FIBER, YARN AND FABRIC CHARACTERS OF THREE LINT GRADES AND THREE COTTON WASTES IN TWO OF EGYPTIAN COTTON CULTIVARS

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Abstract

Three lint grades and three spinning wastes (flat card strips, comber waste and spinning filter waste) in two of Egyptian cotton cultivars i.e Giza 75 and Giza 81, as well as the second grade of polyester were used in this study. The higher grade has the best fiber, yarn and fabric properties. The flat card strips and comber waste contain a high percent of immature fibers which cause in poor of fiber properties as well as yarn and fabric characters. The comber waste has the lowest single strand strength. Ring spinning gave the highest values of mechanical properties of yarn and fabric. Open-end spinning showed the best values of the yarn evenness.

Introduction

Textile industry is the most important in Egypt. Yarn is the first product, where cotton is still the principle raw materials. Different types of wastes result from different stages of the production, these wastes has economic value, which must be reuse. The economic wastes are flat and filter waste which represent about 25% of spinning industry.

Nawar (1979) concluded that the highest values of yarn strength were resulted from different blending percentages, this might be due to the cotton cultivars, the percentage of blending and the count, there was a general tendency for the strength to be increased more in the coarser yarns than in the finer ones. Devochkin (1980) found that using yarn counts of 56 and 60 Tex. are available to produce yarns from cotton spinning wastes. Schonung (1980) stated that the maximum yarn tenacity is dependent both on the staple length, fiber fineness, and the rotor diameter. Audivert (1982) found that the ring spun yarns had a higher tenacity at break and a lower elongation at break than rotor open-end spun yarns. Dutta *et al.* (1982) stated that the blends of Indian cotton containing flat strips, comber waster and inferior short-staple have been spun on a rotor spinning machine. Marino *et al.* (1984) revealed that the effect of the draw off nozzle on yarn properties was more pronounced on polyester yarns than on cotton yarn, probably as a result of the twist levels. The rotor speed influenced all yarn parameters strongly.

Both the fabric construction and the constituent fiber properties affected thermal transport (Yoon and Buckley, 1984). In Egypt, Fully Good grade or higher of Giza 45 cultivar was the best to produce yarn count (220^s) on the ring frame spinning system (Shabayek, 1991).

Materials and Methods

Two of long staple of the Egyptian cotton cultivars i.e., Giza 75 and Giza 81, as well as (Good + 3/8), (Good) and (Good - 3/8) grades of Giza 75 cv., and (Good + 1/4), (Good) and (Good - 1/4) grades of Giza 81 cv. were used in the present study.

Three types of spinning wastes of both cultivars i.e.; a) carding waste (flat card strips), b) Combing waste (comber waste), and c) Spinning filter waste (filter waste) were used. Samples of the above cottons were supplied by El-Siouf Spinning and Weaving Company (ESSWC), Alexandria, Egypt. Each sample was about 10 kilograms in weight. The lint grades were classified by three classers of the "Cotton Arbitration and Testing General Organization (CATGO)", Egypt.

Samples of the second grade of Egyptian polyester were supplied by Misr Rayon Company, Egypt, in total weight of about 85 kg.

The samples were divided to two subsamples. The first subsample was spun using the open-end spinning shed for the English count of $20^{'s}$ at twist factor of 4.5. The other was spun using the ring spinning shed for the same English count at twist factor of 3.6.

The attained yarns were used as a weft yarns for a normal warp cotton yarns to produce a plain fabric by the mechanical weaving shed.

All tests were carried out at Cotton Res. Inst., ARC, Giza, Egypt. The open-end spinning and ring spinning and weaving process as well as non lint content, yarn and fabric test, were carried out at the Lab. of ESSWC. The following characters were studied:

Fiber Properties:

1. Fiber length by Fibrograph.
2. Color by Nickerson-Hunter.
3. Micronaire reading, fiber maturity and fineness by FM/T.
4. Non-lint content by Shirley Analyzer.

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Yarn Properties:

1. Single yarn strength (RKM) and elongation % by Uster.
2. Yarn-evenness by Uster evenness tester II.

Fabric Properties:

3. Breaking load in kilogram and elongation % by "Good Brand Gbx".

Results and Discussion

Lint Grades and Wastes Properties

Data of fiber length parameters, non-lint content, lint color, fiber fineness and maturity and fiber bundle strength and elongation % are shown in Tables (1 and 2). regarding fiber length parameters, it could be noticed that increasing the grade increase fiber length parameters. Also, the filter waste showed the highest value of UR%. Meanwhile, the comber waste possessed the lowest values of length parameters. At the same time the comber waster gave the highest value of floating fiber index. The finding is in accordance with that stated by Lord (1961), Nawar (1979) and Abo-Zeid (1988).

Comparing non-lint content, there was a gradual increase in non-lint content percentage by decrease lint grade. The same trend was observed from filter waste to comber waste and to flat card strips. This finding is in harmony with that obtained by Nawar (1975), who found that the percentage of non-lint content and the percentage of wastes of the first card generally increased as the cotton grade index of cotton decreased.

With respect to degree of yellowness (+b), no significant differences was obtained among lint grades or cotton wastes for both cultivars in this study. Generally, by increasing grade, the reflectance degree (Rd%) was increased.

As to micronaire reading, mature percent and fineness, it could be noticed that the lowest values of the fiber maturity (68.33 and 65.33%) were resulted from the flat card strips and comber waste fro Giza 75 and Giza 81; respectively. The highest values were recorded from the lint grade (Good + 3/8) and the filter waste for Giza 75 and Giza 81, being 80.67 and 75.00%, respectively. Generally, downward trend in micronaire, mature percent and fineness was by decreasing the lint grade (Hancock, 1937; Hembree, 1961 and Nawar, 1979).

Regarding fiber tensile properties, filter wastes and higher grades recorded the highest values of fiber strength and elongation %. These results clear that the flat card strips and comber waste contain a high percent of immature fibers which cause in poor of fiber strength and elongation %.

Yarn and Fabric Properties

Thin places, thick places, number of neps per 1000 m, C.V.% of unevenness, single strand strength (rkm), single yarn elongation %, fabric breaking load kg. and fabric elongation % are presented in Tables (3 and 4). It could be noticed that thin places, thick places and number of neps recorded the highest values at the highest lint grades. Meanwhile, the filter waste had the higher values of the thick places and C.V.% of yarn unevenness.

Regarding mechanical yarn properties, the highest values of single strand strength and elongation % were resulted from the second grade polyester. meanwhile, the lowest of single strand strength were recorded by the comber wastes for Giza 75 and Giza 81 cvs.

As to fabric properties, it could be noticed that the highest fabric breaking load and elongation % were attained from the second grade polyester for both cotton cultivars.

Spinning Methods

Yarn properties as affected by the spinning method for Giza 75 and Giza 81 cvs. are shown in Tables (5 and 6). Rings spinning had the highest values of thin places, thick places, number of neps and C.V.% of unevenness, being 107.38, 335.50, 115.0 and 23.02, respectively, whereas the open-end spinning recorded the lowest values, being 5.80, 31.0, 61.84 and 15.19, respectively in Giza 75 cv. On the other hand, Giza 81 cv. recorded same trend in this respect.

Ring spinning gave the highest values of single strand strength and elongation % as well as breaking load and elongation % of fabric in both cultivars under study.

Open-end spinning showed the best values of thin places, thick places, number of neps per 1000 m and C.V.% of unevenness in both cultivars.

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Table 1. Effect of the studied different materials on fiber characters for Giza 75 cultivar.

Fiber properties	Good+ 3/8	Good	Good-3/8 card strips	Flat waste	Comber waste	Filter	L.S.D.
Fiber length parameters							
2.5% S.L. mm	29.23	29.20	28.63	26.83	24.13	28.67	1.10
50% S.L. mm	14.10	13.93	12.83	11.50	9.73	13.83	0.763
Uniformity ratio %	48.20	47.73	44.87	42.87	40.13	48.27	1.729
Floating fiber index %	12.54	13.27	17.59	21.38	26.00	13.03	2.547
Non-lint content %	2.33	3.03	4.10	5.95	0.28	0.07	0.214
Color							
Reflectance %	73.43	69.60	66.37	67.30	72.23	73.07	2.55
Degree of yellowness	11.17	11.00	10.47	10.77	10.87	10.97	NS
Micronaire reading	3.53	3.43	3.07	4.10	3.10	3.83	0.151
Maturity %	80.67	79.67	75.33	68.33	69.33	75.00	6.148
Fineness (millitex)	175.33	150.00	143.00	136.00	141.00	174.00	15.78
Fiber strength (g/tex)	28.77	25.83	23.57	23.53	25.50	33.93	3.082
Filter Elongation %	6.77	6.00	6.87	5.50	5.40	6.83	0.754

Table 2. Effect of the studied different materials on fiber characters for Giza 81 cultivar.

Fiber Properties	Good + 1/4	Good	Good - 1/4	Flat Card Strips	Comber waste	Filter Waste	
Fiber length parameters							
2.5% S.L. mm	29.20	28.57	28.40	24.20	18.83	27.33	1.079
50% S.L. mm	14.43	13.60	13.43	10.50	8.53	13.73	0.655
Uniformity ratio %	49.43	47.60	47.33	43.40	45.30	50.23	1.923
Floating fiber index %	10.97	13.98	14.53	22.56	24.63	13.74	2.560
Non-lint content %	2.56	3.27	4.27	6.16	0.41	0.14	0.136
Color							
Reflectance %	72.37	70.10	68.60	66.63	73.07	76.47	2.124
Degree of yellowness	9.83	9.70	9.63	10.73	10.60	10.77	0.293
Micronaire reading	3.73	3.47	3.03	3.67	2.63	3.63	0.177
Maturity %	73.67	72.67	71.67	65.67	65.33	75.00	NS
Fineness (millitex)	165.00	159.00	139.33	138.67	115.33	167.67	17.988
Fiber strength (g/tex)	26.60	24.47	22.97	21.00	21.72	34.63	1.520
Filter Elongation %	7.23	6.73	6.30	4.90	4.13	6.80	0.476

Table 3. Effect of the studied different materials controls on yarn and fabric qualities for Giza 75 cultivar.

Yarn and Fabric Qualities	Good +3/8	Good	Good - 3/8	Flat Card Strips	Comber Waste	Filter Waste	Polyester Second Grade	L.S.D.
Thin places/1000 m.	39.33	51.00	64.33	208.33	261.67	153.67	66.33	23.469
Thick places/1000 m.	247.00	307.00	350.00	473.33	302.33	583.67	407.00	71.795
Neps/1000 meter	18.33	29.00	40.00	307.67	139.00	15.67	73.67	32.957
Yarn irreg. (C.V.%)	24.54	23.19	25.50	25.51	22.34	25.58	23.68	1.63
Single yarn strength	15.90	15.53	14.17	11.63	10.45	12.40	23.63	0.496
Yarn elongation %	6.94	6.70	6.34	6.21	5.83	5.97	14.49	1.966
Breaking load K.g.	41.33	37.67	31.33	32.33	25.67	32.67	78.37	3.197
Fabric Elongation %	2.23	2.13	2.03	2.03	2.03	2.00	5.03	0.209

Table 4. Effect of the studied different materials control on yarn and fabric qualities for Giza 81 cultivar.

Yarn and Fabric Qualities	Good +1/4	Good	Good - 1/4	Flat Card Strips	Comber Waste	Filter Waste	Polyester Second Grade	L.S.D.
Thin places/1000 m.	65.33	82.33	97.33	253.67	225.33	164.67	66.33	13.095
Thick places/1000 m.	225.67	242.00	291.33	411.67	395.33	515.00	407.00	30.06
Neps/1000 meter	37.67	43.00	70.00	397.33	154.33	59.33	73.67	16.96
Yarn irreg. (C.V.%)	21.48	22.34	23.09	24.32	24.18	25.05	23.68	1.29
Single yarn strength	13.30	13.12	12.81	10.26	9.87	12.39	23.63	0.452
Yarn elongation %	6.26	5.89	5.66	5.93	5.72	5.94	14.49	0.299
Breaking load K.g.	42.33	40.67	33.33	28.33	28.33	39.00	78.67	2.65
Fabric Elongation %	2.13	2.03	1.97	1.97	1.87	1.97	5.03	0.138

Table 5. Effect of spinning method on yarn and fabric qualities for Giza 75 and Giza 81 cultivar.

Properties	Giza 75			Giza 81		
	Open-End Spinning	Ring Spinning	L.S.D	Open-End Spinning	Ring Spinning	L.S.D.
Thin places/1000 m.	5.80	107.38	1.45	6.22	121.73	1.45
Thick places/1000 m.	31.00	335.20	4.27	33.78	298.87	2.45
Neps/1000 meter	61.84	115.00	2.18	83.92	116.34	2.45
Yarn irreg. (C.V.%)	15.19	23.02	0.10	15.84	22.31	0.08
Single yarn strength.	12.89	15.57	0.44	12.69	15.18	0.40
Yarn elongation %	8.35	8.80	0.44	8.43	8.72	0.37
Breaking load K.g.	36.36	43.42	0.21	35.62	44.21	0.21
Fabric elongation %	2.64	2.75	0.18	2.56	2.73	0.17