 6H<sub>2</sub>O : Citric acid (1:1) w/w).

Concentration of resin, %	%, Loss in Breaking strength	%, Loss in Tear strength
8	38	35
10	44	42

Also, it is well known fact that cellulose dyed with sulphur dyes shows tendering due to formation of sulphuric acid during storage in high humidity and temperature. All above factors reduces the strength of fabric.

We at Sarex has developed a cure to minimize strength loss inspite of preventive measure. We have developed a new generation products to improve tear strength capable of improving tear strength 60 - 100% individually and in combination depending on the type of the cellulosic material. The products are:

- 1. Tear strength H
- 2. Tear strength D
- 3. Tear strength X.

Tear strength D and X improves tear strength along with softness and useful for high value shirting, bed sheets and cotton sheets .Tear strength H can be added in certain qualities of fabrics. It does not affect whiteness and brightness of finished fabrics

Above products are compatible with normal finishing ingredients like softners and resins

Guideline recipe for tear strength is as follows:

For Tear strength H - 30-40g/l For Tear strength D - 10-15g/l For Tear strength X -15g/l

**Optional to add** Sarapeach AM – 10-15g/l or Sarapeach MR – 20-30g/l Addition of Sarapeach AM or Sarapeach MR will further improve tear strength Since Tear Strength D/H/X also impart softness, conventional softners from the recipe can be eliminated to optimize the recipe. Products can be applied in normal finishing /softening recipe or along with resin finishes by padding. Products do not improve tear strength of a fabric already finished with conventional recipe.

Performance of these products in finishing of cotton bottom weight is given below :

Finishing Agent	% increase in Tear strength
10g/I Tear strength D	78
20g/I Tear strength D	83
30g/I Tear strength H	67
15g/I Tear strength X	84
30g/I Sarapeach AM	44
40g/I Tear strength H + 30g/I Sarapeach AM	117
40g/I Tearstrength H + 15g/I Tearstrength D + 30g/I Sarapeach AM	100

## **Conclusions:**

It is possible to improve tear strength by selecting a suitable recipe based on specially products like Tearstrength D/H/X with or with out Sarapeach AM /MR

## **References:**

- 1. Thesis entitled "Photochemical degradation of cotton and chemically modified cotton by A.C. Mehta Sep. (1964).
- 2. Project report entitled "Influence of scouring and dyeing on strengthabrasion of durable –press cotton by VJ Verghese (1982-1983) btra.
- 3. Thesis entitled "Studies in resin finishing of cotton textiles including the use of high temperature steam by S.M. Doshi, Oct. (1975)