

Performance of Texturized Jute-blended Carpet

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The processing performance of texturized jute in blends with Proplon staple in a woollen-processing system was evaluated. The properties of texturized jute-blended yarns and their performance as hand-knotted carpet piles were evaluated and compared with those of all-wool yarn and carpets. The 60/40 texturized jute-Proplon blended yarn carpet was quite close to all-wool carpet in area recovery from compression.

Keywords: Carpet, Jute, Proplon, Texturized jute blends

1 Introduction

Blending of jute with other natural and man-made fibres has been studied by some research workers¹⁻³. The main aim was to diversify the use of jute for end-products like blankets, carpets and furnishing fabrics. However, the work on texturized jute blending was mostly confined to wool for developing blankets and carpets^{4,5}. In fact, texturized jute is commonly known as woollenized jute as the development of crimp in jute results in an appearance similar to that of wool. Jute is texturized through a strong caustic solution treatment. This fibre is suitable for blending with wool and synthetic fibres. Polypropylene, the cheapest synthetic fibre, has many desirable properties like bulkiness, high strength and great rot and microbial resistances. Hence, we carried out studies on the processing of texturized jute-Proplon blends on a jute-processing system with a view to developing light-weight cheaper blankets. However, we observed that the processing of texturized jute blends in a normal jute-processing system removes almost all the crimp of texturized jute. Hence we chose an woollen-processing system as this may be better for processing of texturized jute in blends with proplon and viscose rayon fibres. The performance of blended yarn as a hand-knotted carpet pile was also considered worthy of investigation.

2 Experimental Procedure

W-2 grade jute fibre, and crimped Proplon and viscose rayon fibres of 1.7 tex and 0.7 tex respectively were used for spinning. Jute was carded in a jute breaker card and the carded jute sliver was texturized in accordance with the method reported earlier⁶.

Texturized jute, Proplon and viscose fibres were separately opened in a woollen willow machine. A

proportionate weight of each fibre was taken to prepare a blend of 15 kg size, which was hand-mixed and passed through the willow machine. An oil emulsion (2%) was sprayed on the fibre, and the sprayed fibre was kept overnight. Before being fed into a woollen card hopper feeder, the material was willowed once again and was carded in a Torrigoe (Japan) 3-cylinder woollen card. Yarn of about 400 tex with a twist multiplier of 22 was spun in the woollen ring-spinning frame. Texturized jute-Proplon (80/20 and 60/40) blends and texturized jute/viscose/Proplon (50/30/20) blend and 100% Proplon were processed. Yarn properties were evaluated in accordance with the method given elsewhere⁶.

Hand-knotted carpet samples of 6 × 9 knots per sq. inch with a pile height of 20 mm were prepared with the help of M/s Neomer Ltd, Baroda. The carpet samples were evaluated for compression and recovery, thickness and tuft withdrawal force. The details of the testing procedures are as follows:

2.1 Thickness

The thickness of the carpet sample was measured by an Essdiel thickness gauge with a foot pressure of 20 g/cm² for a compression period of 20 s.

2.2 Compression and Recovery

The thickness of the carpet sample was measured under a compressive load of 500, 1000, 1500 and 2000 g/m² respectively for a compression period of 20 s for each load. Similarly, the period of recovery from each compressive load was also noted. A graph of compression and recovery of thickness against pressure was plotted. The area under compression and recovery curves were considered in calculating the work recovery.

The percentage work recovery was calculated from the following expression:

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Percentage work recovery

$$= \frac{\text{Area of recovery}}{\text{Area of compression}} \times 100$$

2.3 Tuft Withdrawal Force

The single-pile withdrawal force was measured by a WIRA tuft withdrawal tensiometer. An average of 20 single-pile withdrawal force in gf per pile was expressed as tuft withdrawal force of the carpet.

3 Results and Discussion

The processing performance was satisfactory, with no technical problems. As the lot was of small size (15 kg), the waste percentage in different stages was not considered. However, during spinning the end breakage was negligible and addition of viscose fibre smoothed the processing while use of Proplon in higher proportion generated static charges during carding. The yarn properties (Table 1) show that the strength and elongation of all-Proplon yarn are very high as compared to those of other blended yarns. Among the three blends the strength and elongation of 80/20 texturized jute(TJ)-Proplon(PP) are the lowest,

i.e. 3.59 g/tex and 12.3% respectively. The performances of 60/40 TJ-PP and 50/30/20 TJ-viscose-PP blended yarns are quite satisfactory, the strength in particular being superior to that of all-wool yarn. The elongation of 60/40 TJ-PP blended yarn was slightly lower than that of all-wool yarn while that of 50/30/20 TJ-viscose-PP was much lower (11.5%). The higher elongation of the 60/40 TJ-PP can be explained as due to the higher breaking extension of Proplon fibre. The tenacity and elongation of yarn remained almost unchanged on wetting but its strength improved while the blended yarn containing viscose showed a slight increase in elongation on wetting. It is well known that the strengths of texturized jute and viscose decrease on wetting but the blended yarns of these materials showed no such strength reduction, which may be due to increase in inter-fibre cohesion on wetting. The diameter of the blended yarns showed a slight increase with increase in Proplon proportion in the blend.

Table 2 shows that the area density of the blended carpets is about 420 g/m² but that of all-Proplon is 335 g/m². The low-area density of all-Proplon carpet is due to the fineness of Proplon yarn.

Table 1— Properties of Texturized Jute-blended Yarns

Blend proportion	Linear density tex	Diameter µm	Tenacity, g/tex		Breaking extension, %	
			Dry	Wet	Dry	Wet
80:20 TJ-PP	390 (16.4) ^a	973 (17.8)	3.49	3.59	9.5	12.3
60:40 TJ-PP	410 (10.6)	1051 (16.4)	6.81	6.85	14.5	14.9
50:30:20 TJ-V-PP	358 (7.2)	1020 (17.0)	5.70	5.84	10.6	11.5
100% Proplon	308 (10.9)	995 (20.0)	17.13	17.69	24.7	25.0
100% Wool	298 (6.4)	975 (14.8)	3.75	4.98	17.9	28.8

TJ—Texturized jute; PP—Proplon; V—Viscose rayon

^aFigures in parenthesis indicate CV%

Table 2— Properties of Texturized Jute-blended Carpets

Blend proportion	Area density g/cm ²	Thickness mm	Pile height mm	Tuft (single pile) withdrawal force kgf	Area under compression (A) mm ²	Area under recovery (B) mm ²	% Recovery $\frac{B}{A} \times 100$
80:20 TJ-PP	0.45	21.8	17.2	1.66	567	80	14.11
60:40 TJ-PP	0.47	19.8	15.2	1.97	464	126	27.15
50:30:20 TJ-V-PP	0.44	21.2	16.6	3.26	472	57	12.07
100% Proplon	0.36	22.8	18.3	1.07	588	132	22.44
100% Wool	0.42	21.0	16.4	1.75	498	144	29.00

TJ—Texturized jute; PP—Proplon; V—Viscose rayon

The single-pile tuft withdrawal force is much higher in blended yarn containing 50/30/20 TJ-viscose-PP. However, the all-Proplon carpet showed a lower tuft withdrawal force, which may be due to the slippery surface of Proplon fibre resulting in knot slippage. The recovery of surface pile from compression is better in 60/40 TJ-PP blended carpet and it is quite close to that of all-wool carpet. While the all-Proplon carpet showed 22.5% recovery from compression, carpets of 80/20 TJ-PP and 50/30/20 TJ-viscose-PP showed 14.11% and 12.07% recovery respectively. This shows that 60/40 TJ-PP blended yarn if used as a carpet pile may result in a carpet close to all-wool carpet in recovery. However, the all-wool carpet possesses fibre extinguishing properties, whereas the texturized jute-Proplon blended carpet may be prone to fire hazards for which a suitable flame-retardant finishing is required.

4 Conclusion

Texturized jute fibres in blend with Proplon and viscose rayon staple fibres can be processed satisfactorily in the existing woollen processing system. The blended yarns are comparable to all-wool yarn in physical and mechanical properties. The 60/40 texturized jute-Proplon blended yarn carpet is similar to all-wool carpet in area recovery from compression. Hence texturized jute-Proplon blended yarn could be used as a carpet pile for manufacturing low-cost carpets.

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