POSSIBILITY OF SPINNING AND BLENDING THE WASTE OF CARDING AND COMBING FOR COARSE COUNT ON THE OPEN – END ROTOR SPINNING

MABROUK, K. I. K. AND O. D. M. NOUR

Cotton Research Institute, Agricultural Research Center, Giza, Egypt.

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Abstract

This investigation was carried out to study the effect of blending the waste from spinning the extra long – staple cotton such as comber noils and the waste of carding process with Giza 90 cotton variety at yarn counts, 10s,15s and 20s with 3.6 twist multiplier on the open end rotor spinning. The blends were ; 75% Cotton + 25% waste, 50% Cotton + 50% waste, and 25% Cotton + 75% waste.

The results indicated that fiber strength, yarn lea count strength product, yarn tenacity, fiber elongation %, yarn elongation %, fiber length parameters and fiber maturity % decreased as the waste percentage increased in the blend. Opposite to that, micronaire value, fiber hair weight, single yarn strength c. v. %, yarn elongation c. v. %, yarn unevenness c. v. % thick places, thin places, and neps increased as the waste percentage increased in the blend. It seems possible to spin and blend the waste with different percentages of Giza 90 Cotton variety and spun into O. E. rotor spun coarse counts.

INTRODUCTION

Instead of using high quality Egyptian Cotton to get coarse yarn, it may be possible to use the waste of different processes of ring spinning mills by blending it with long staple Cotton in order to reduce the cost of production and to be economical for the popular fabrics.

Louis *et al.* (1961) studied the effect of blending two cottons differing in fiber bundle elongation. They reported that yarn strength and yarn elongation were affected by varying fiber elongation. Furthermore, nep formation increased linearly as the percentage of higher elongation cotton increased in the blend. Abdel – Salam (1972) found that neither maturity alone, nor maturity, length and fineness together could completely explain the differences in the nep count levels. International Institute for Cotton (1974) showed that about two thirds of open end yarn currently being produced on the short staple is of pure cotton. The system will accept very short staples or wide staple mixes, blends of short staple cotton and clean cotton waste can be spun successfully. Douglas and Mech (1975) showed that the waste fiber could be processed successfully on the rotor – spinning machine. Pillay (1975) stated that the strength deficiencies of open – end rotor yarns are smaller for short staple cottons than long staple ones, and that this coupled with the definite economic advantages of open – end rotor spinning in the coarser count range, may open up new avenues for the use of short staple cottons and waste. Aboul – fadl (1979) showed that the Egyptian cotton waste was spinnable on open end rotor spinning, and the yarn obtained was of acceptable strength up to count 17 Ne. he added that this limit may be raised by using the modern card machines to provide more even and clean silver. Samra and Ashour (1987) stated that fiber strength, single yarn strength, and toughness decreased as the percentages of Upland cotton increased in the blends of Upland and Egyptian cotton. They added that contrarily, micronaire reading , hair weight, and number of neps increased as the percentages of Upland cotton increased. Tetzlaff and Wulfhorst (1992) emphasized that the economic benefits of open – end rotor spinning technology lie especially in the production of yarns of medium and coarse count. Ruger (1993) stated that the fibers of widely varying length, including extremely short fibers, could be processed on rotor spinning machines to produce yarns of outstanding uniformity. El Sayed (1996) indicated that the strength of open – end spinning decreased considerably with decreasing fiber length and increasing short fiber content, meaning that the long fibered cotton with lower short fiber content could be spun into yarns of higher strength than the shorter cotton containing higher percentage of short fibers. Mohamed and El – Sayed (2002) stated that the short fiber index, micronaire reading and strength showed the greatest influence upon open – end yarn strength. They added that the open – end rotor spinning offers the opportunity for variable spinning of cotton wastes (comber noils) and low quality cottons prepared in recycling process for end uses with adequate yarn quality.

MATERIALS AND METHODS

The long staple Giza 90 cotton variety was chosen for this study during season 2003. This investigation was carried out at the Cotton Technology Research Laboratories, Cotton Research Institute, Agriculture Research Center. Fiber and yarn properties were tested under controlled atmospheric condition of 20 ^{0}c ± 2 ^{0}c temperature and 65% ± 2% relative humidity. All samples were processed under similar conditions at the open – end spinning section of the Cotton Research Institute. The cotton waste include; comber noils extracted from Giza 45, Giza 70, and Giza 80 cotton varieties and the carded waste of the same varieties. The blend proportion was as follows:

1- 100% cotton
2- 75% cotton + 25% waste
3- 50% cotton + 50% waste
4- 25% cotton + 75% waste
5- 100% waste

The blending samples were carried out according to the standard method designated by Hollen and Saddler (1973). All the samples were spun at three count ; 10, 15, and 20 with 3.6 twist multiplier for measuring yarn properties. On the other hand, fiber samples were taken from the card cotton silvers for measuring the fiber properties. The experiments was in randomized complete design with three replications as outlined by steel and Torrie (1960). Mean values were compared 0.05 level according to Duncan's multiple range test. Fiber and yarn properties were measured as follow :

1- Fiber length parameters; upper half mean length (UHML) and uniformity index % (U.I %) were determined by digital Fibrograph 730 according to A.S.T.M. (D 1447 – 83, 1998).
2- Strength in (g./tex) and elongation % were determined by using Stelometer at ⅛ inch gauge length according to ASTM (D 1445 – 75, 1998).
3- Micronaire value maturity % and maturity ratio (MR) were determined by using Micromat Tester and Maturity Tester (F/MT) according to ASTM (D 3818 – 79, 1998).
4- Yarn lea count strength product for fourty – eight lease from each sample were tested on the Good Brand Lea Tester to determined the lea strength in pounds ASTM (1967 – D1578). The broken lease were weighed by Sauter Alfered Balance ASTM (1967 – D 1907) to estimate its actual count.
5- Yarn uniformity and unevenness were measured by using tester III ASTM (D – 1425- 84).

RESULTS AND DISCUSSION

Effect of cotton blends on fiber properties:

1- Fiber uniformity ratio % (U.R.%) and fiber uniformity index (U.I.%):

As shown in Table (1) and Figure (1) the results indicated that the blends had significant effect on fiber length parameters. Meanwhile, fiber uniformity ratio % and fiber uniformity index were decreased significantly as the waste percentage increased. On the other hand, the (100% waste) exhibited the lowest mean value (24.3 and

77.81) compared with the other blends, while the (100% cotton) gave the highest values of both the fiber length parameters (29.0 and 86.53 respectively).

2- Fiber strength (g/tex):

The data in Table (1) and Figure (1) showed that the blends had highly significant effect on fiber strength. However, the mean values of fiber strength had no differences between the blend (100% cotton) and the blend (75% cotton + 25% waste). Also there were no differences between the blend (50% cotton + 50% waste) and the blend (25% cotton + 75% waste).

On the other hand, fiber strength decreased as the waste percentage increased. Comparing the blend (25% cotton + 75% waste) with the blend (100% waste), there were no differences between those two blends too.

3- Micronaire value and fiber weight (m/tex):

The results shown in Table (1) and Figure (1) indicated that the blends had highly significant effect on micronaire value, and fiber weight (m/tex). The data of micronaire value and fiber weight increased significantly as the waste percentage increased. Comparing the mean values, the (100% cotton) exhibited the lowest values of micronaire and fiber weight (3.6 and 124 respectively), while, the (100% waste) give the highest values of the fiber fineness parameters (4.1 and 144 respectively).

4- Fiber elongation % and Maturity %:

As shown in Table (1) and Figure (1) the results indicated that the blends had highly significant effect on fiber elongation and maturity %. Meanwhile, the mean values of the both properties decreased as the waste percentage increased. Comparing the mean values, the (100% cotton) exhibited the highest values of fiber elongation and maturity % (7.19 and 88.9 respectively), while the (100% waste) gave the lowest values of the both properties (6.26 and 77.1 respectively).

These results were in agreement with Louis *et al.* (1961), Douglas and Mech (1975), Ashour (1987), El - Sayed (1996) and Mohamed and El - Sayed (2002).

Table 1. Effect of blends on fiber properties.

Blends	Fiber (U.R.%)	Fiber (U.I.%)	Fiber Strength (g/tex)	Micronaire Value	Fiber Weigth (m/tex)	Fiber Elongation %	Maturity %
(100% cotton)	29.0^{a}	86.53^{a}	26.13^{a}	3.6^{a}	124^{a}	7.19^{a}	88.9^{a}
(75% cotton + 25% waste)	28.2^{b}	84.99^{b}	25.75^{a}	3.7^{a}	133^{a}	7.17^{a}	86.8^{b}
(50% cotton + 50% waste)	27.5^{b}	82.72^{c}	25.55^{b}	3.8^{a}	142^{ab}	6.88^{b}	83.1^{c}
(25% cotton + 75% waste)	26.5^{c}	80.82^{d}	25.09^{c}	3.9^{a}	143^{bc}	6.62^{c}	80.9^{d}
(100% waste)	24.3^{d}	77.81^{e}	24.54^{c}	4.1^{b}	144^{c}	6.26^{d}	77.1^{e}

Effect of cotton blends on yarn properties:

1- Yarn lea count strength product (L.C.S.P) and yarn tenacity :

The results shown in Table (2) and Figure (2) exhibited that the blends and the counts had highly significant effect on yarn lea count strength product (L.C.S.P) and yarn tenacity (single yarn strength). However, the yarn (L.C.S.P) and yarn tenacity were decreased as the percentage increased at the three count (10s, 15s and 20s). considering the mean value of (L.C.S.P) and tenacity for the blends, it could be arranged in descending order; (100% cotton), (75% cotton + 25% waste), (50% cotton + 50% waste), (25% cotton + 75% waste) and (100% waste) at the three counts. On the other hand, the mean values of the yarn L.C.S.P. and yarn tenacity exhibited that the (100% cotton) gave highest value (2180) and (12.53) at the count 10 respectively, with the (100% waste) gave the lowest values (1060) and (8.00) at the count 20 respectively. These results due to the percentages of the short fiber, trash content and neps were higher in the (100% waste) than the (100% cotton) which caused a reduce in the yarn strength.

Table 2. Effect of blends and yarn counts on the physical yarn properties of various cotton / waste blends.

Blends	Counts	Lea count strength product	Yarn tenacity (gm/tex)	Yarn elongation (c.v. %	Single yarn strength (c.v. %)	Yarn elongation (c.v. %)	Yarn unevenness (c.v. %)	Thick places (k.m.)	Thin places (k.m.)	Neps (k.m.)
(100% cotton)	10	2180	12.53	6.8	3.9	4.2	11.7	10	10	70
	15	2175	12.17	5.5	4.8	4.3	12.8	10	10	70
	20	2170	12.38	5.2	5.0	4.5	14.4	30	20	140
(75% cotton + 25% waste)	10	2105	11.46	5.3	4.9	4.9	12.5	20	20	120
	15	2010	11.87	5.3	5.2	5.3	13.3	30	30	130
	20	2005	11.17	5.1	6.0	5.4	15.0	70	50	190
(50% cotton + 50% waste)	10	2060	10.40	4.9	5.8	4.9	13.0	30	30	130
	15	1890	10.23	4.8	6.1	5.6	14.5	50	50	150
	20	1735	9.98	4.7	6.2	5.7	15.8	130	60	230
(25% cotton + 75% waste	10	1945	9.65	4.3	6.7	6.1	14.3	60	40	140
	15	1560	9.16	4.1	7.9	6.2	16.6	80	70	160
	20	1395	9.10	3.9	7.9	6.3	16.8	140	80	250
(100% waste)	10	1745	8.19	4.0	8.5	6.7	15.6	100	70	170
	15	1465	8.15	3.6	9.2	6.9	16.9	130	90	190
	20	1060	8.00	3.4	9.6	7.9	17.0	170	100	270

2- Yarn elongation %:

Table (2) and Figure (2) showed that the blends had highly significant effect on yarn elongation at break %. However, yarn elongation at break % decreased as the waste percentage increased at all counts. These results could be due to the lower number of fiber in cross – section in the (100% waste) at the count 10 in the (100% cotton) at the count 20. Considering the mean values of yarn elongation at break % for the blends, it could be arranged in decreasing order; (100% cotton), (75% cotton + 25% waste), (50% cotton + 50% waste), (25% cotton + 75% waste) and (100% waste) at the three counts. The highest mean values of the yarn elongation at break % were shown by the (100% cotton) (6.8) at the count 10, while the lowest ones were obtained form the (100% waste) (3.4) at the count 20.

3- Yarn unevenness parameters :

The data presented in Table (2) and Figure (2) demonstrated that, for a given count, three was a general tendency of increase in unevenness (c.v.%), thick places, thin places, and neps as the percentages of the waste increased in the blends at all counts. These trend due to the (100% waste) was of higher short fiber content and higher neps them those were obtained from the (100% cotton). The values of the unevenness parameters could be arranged in descending order; (100 waste), (25% cotton + 75% waste), (50% cotton + 50% waste), (75% cotton + 25% waste) and (100% cotton) at all counts.

On the other hand the mean values of the yarn parameters exhibited that the (100% cotton) gave the lowest unevenness (c.v.%), thick places, thin places, and neps (11.7), (1), (1), and (7) for one kilo meter length at the count 10 respectively, while the (100 waste) gave the highest unevenness (c.v.%), thick places, thin places, and neps (17.0), (17), (10) and (27) for one kilo meter length at the count 20 respectively.

These results were in agreement with Abdel – Salam (1972), Pillay (1975), Samra and Ashour (1987) El – Sayed (1996)

Figure 1. Effect of Blends on fiber properties.

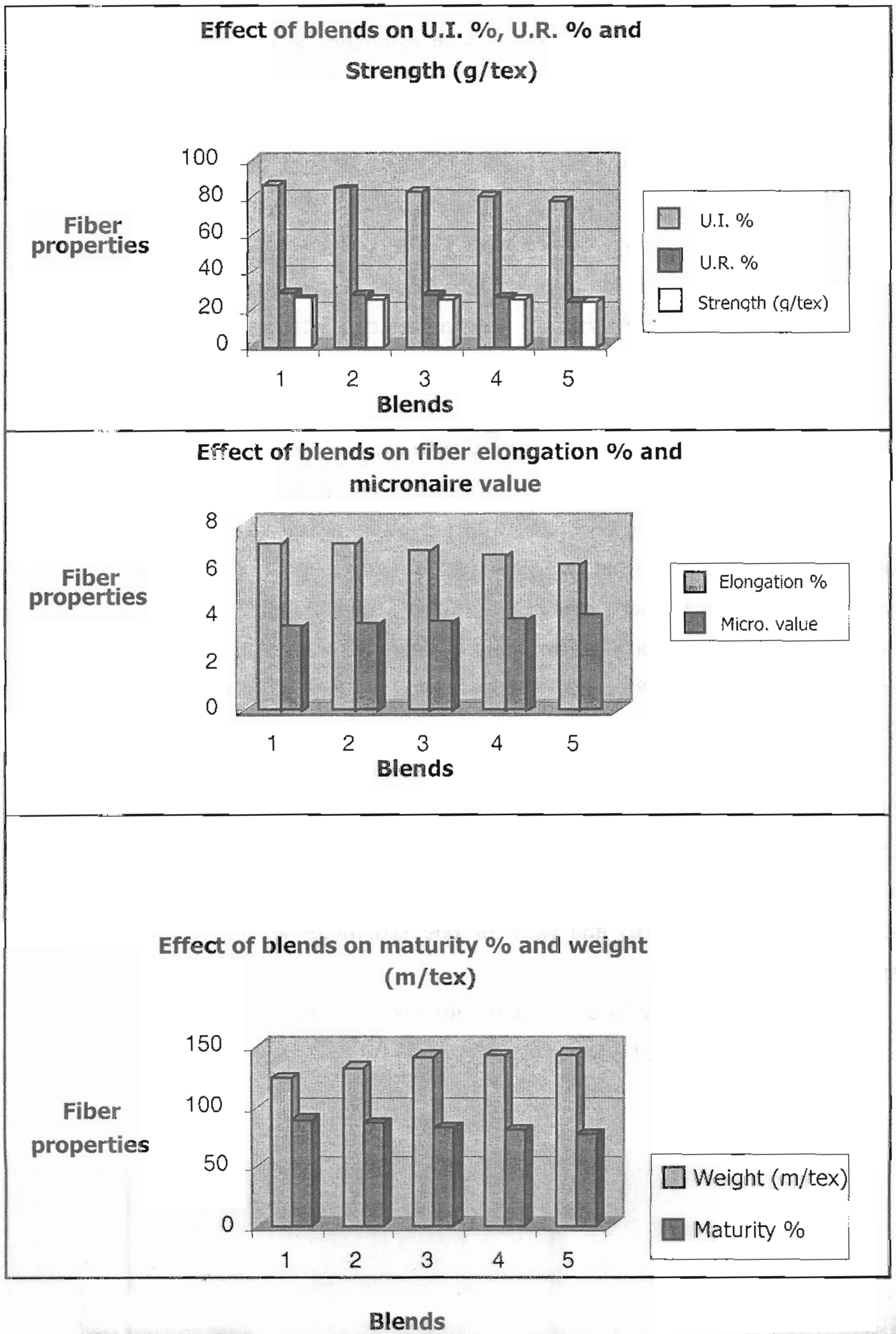
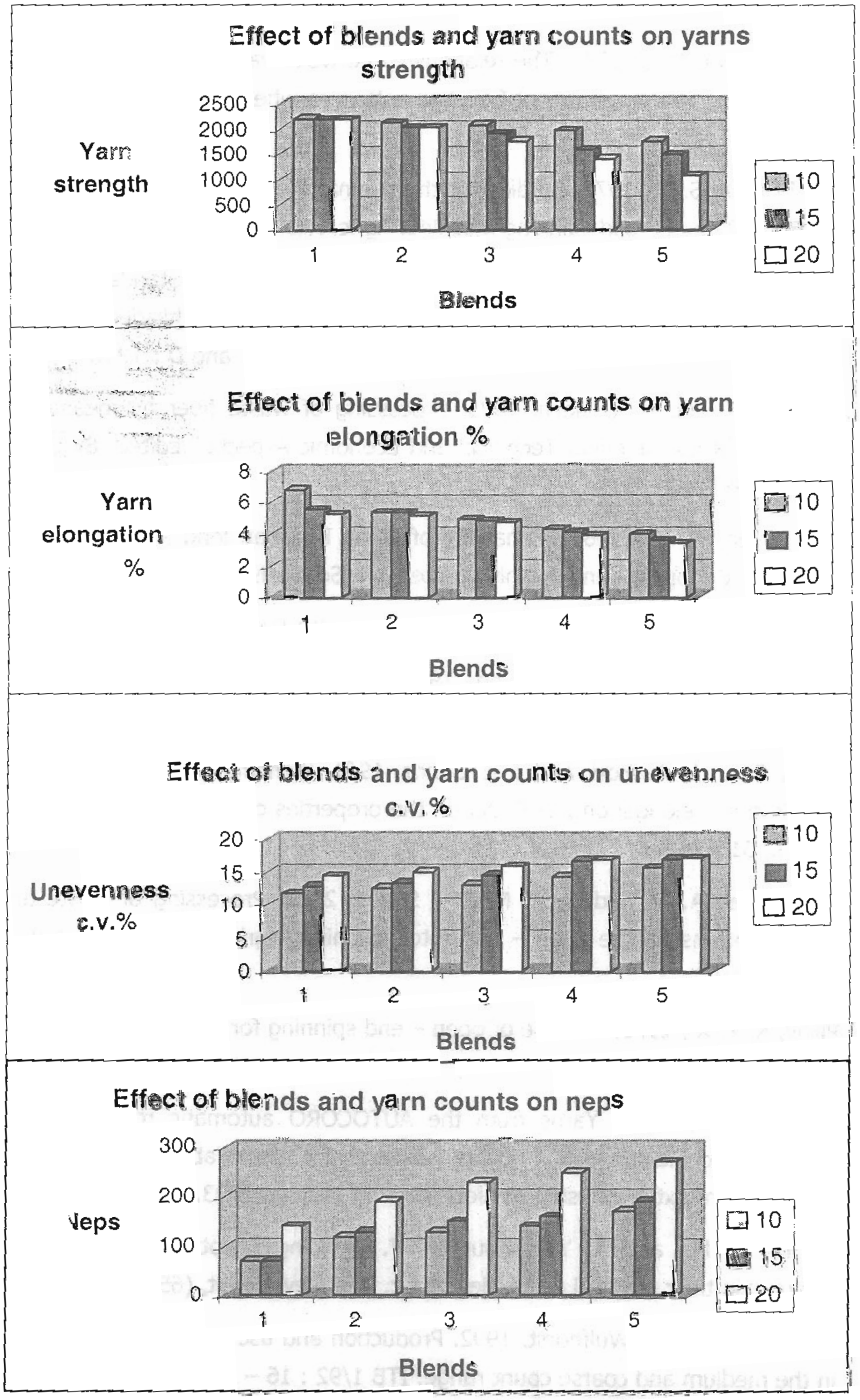


Figure 2. Effect of blends and yarn counts on yarn properties.



REFERENCES

1. Abd El Salam, M. E. 1972. The relationship between yarn fineness, twist multiplier and yarn physical properties of Egyptian cotton varieties. Egypt. Cott. Gaz., no. 58, pp 101 – 124.
2. Abo El Fadl, S. M. 1979. Studies on the spinnability of Egyptian cotton waste on the BD 200 open – end spinning machine. Agric. Res. Rev., 57:11 – 17.
3. ASTM, 1998. American Society for testing and Materials. Standards on textile materials. D , 1445 – 75, D : 1447 – 83, and D : 3818 – 79. Philadelphia, Pa., U. S. A., ASTM 1984 D : 1425 – 84 and ASTM. 1967. D : 1578, and D : 1907.
4. Douglas, K. and M. I. Mech. 1975. Processing of waste fiber by means of rotor spinning " Rotor Spinning Technical and Economic Aspects ",edited. By Dyson, E., The Textile Trade, Press.
5. El – Sayed, M. A. 1996. Spinnability of some Egyptian long staple cotton of low quality on the open – end spinning system. M. Sc. Tesis. Fac. Agric. Alex. Unv.
6. Hollen, N. and J. saddler. 1973. Textile. Macmillan Co., New – York.
7. International Institute for Cotton. 1974. Open – end spinning of Cotton. Cott. Grow. Rev., 51 : 167 – 177.
8. Louis, G. L., L. A. Fiori, and J. E. Sands. 1961. Blending cottons differing in fiber bundle break elongation . 1- Effect on the properties of combed single yarns. Text. Res. J., 31 : 34 – 57.
9. Mohammed A. M. and M. A. M. El – Sayed. 2002. Processing of waste and low quality cottons on the open – end rotor spinning. Agric. Res. Rev., Egypt, (80) : 1709 – 1718.
10. Pillay, K. P. R., 1975. The use of open – end spinning for short staple Cottons. Tex. Res. J. 45 : 493 – 499.
11. Ruger, E. H., 1993. Yarns from the AUTOCORO automatic rotor spinning and winding machine for high – quality woven and Knitted Fabrics. Customer day for the Egyptian textile industry, in Alexandria on 19 June 1993.
12. Samra, A. M., and A. Y. Ashour, 1987. Blending Egyptian and Upland cotton diversed in their physical properties. Agric. Res. Rev. Egypt, (65) :749 – 759.
13. Tetzlaff, G. and B. Wulfhorst, 1992. Production and use of Open – End rotor yarns in the medium and coarse count range. ITB 1/92 : 16 – 29

إمكانية غزل وخلط عوادم التسريح والتمشيط على نمر خشنة في الغزل ذو الطرف المفتوح

خلف إبراهيم خلف مبروك ، أسامة دسوقي محمد نور

معهد بحوث القطن – مركز البحوث الزراعية – الجيزة – مصر .

أجري هذا البحث بهدف دراسة تأثير غزل عوادم التسريح والتمشيط وخلطها مع صنف يتبع طبقه الأقطان الطويلة وهو صنف جيزة ٩٠ بنسب مختلفة وهي (١٠٠%) ، (٧٥% قطن + ٢٥% عادم) ، (٥٠% قطن + ٥٠% عادم) ، (٢٥% قطن + ٧٥% عادم) ، (١٠٠% عادم). وقد أظهرت الدراسة أن متانة التيلة وطول التيلة وكذلك استطالة التيلة والنضج قد تناقصت تدريجياً حتى وصلت إلى أقل قيمة عند (١٠٠%عادم) بينما تزايدت قيم قراءة الميكرونير والنعومة بالوزن كلما زادت نسبة العوادم.

كما أظهرت نتائج الغزل أن متانة الغزل والخيط المفرد والاستطالة قد تناقصت كلما زادت نسبة العوادم للنمرة الواحدة وقد تناقصت أيضاً كلما زادت النمرة من ١٠ إلى ٢٠. أما معامل اختلاف متانة الخيط المفرد ومعامل اختلاف الاستطالة ومعامل اختلاف عدم الانتظام وكذلك المناطق السميكة والرفيعة والعقد فقد زادت كلما زادت نسبة العوادم وقد زادت أيضاً كلما زادت النمرة من ١٠-٢٠.

كما أظهرت النتائج إمكانية غزل وخلط القطن صنف جيزة ٩٠ بالعوادم بنسب مختلفة والحصول على صفات جودة معقولة نسبياً من هذه الخلطات يمكن الاستفادة منها اقتصادياً في الغزول الخشنة.