J Krishi Vigyan 2021, 10 (1) : 263-267 DOI : 10.5958/2349-4433.2021.00103.3

Selection of Softener Combination for Softening of Jute Fabric

Zeba Jamal[1] and Nisha Arya[2]

Dept. of Textile and Apparel Designing
IC COHS, CCS Haryana Agricultural University, Hisar- 125004 (Haryana)

ABSTRACT

Jute is a very important fibre crop in reference to India as it has a number of benefits but due to its harsh nature, rough texture and undesirable feel can not be ventured into primary applications. Therefore, there is an urgent need to treat jute in a manner which not only makes it soft and supple but also is non-toxic towards nature. Realizing the importance of development of an eco-friendly treatment, three softeners *i.e.,* Abrosil RUC, Abrosoft Redico and Abrosoft NI were applied on the jute fabric in 18 different combination ratios with 4 per cent concentration at 40º C for 30 minutes with 1:8 material to liquor ratio at 5-6 pH through exhaust method. These treated samples were got assessed by a committee over the parameters of hand feel and appearance. The combination 100 per cent Abrosil RUC (aminosilicone softener) depicted highest weighted mean scores 4.6 (hand feel) and 4.8 (appearance) was considered to be the best and most suitable for softening of jute fabric. Aminosilicone softener acted on the jute substrate and provided a supple feel and bright texture by masking the surface irregularities of jute substrate. Softening by employing softener instead of chemicals is a novel approach and it is not only ecofriendly but also fabric friendly.

Keywords: Softener, jute, harsh, appearance

INTRODUCTION

Jute fibre is a ligno-cellulosic fibre and falls into the bast fibre category along with kenaf, industrial hemp, flax (linen), ramie, etc. The fibres are usually off-white to brown in colour, with a length of 1 to 4 m and can be spun into coarse, strong yarns. It is produced from plants belonging to genus *Corchorus*, family *Tiliaceae*. It is extensively used in industrial applications like sacking, packaging, carpet backing and to some extent it also finds its usability in geotextiles (Debnath and Madhusoothanan, 2011). It has many beneficial properties such as high tensile strength and modulus with good dimensional stability, moisture absorption, heat and sound insulation. These qualities make it a promising fibre to be used most widely in sectors such as industrial textiles, home textiles, geotextiles, apparels etc. Fabrics made of jute fibres are carbon-dioxide neutral and naturally decomposable. It has low extensibility and ensures better breathability of fabrics (Vigneswaran and Jayapriya, 2010). Besides its beneficial properties, it has a few drawbacks such as a meshy structure, poor wrinkle recovery and high fibre shedding. Jute fibres contain very low quantity of natural fats and waxes and show prominent stiffness and harshness, which offer hindrance in smooth and trouble-free applications (Basu *et al,* 2008). Harshness, one of the main limitations of the jute fabric, can be overcome by applying different softening agents.

The softening of jute fibres is an age-old procedure where dextrin, glycerin, sulfonated oils, sulfated tallow and sulfated alcohols are added to the fibres in order to make them softer and render better spinnability. However, these agents are toxic in nature as in addition to causing detrimental effect on environment, synthetic softening agents also lead to weakening of the fibre by thinning down its diameter as well as by affecting its tensile properties, strength and change in the colour of the fabric (Akhila et al, 2005, Jayapriya and Vigneswaran, 2010).

Corresponding Author's Email: zebajamal@hau.ac.in

[1]Ph.D. Research Scholar and [2]Asstt. Prof.

Table 1. Combinations of softeners.

Sr. No	Ratio	Combination of softeners
1	100 %	Abrosoft Redico
2	100 %	Abrosil RUC
3	100 %	Abrosoft NI
4	50: 50	Abrosoft Redico + Abrosil RUC
5	50: 50	Abrosil RUC + Abrosoft NI
6	50: 50	Abrosoft NI + Abrosoft Redico
7	60 : 40	Abrosoft Redico + Abrosil RUC
8	60 : 40	Abrosil RUC + Abrosoft NI
9	60 : 40	Abrosoft NI + Abrosoft Redico
10	80 : 20	Abrosoft Redico + Abrosil RUC
11	80 : 20	Abrosil RUC + Abrosoft NI
12	80 : 20	Abrosoft NI + Abrosoft Redico
13	90 : 10	Abrosoft Redico + Abrosil RUC
14	90 : 10	Abrosil RUC + Abrosoft NI
15	90 : 10	Abrosoft NI + Abrosoft Redico
16	30 : 30 : 40	Abrosoft Redico + Abrosil RUC + Abrosoft NI
17	30 : 30 : 40	Abrosil RUC + Abrosoft NI + Abrosoft Redico
18	30 : 30 : 40	Abrosoft NI + Abrosoft Redico + Abrosil RUC

With the advancement in science and technology, novel approaches have been developed for softening of harsh jute fibres. A variety of commercial softeners, classified on the basis of their chemical nature into cationic, anionic, non-ionic and silicone are also used for softening. For last several years, specially organo-modified silicones have been used in textile finishing because they contain additional reactive organic groups, such as amines, amides and epoxides, that normally contribute to the softness and/or durability. The methods of softening, using commercial softeners are environmentally benign and non-toxic. Thus, the present study was planned in order to assess the effect of softeners and their combinations for application on jute fabric.

MATERIALS AND METHODS

Materials

Three softeners namely Abrosil RUC (aminosilicone), Abrosoft Redico (cationic) and Abrosoft NI (non-ionic) were procured from ABH Biochemicals Private Limited, Gurugram. All the softeners were used as received without any further purification. Jute fabric in grey state (9 × 6 ends and picks per sq. inch, weighing 232.6 g/m^2, 3.250 mm thickness) was procured from Himanshu Jute Fab, Delhi, India. The enzymes EBzyme Amylase (200000 EBU/gm) and EBzyme Pectinase (30000 EBU/gm), were procured from Enzyme Bioscience Private Limited, Surat, India.

Enzymatic desizing and scouring

The jute fabric was desized with 2.5 percent EBzyme Amylase at 60º C for 1 hr with material to liquor ratio 1:20 by maintaining the pH at 7. The treatment liquor was drained out and the fabric was given one hot and one cold wash. Then the fabric was dried. After desizing, the fabric was scoured in a bath containing 2 per cent EBzyme Pectinase at 60º C temperature with 1:15 material to liquor ratio at 7 pH for 60 min. The fabric was rinsed in hot and cold water and dried on a flat surface.

Application of commercial softeners and their combinations

Commercial softeners from three different categories were selected based on the literature, suitability for application on cellulosic fabric, eco-friendliness of nature, easy availability and economic soundness. Three softeners *i.e.,* Abrosil RUC (aminosilicone), Abrosoft Redico (cationic) and Abrosoft NI (non ionic) were applied on the jute fabric in 18 different combination ratios with 4 per cent concentration at 40º C for 30 min. with 1:8 material to liquor ratio at 5-6 pH through exhaust method, following the specifications given by the suppliers. After the treatment, the samples were taken out and rinsed thoroughly. After rinsing, the samples were dried at ambient temperature and stored in airtight packets.

Selection of experts

Five experts from Department of Textile and Apparel Designing, Department of Extension Education and Communication Management and Department of Family Resource Management, CCS Haryana Agricultural University, Hisar, were purposively selected as experts on the basis of their knowledge and availability.

Assessment of treated fabric samples

The fabric samples treated with different softener combination in different ratios were exhibited before the members of advisory committee and their preference was noted on different parameters of hand feel (smooth, smooth and light, rough, coarse, rough and coarse) and appearance (lustrous, brightly whitish, bright, grey, dull brownish grey). Weighted mean score was calculated on five-point continuum scale.

Statistical analysis

Frequency: Frequencies were calculated and used to calculate weighted mean scores.

Weighted mean score: To quantify the data regarding selection of commercial softener combination weighted mean scores were calculated and ranks were allotted on that basis. Weighted mean score of each feature was worked out separately using equation 1:

$$\text{Weighted Mean Score} = \frac{\text{WI XI + W2 X2+------ +WnXn}}{\text{Total number of respondents}} \quad (1)$$

where,

W1, W2----------Wn are weights

X1, X2----------Xn are frequencies

RESULTS AND DISCUSSION

The data elucidates the preference of experts for 18 different applied combinations of commercial softeners regarding parameters of hand feel and appearance (Table 1). Igarashi and Nakamura (2019) also applied softener on cotton threads and conducted a sensory evaluation where the threads were touched with bare hands in order to feel it and the softness was found to increase. It was clear from the table that 100 % Abrosil RUC (aminosilicone) softener ranked I in the list with weighted mean score of 4.6 (hand feel) and 4.8 (appearance). Second rank was achieved by combination 30 % + 30 % + 40 % Abrosoft Redico + Abrosoft NI + Abrosil RUC with weighted mean score 4.4 (hand feel) and 3.4 (appearance). Likewise, the combination 30 % + 30 % + 40 % Abrosil RUC + Abrosoft NI + Abrosoft Redico got rank III for hand feel with weighted mean score 4.0 and combination of 90 % + 10 % Abrosoft Redico + Abrosoft NI got III rank in appearance with weighted mean score 3.2.

The improvement in hand feel and appearance after aminosilicone softener treatment may be attributed to masking of the microvoids by the softener, thus giving a supple and smooth handle to the fabric. The findings of Islam *et al* (2015) also suggested that silicone softener improved the quality of the treated fabric by imparting silk soft hand, very good lubricity and abrasion resistance etc. Manjulatha and Mahale (2017) applied cationic, non-ionic and silicone softener on deccani woollen blanket for softening treatment. They observed changes in drape coefficient 60.48 (control), 57.84

Table 2. Selection of softener combination for softening treatment of jute fabric.

Sr. No.	Commercial softener combination	Hand feel		Appearance	
		WMS	Rank	WMS	Rank
	100% Abrosoft Redico	2.0	XI	2.4	VII
	100% Abrosil RUC	4.6	I	4.8	I
	100% Abrosoft NI	2.4	IX	2.8	V
	50+50 Abrosoft Redico + Abrosil RUC	3.2	V	2.4	VII
	50+50 Abrosil RUC + Abrosoft NI	1.6	XII	2.6	VI
	50+50 Abrosoft Redico + Abrosoft NI	2.4	IX	1.8	IX
	60+40 Abrosoft Redico + Abrosil RUC	2.2	X	2.8	V
	60+40 Abrosil RUC + Abrosoft NI	2.8	VII	3.0	IV
	60+40 Abrosoft Redico + Abrosoft NI	3.4	IV	3.4	II
	80+20 Abrosoft Redico + Abrosil RUC	3.2	V	3.4	II
	80+20 Abrosil RUC + Abrosoft NI	2.2	X	2.4	VII
	80+20 Abrosoft Redico + Abrosoft NI	2.0	XI	1.8	IX
	90+10 Abrosoft Redico + Abrosil RUC	2.4	IX	1.8	IX
	90+10 Abrosil RUC + Abrosoft NI	3.0	VI	2.4	VII
	90+10 Abrosoft Redico + Abrosoft NI	1.2	XIII	**3.2**	**III**
	30+30+40 Abrosoft Redico + Abrosil RUC + Abrosoft NI	2.6	VIII	2.6	VI
	30+30+40 Abrosil RUC + Abrosoft NI + Abrosoft Redico	**4.0**	**III**	2.0	VIII
	30+30+40 Abrosoft Redico + Abrosoft NI + Abrosil RUC	4.4	II	3.4	II

(cationic softener), 59.05 (non-ionic softener) and 56.94 (silicone softener) and hence suggested silicone softeners to be the best for softening treatments.

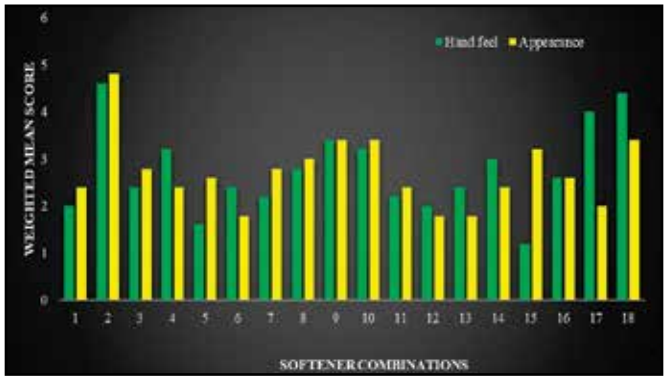

Fig. 1: Selection of softener combination for softening treatment of jute fabric

CONCLUSION

The application of aminosilicone softener will help in reduction of harshness and roughness by adding to a soft and supple feel to jute fabric. Therefore, jute fabric will be utilized in several fields of primary uses which will help in increase in its consumption directly and in the income of jute farmers and people engaged and employed in jute industries indirectly.

REFERENCES

Akhila R, Resmi C S, Pavithhran C and Abraham TE (2005). Bio softening of coir fiber using selected microorganisms. *Bioprocess and Biosystems Engineer* **28**(3):165–173.

Basu G, Samanta AK and Ghosh P (2008). Enzyme and silicone treatments on jute fibre part II: effect on process performance during yarn making and yarn properties. *J Textile Institute* **99**(4):307-316.

Debnath S and Madhusoothanan M (2011). Thermal resistance and air permeability of jute-polypropylene blended needle-punched nonwoven. *Indian J Fibre and Textile Res* **36**(6):122-131.

Igarashi T and Nakamura K (2019). Mechanism of softening effect of fabric softener. *J Materials Sci Res* **8**(1):35-42.

Islam MM, Islam A and Jiang H (2015). Silicone softener synthesis and application on knit and woven white cotton

fabrics. *American J Polymer Sci & Engineer* **3**(1):129-138.

Manjulatha C and Mahale G (2017). Effect of finishing treatment with softeners on performance properties of deccani woollen blanket. *J Krishi Vigyan* **5**(2):35-38.

Vigneswaran C and Jayapriya J (2010). Effect on physical characteristics of jute fibres with cellulase and specific mixed enzyme systems. *J Textile Institute* **101**(6):506-513.

Received on 12/11/2021 Accepted on 23/11/2021