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EFFECT OF TEMPERATURE ON PHYSICAL PROPERTIES AND SOME CHEMICAL CONSTITUENTS OF COTTON FIBERS

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Abstract

Five commercial cotton cultivars of the two Egyptian cotton categories, i.e., Extra-long staple (Giza 76, Giza 77 and Giza 70) and long-staple cottons (Giza 75 and Giza 80) were used in this study. From each cultivar, samples of fibers of three levels of micronaire reading (low, medium and high) were obtained and subjected to four different temperature treatments (0, 50, 100 and 200oC).

The results obtained showed that reflectance percent (Rd%), fiber length at both 50% and 2.5% S.L., fiber strength at zero and 1/8 gauge length, fiber strength, uniformity ratio, fiber elongation and fiber wax content were significantly decreased as the temperature degrees increased while; degree of yellowness (+b) and fiber sugar content were significantly increased. The severe effect of different temperature treatments were more pronounced on cotton fibers of low micronaire reading. Fiber length uniformity ratio did not follow a constant trend of increasing or decreasing. Micronaire reading was not affected by different temperature treatments.

INTRODUCTION

Seed cotton, cotton fibers, yarn and fabrics are subjected to heat treatments either in ginning, spinning, weaving and specially in finishing or even in end use through ironing clothes. These heat treatments affect much the quality and the properties of these products. It is well known that treatment with high temperature causes obvious damage in almost all fiber properties, but it is not clear whether all cotton cultivars are affected similarly or not. This point is important to not only the cotton breeder and grower but also to the cotton manufacturer.

Therefore, this investigation was carried out to study to what extent heat treatments affect the physical and chemical properties of fibers of the Egyptian commercial cotton cultivars at different fiber maturity levels.

Brushwood (1988) found that the degree of yellowness (+b) of cotton fibers was affected by the heating temperature, changed very little up to 100°C. Above this temperature, (+b) value increased sharply. Azza (1990) came to the same conclusion. Perkins (1971) showed that excessive heating decreased fiber length and increased short fiber percent. Brushwood (1988) stated that fiber length at both 50% and 2.5% S.L. decreased slightly at temperature below 180°C, fiber length decreased linearly at about an average of 0.6% and 0.3% per minute for 50% and 2.5% S.L. Azza (1990) found that heat treatments caused an insignificant decrease in 50% and 2.5% S.L. for all studied cultivars except for Giza 70 and Giza 75 which significantly decreased. Brushwood (1988) stated that adverse effects associated with heating were more pronounced on low micronaire reading (high non-cellulose content cottons) than on high micronaire reading (low non-cellulose content cottons). Azza (1990) found that the effect of heat treatments was very small either for varying temperature or varying time of treatment. Hessler and Workman (1959) found that physical changes, to some extent, depended on the physical nature of the fibers. A slight decrease in tensile strength was noted in drying at moderate temperature where a substantial drop occurred by drying at high temperature. Brushwood (1988) revealed that heating treatments up to 160°C for the 20 minutes caused little loss in strength. However, rapid deterioration of strength occurred above this temperature. Fiber elongation was not affected to any extent at temperature below 180°C. At higher temperature, average elongation decreased by about 16%. Azza (1990) found that treatment of high temperature for a constant time or increasing time caused a general decrease in fiber strength at zero and at 1/8 gauge lengths for all studied cultivars. Fiber strength uniformity ratio did not follow the constant trend. Also, the heat treatments caused insignificant decrease in fiber elongation for most cultivars. Brushwood (1988) showed that reduction in sugar level increases up to 100% at the 200°C level heating. Azza (1990) found that heat treatments for constant or varying exposure time caused insignificant increases in reducing sugars for all studied cultivars except Giza 77 and Giza 75. Brushwood (1988) found that wax content decreased with increasing both micronaire reading or heat temperature. Azza (1990) showed that the heat treatments for constant or varying times cause a highly significant decrease in wax percent in most studied cultivars.

MATERIALS AND METHODS

Five Egyptian commercial cotton cultivars were used in this study, of which three cultivars represented the Extra-Long Staple category (Giza 76, Giza 77 and Giza 70), and two represented the Long Staple (Giza 75 and Giza 80). Three levels of micronaire reading from each of the studied cultivars were taken to represent three different levels of maturity (low, medium and high) as indicated in the following Table.

	Variety				
Micronaire level	Giza 76	Giza 77	Giza 70	Giza 75	Giza 80
Low	2.4	2.6	2.4	3.0	4.3
Medium	2.8	3.0	3.0	3.8	4.8
High	3.2	3.6	3.3	4.3	5.2

The cotton samples were conditioned to about 6.2% moisture content at 65% relative humidity and 21±1°C. All samples were subjected to heat treatments in a laboratory forced draft oven. Oven ambient air temperatures were 50, 100 and 200oC for a fixed time of 20 minutes ± 30 seconds. Each treatment was replicated three times. The means were compared at 0.05 level of probability using L.S.D. method.

The studied characters included: Colour of raw cotton (degree of yellowness (+b) and reflectance percent (Rd%)} of raw cotton by HVI according to the ASTM: D 2253-76, 1984), Fiber length at both 50% and 2.5% S.L. in mm by fibrograph (ASTM: D 1447-83, 1984). Uniformity ratio was calculated according to the method of Sundaram (1979) Micronaire reading according to the ASTM; D: 1448-59, 1984), Fiber strength and elongation: Fiber strength at both zero and 1/8 inch gauge lengths in g/tex and elongation percent by stelometer according to ASTM: D1445-75, 1984, Sugar content was determined by using Soxhlet extraction according to the methods of Smith (1956), and Wax content: Total wax content of cotton fiber was determined by the method of Conrad (1944).

RESULTS AND DISCUSSION

I. Effect of temperature on physical properties of cotton fiber:

1. Degree of yellowness (+b) and reflectance percent (Rd%)

It is evident from Table (2) and figure (1) that the +b values changed very little below 100°C. Above this temperature +b values sharply increased. Also, it was found that the degree of yellowness increased as the micronaire level decreased. Such increase in degree of yellowness in low micronaire reading could be due to the larger percentage of noncellulosic materials associated with lower maturity. It is worthy to mention that all studied cultivars had the same trend of response to different temperature treatments.

Table 2. Degree of yellowness (+b) and reflectance percent as affected by temperature.

Temp., °C		Degree of yellowness %					Reflectance, %				
		Control	50	100	200	Mean	Control	50	100	200	Mean
Giza 67	2.4	9.5	9.7	11.8	17.0	12.0	73.1	72.5	71.6	46.2	65.9
	2.8	9.2	9.8	10.4	15.8	11.3	74.4	73.0	71.8	46.4	66.4
	3.2	9.0	9.0	9.7	15.6	10.8	77.6	75.6	73.6	47.8	68.7
	Mean	9.2	9.5	10.6	16.1	11.4	75.0	73.7	72.3	46.8	67.0
Giza 77	2.6	13.0	13.1	13.1	14.2	13.4	66.9	66.4	65.2	42.3	60.2
	3.0	12.4	12.8	13.1	14.7	13.3	76.7	67.0	66.7	44.4	63.7
	3.6	12.6	12.6	12.8	14.2	13.1	76.2	68.6	67.3	45.1	64.3
	Mean	12.7	12.8	13.0	14.4	13.3	73.3	67.3	66.4	43.9	62.7
Giza 70	2.4	10.4	10.5	11.1	18.0	12.5	74.3	72.4	70.0	49.0	66.4
	3.0	10.1	10.3	10.6	18.0	12.2	73.3	71.8	71.3	49.1	66.4
	3.3	9.1	10.4	10.9	17.5	12.1	72.1	71.5	72.3	51.5	66.9
	Mean	10.0	10.4	10.9	17.8	12.3	73.2	71.9	71.2	49.9	66.6
Giza 75	3.0	9.5	9.8	10.1	13.9	10.7	73.8	72.2	62.8	42.4	62.8
	3.8	8.9	9.9	9.9	14.1	10.9	73.5	73.5	70.7	44.2	65.5
	4.3	7.2	8.9	9.0	12.3	9.4	74.8	74.7	73.3	44.4	66.8
	Mean	8.5	9.5	9.7	13.4	10.3	74.0	73.5	68.9	43.7	65.0
Giza 80	4.3	12.3	13.2	13.3	13.6	13.1	64.4	64.3	59.8	42.2	57.7
	4.8	12.2	12.8	13.2	13.6	13.0	64.7	63.8	63.7	42.4	58.7
	5.2	12.2	12.2	12.3	13.7	12.6	67.2	66.9	65.1	42.2	60.4
	Mean	12.2	12.7	12.9	13.6	12.9	65.4	65.0	62.9	42.3	58.9

L.S.D. at 0.05 level for	Cultivar (C)	0.05	0.19
	Micronaire (M)	0.04	0.14
	Temperature (T)	0.04	0.17
	CxM	0.08	0.32
	C x T	0.10	0.37
	M x T	0.07	0.29
	C x M x T	0.16	0.64

The above mentioned results could be explained by the assumption that high temperatures cause decomposition of cellulose and other fiber constituents. Also, this result is of practical improtance specially in ironing cotton fabrics at high temperatures which causes drastic yellow colours for the fabrics. In addition, this is important in the finishing industry when using high temperatures during drying and finishing cotton fabrics. These results are in conformity with those obtained by Brushwood (1988) and Azza (1990).

As to reflectance of lint to light, it is clear from Table (2) and Figure (1) that the values of reflectance percent (Rd%) slightly decreased as the ambient air temperature increased up to 100°C then the reflectance rapidly decreased at 200°C temperature. Also, it is obvious that the reflectance increased as the micronaire reading increased. This results could be due to the decrease of the percentage of noncellulosic materials (coloured materials) which accompany the increase in maturity.

All studied cultivars followed the same trend of response to different temperature treatments. These results are in harmony with those of Brushwood (1988) and Azza (1990).

2. Fiber length parameters

It is clear from Table (3) and Figure (1) that fiber length at both 50% and 2.5% S.L. were slightly decreased as the temperature increased. This small reduction in fiber length could be attributed to the damaging effect of heating on fiber length. This result is in agreement with those obtained by Perkins (1971), Brushwood (1988) and Azza (1990). It is important to note that fiber length did not follow a constant trend of effect to different temperature treatments.

The results also indicated that fibers of low micronaire reading were more affected by different temperature treatments than fibers of high micronaire reading. This trend was true for all studied cultivars.

3. Micronaire reading

It is well known that micronaire reading generally expresses both fiber fineness and maturity but within any cultivar it expresses mainly fiber maturity. It is obvious from Table (3) that the different temperature treatments nearly had no effect on micronaire reading. These results are true for all micronaire levels and cultivars under study. However, Azza (1990) observed that the effect of heat on micronaire reading was very small.

4. Fiber mechanical properties:

It is obvious from Table (4) and Figure (1) that as the temperature degree in-

Table 3. Fiber length parameters and micronaire reading as affected by different temperature treatments.

Temp., °C		Control	50	100	200	Mean	Control	50	100	200	Mean
		50% S.L., mm					2.5% S.L., mm				
Giza 76	2.4	15.6	15.4	15.2	13.9	15.0	31.5	31.0	30.3	28.5	30.3
	2.8	15.7	15.5	15.2	15.2	15.4	31.5	31.0	30.8	30.6	30.9
	3.2	15.4	15.4	15.2	15.2	15.3	31.4	30.7	30.7	30.6	30.9
	Mean	15.6	15.4	15.2	14.8	15.2	31.4	30.9	30.6	29.8	30.7
Giza 77	2.6	15.6	15.3	15.3	14.8	15.3	31.5	31.2	30.6	29.6	30.7
	3.0	16.4	15.6	15.3	15.0	15.6	32.5	31.3	31.3	29.4	31.1
	3.6	16.3	15.6	15.3	15.3	15.6	32.5	31.5	31.4	31.0	31.6
	Mean	16.1	15.5	15.3	15.0	15.5	32.2	31.4	31.1	30.0	31.1
Giza 70	2.4	15.6	14.6	14.3	12.6	14.3	30.6	28.6	28.5	26.5	28.6
	3.0	16.4	15.8	15.1	13.6	15.2	32.0	31.2	30.0	28.6	30.5
	3.3	16.3	15.6	15.0	14.6	15.4	32.3	31.7	31.6	28.8	31.1
	Mean	16.1	15.3	14.8	13.6	15.0	31.6	30.5	30.0	28.0	30.0
Giza 75	3.0	14.6	14.4	14.0	13.4	14.1	29.1	28.8	28.6	26.8	28.3
	3.8	14.6	14.5	14.3	13.6	14.3	29.6	28.7	27.8	27.5	28.4
	4.3	14.6	14.5	14.0	13.6	14.2	29.6	29.0	28.7	27.6	28.7
	Mean	14.6	14.5	14.1	13.5	14.2	29.4	28.8	28.4	27.3	28.5
Giza 80	4.3	15.4	14.7	14.7	14.4	14.8	30.0	29.8	29.5	27.9	29.3
	4.8	15.6	15.6	15.4	14.4	15.3	31.0	30.0	29.0	28.1	29.5
	5.2	15.3	15.1	14.9	14.2	14.9	30.8	29.7	29.1	28.7	29.6
	Mean	15.4	15.1	15.0	14.3	15.0	30.6	29.8	29.2	28.2	29.5
		Fiber length uniformity ratio (%)					Micronaire reading				
Giza 76	2.4	49.5	49.7	50.2	48.8	49.6	2.4	2.4	2.5	2.5	2.5
	2.8	49.8	50.0	49.4	50.0	49.8	2.8	2.7	2.7	2.7	2.7
	3.2	49.0	50.2	49.5	49.7	49.6	3.2	3.3	3.3	3.2	3.3
	Mean	49.4	50.0	49.7	49.5	49.7	2.8	2.8	2.8	2.8	2.8
Giza 77	2.6	49.5	49.0	50.0	50.0	49.6	2.6	2.6	2.7	2.7	2.6
	3.0	50.5	49.8	48.9	51.0	50.1	3.0	3.1	3.1	3.1	3.1
	3.6	50.2	49.5	48.7	49.4	49.5	3.6	3.5	3.5	3.5	3.5
	Mean	50.1	49.4	49.2	50.1	49.7	3.1	3.1	3.1	3.1	3.1
Giza 70	2.4	51.0	51.0	50.2	47.5	49.9	2.4	2.5	2.4	2.4	2.4
	3.0	51.0	50.6	50.3	47.6	49.9	3.0	3.1	3.1	3.1	3.1
	3.3	50.5	49.2	47.5	50.7	49.5	3.3	3.2	3.2	3.2	3.2
	Mean	50.8	50.3	49.3	48.6	49.8	2.9	2.9	2.9	2.9	2.9
Giza 75	3.0	50.2	50.0	48.9	50.0	49.8	3.0	2.9	2.9	2.9	2.9
	3.8	49.3	50.5	51.4	49.5	50.2	3.8	3.7	3.8	3.8	3.8
	4.3	49.3	50.0	48.8	49.3	49.4	4.3	4.2	4.2	4.2	4.2
	Mean	49.6	50.2	49.7	49.6	49.8	3.7	3.6	3.6	3.6	3.6
Giza 80	4.3	51.3	49.3	49.8	51.6	50.5	4.3	4.3	4.2	4.2	4.2
	4.8	50.3	52.0	53.1	51.2	51.7	4.8	4.8	4.7	4.8	4.8
	5.2	49.7	50.8	51.2	49.5	50.3	5.2	5.1	5.2	5.2	5.2
	Mean	50.4	50.7	51.4	50.8	50.8	4.8	4.7	4.7	4.7	4.7

L.S.D. at 0.05 level for	50% S.L.	2.5% S.L.	Fiber length U.R.	Micronaire reading
Cultivar (C)	0.05	0.08	0.8	0.5
Micronaire (M)	0.04	0.06	0.06	0.04
Temperature (T)	0.04	0.07	0.07	NS
CxM	0.08	0.17	0.14	0.08
C x T	0.09	0.13	0.17	NS
M x T	0.07	0.29	0.13	NS
C x M x T	0.16	0.64	0.29	NS

Table 4. Fiber mechanical properties as affected by different temperature treatments.

Temp., °C		Control	50	100	200	Mean	Control	50	100	200	Mean
		Fiber strength at zero, g/tex					Fiber strength at 1/8, g/tex				
Giza 76	2.4	47.14	46.49	44.37	31.74	42.44	31.13	29.74	29.63	17.81	27.08
	2.8	47.14	46.67	15.2	36.93	44.21	32.44	31.31	31.31	22.13	29.30
	3.2	47.32	46.73	15.2	38.11	44.72	32.69	32.62	31.50	24.30	30.28
	Mean	47.20	46.63	15.2	35.59	43.79	32.09	31.22	30.81	21.41	28.89
Giza 77	2.6	46.14	45.55	15.31	36.23	42.93	34.28	32.00	31.37	21.19	29.71
	3.0	49.91	46.37	5.3	39.06	44.79	34.36	31.55	31.15	22.11	29.79
	3.6	50.39	48.38	15.3	40.83	46.73	34.67	34.36	33.36	22.31	31.18
	Mean	48.81	46.77	15.3	38.71	44.82	34.44	32.64	31.96	21.87	30.23
Giza 70	2.4	46.61	46.55	14.3	37.05	44.09	33.89	33.47	31.55	20.08	29.75
	3.0	49.21	47.55	15.1	37.64	45.16	34.72	33.72	33.89	20.92	30.81
	3.3	49.32	47.62	15.0	38.64	45.59	34.77	34.73	33.90	23.36	31.69
	Mean	48.38	47.24	14.8	37.78	44.95	34.77	33.97	33.11	21.45	30.75
Giza 75	3.0	46.44	46.26	14.0	33.46	42.96	34.46	30.52	35.52	18.33	27.69
	3.8	47.67	47.67	14.3	34.69	44.12	31.39	30.59	30.76	21.14	28.60
	4.3	48.62	47.96	14.0	35.87	44.83	31.90	30.75	30.96	22.08	28.93
	Mean	47.58	47.30	14.1	34.67	43.97	31.93	30.62	30.74	20.52	28.41
Giza 80	4.3	42.48	40.59	14.7	32.80	38.76	31.74	30.95	30.75	22.42	28.87
	4.8	42.93	41.18	15.4	33.62	39.26	31.35	30.99	30.79	22.21	28.88
	5.2	42.99	41.54	14.9	37.29	40.63	31.54	30.99	30.81	23.49	29.17
	Mean	42.80	41.10	15.0	34.57	39.55	31.43	30.98	30.78	22.71	28.98
		Fiber strength U.R., %					Fiber elongation, %				
Giza 76	2.4	66.03	63.97	66.78	56.12	63.23	6.29	6.02	6.02	5.75	6.02
	2.8	68.82	67.09	67.95	59.92	65.95	6.56	6.29	6.15	6.02	6.25
	3.2	69.08	69.81	67.41	63.86	67.52	6.42	6.29	6.25	6.12	6.27
	Mean	67.98	66.96	67.38	59.93	65.57	6.42	6.20	6.14	5.96	6.18
Giza 77	2.6	74.30	70.25	71.65	58.49	68.67	5.30	5.33	5.26	5.20	5.27
	3.0	68.84	68.04	71.10	56.61	66.15	5.51	5.51	5.39	5.26	5.42
	3.6	68.80	71.02	70.50	54.64	66.24	5.51	5.51	5.26	5.26	5.39
	Mean	70.65	69.77	71.08	56.58	67.02	5.44	5.45	5.30	5.24	5.30
Giza 70	2.4	72.71	71.90	68.38	54.20	66.80	6.01	5.64	5.63	5.37	5.66
	3.0	70.55	70.91	73.28	55.79	67.63	6.02	5.89	5.76	5.50	5.79
	3.3	70.50	72.93	72.47	60.46	69.09	6.02	5.89	5.89	5.50	5.83
	Mean	71.25	71.91	71.38	56.82	67.84	6.02	5.81	5.76	5.46	5.76
Giza 75	3.0	75.13	70.30	71.21	54.78	67.86	5.76	5.56	5.55	5.49	5.59
	3.8	73.21	68.36	70.56	63.65	68.95	5.89	5.63	5.60	5.50	5.66
	4.3	69.79	68.29	70.35	58.94	66.84	5.89	5.63	5.60	5.50	5.66
	Mean	72.71	68.98	70.71	59.12	67.88	5.85	5.61	5.58	5.50	5.64
Giza 80	4.3	73.80	76.25	78.48	68.35	74.22	6.14	6.14	6.01	5.76	6.01
	4.8	73.47	75.25	78.37	66.06	73.29	6.14	6.14	6.01	5.49	5.95
	5.2	73.02	74.60	75.68	62.99	71.57	6.42	6.29	6.29	5.15	6.29
	Mean	73.43	75.37	77.51	65.80	73.03	6.23	6.19	6.10	5.80	6.08

L.S.D. at 0.05 level for	Fiber strength at zero,g/tex.	Fiber strength at 1/8, g/tex	Fiber strength U.R., %	Fiber elongation, %
Cultivar (C)	0.70	0.05	0.03	0.01
Micronaire (M)	0.54	0.04	0.02	0.003
Temperature (T)	0.62	0.05	0.02	0.01
CxM	NS	0.08	0.05	0.01
C x T	1.39	0.10	0.06	0.01
M x T	1.08	0.08	0.04	0.01
C x M x T	2.44	0.18	0.10	0.02

creased up to 100°C, a little decrease in fiber strength at both zero and 1/8 gauge length occured but the rapid deterioration in strength occured when the temperatrre was raised above this level. In addition, the results indicated that the loss in fiber strength was more pronounced for fibers of lower micronaire reading. Also, it was found that fiber strength at both zero and 1/8 inch increased as micronaire reading increased (Abdel Aziz et al., 1996). These results are so true for all cultivars under study.

The infered reduction in fiber strength was expected since high temperatures cause damage and break of cellulose molecules and bonds between these molecules, also cause severe damage in the primary wall. These results are in agreement with those found by Brushwood (1988) and Azza (1990). It is worthy to mention that the loss in fiber strength at 1/8 inch was greater than that at zero. This might be attributed to the effect of weak points on fiber which becomes more apparent when gauge length increases.

With regard to fiber strength uniformity ratio, it is well known that fiber strength uniformity ratio is the percentage ratio between fiber strength at 1/8 inch (T_1) and fiber strength at zero (To). So any factor that affects either T_1, To or both would affect fiber strength uniformity ratio. The results in Table (4) revealed that the values of fiber strength uniformity ratio did not follow a constant trend with the temperature treatment of 100°C but sharply decreased at 200°C. This reduction in fiber strength uniformity ratio could be ascribed to the higher decrease in fiber strength at 1/8 inch than that at zero as indicated before, which resulted from the effect of high temperature on creating weak places in the fiber structure. Also, the results proved that the degree of severity of temperature effect was more pronounced for samples of lower micronaire reading for all cultivars under study. These results are in conformity with those obtined by Brushwood (1988) and Azza (1990).

As to fiber elongation, it was found that fiber elongation was slightly decreased at temperature up to 100°C then sharply decreased at 200°C. The effect of high temperature on elongation was more obvious in cotton with low micronaire reading as compared with that of high micronaire reading. These results were true for all studied cultivars. Such results are in harmony with those reported by Brushwood (1988) and Azza (1990).

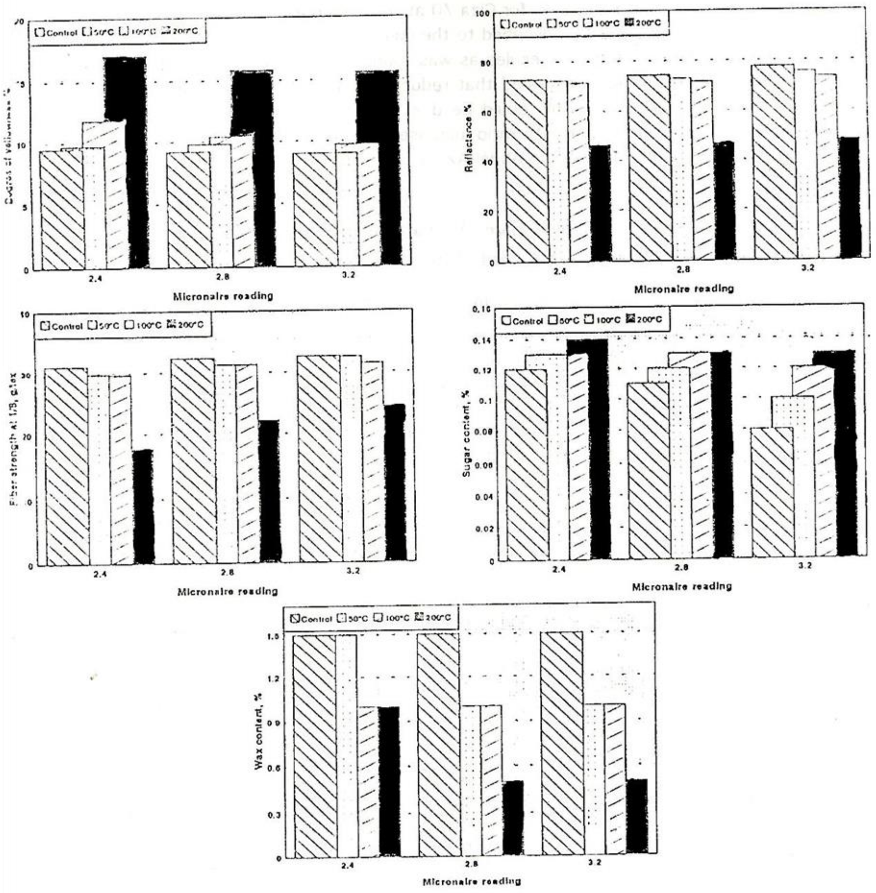

Fig.1. Degree of yellowness + b, reflectance percent Rd, fiber strength, fiber sugar content and wax content as affected by different temperature treatments.

II. Effect of different temperature treatments on chemical constituents of cotton fiber

1. Reducing sugar content

The results in Table 5 and Figure 1 indicate that reducing sugar content increased by 11% for Giza 80 and 57% for Giza 70 at the temperature of 200^{o}C. Such increase in sugar content could be ascribed to the damage and breaking of the cellulose molecules to smaller sugar molecules as was found by Brushwood (1988) and Azza (1990). Also, the results revealed that reducing sugar content decreased as the micronaire level increased. This could be due to the primary wall percentage which decreased as the fiber maturity ratio increased. These results are in harmony with those of Salwa et al. (1995) and Abdel-Aziz et al. (1996).

2. Wax content

It is clear from Table (5) and Figure (1) that wax content decreased with increasing temperature. Low wax content at high temperatures would be associated

Table 5. Chemical constituents of cotton fiber as affected by different temperature treatments.

Temp., ^{o}C		Sugar content (%)					Wax content (%)				
		Control	50	100	200	Mean	Control	50	100	200	Mean
Giza 76	2.4	0.12	0.13	0.13	0.14	0.13	1.5	1.5	1.0	1.0	1.3
	2.8	0.11	0.12	0.13	0.13	0.12	1.5	1.0	1.0	0.5	1.0
	3.2	0.08	0.10	0.12	0.13	0.11	1.5	1.0	1.0	0.5	1.0
	Mean	0.10	0.12	0.13	0.13	0.12	1.5	1.2	1.0	0.7	1.1
Giza 77	2.6	0.12	0.12	0.13	0.22	0.15	1.5	1.5	1.0	0.5	1.1
	3.0	0.11	0.11	0.12	0.21	0.14	1.5	1.0	1.0	0.5	1.0
	3.6	0.10	0.11	0.11	0.14	0.11	1.0	1.0	1.0	0.5	0.9
	Mean	0.11	0.11	0.12	0.14	0.13	1.3	1.2	1.0	0.5	1.0
Giza 70	2.4	0.07	0.11	0.14	0.19	0.12	1.7	1.5	1.5	1.0	1.4
	3.0	0.07	0.10	0.11	0.16	0.10	1.5	1.5	1.0	0.5	1.1
	3.3	0.07	0.10	0.11	0.12	0.10	1.5	1.0	11.0	0.5	1.0
	Mean	0.07	0.10	0.12	0.12	0.11	1.6	1.3	1.2	0.7	1.2
Giza 75	3.0	0.12	0.13	0.13	0.13	0.15	1.5	1.0	1.0	1.0	1.1
	3.8	0.08	0.12	0.13	0.20	0.13	1.5	1.0	1.0	1.0	1.1
	4.3	0.08	0.11	0.12	0.17	0.12	1.0	1.0	0.5	0.5	0.8
	Mean	0.09	0.12	0.13	0.15	0.13	1.3	1.0	0.8	0.8	1.0
Giza 80	4.3	0.09	0.09	0.11	0.17	0.11	1.7	1.5	1.5	0.5	1.3
	4.8	0.09	0.09	0.11	0.14	0.10	1.5	1.0	0.5	0.5	0.9
	5.2	0.09	0.09	0.09	0.12	0.10	0.5	0.5	0.5	0.5	0.5
	Mean	0.09	0.09	0.10	0.12	0.10	1.2	1.0	0.8	0.5	0.9

L.S.D. at 0.05 level for		Sugar	Wax
	Cultivar (C)	0.06	0.15
	Micronaire (M)	0.05	0.11
	Temperature (T)	0.06	0.13
	CxM	0.11	0.25
	C x T	0.13	0.29
	M x T	0.10	0.23
	C x M x T	0.22	0.51

with lower carbonyl content as reported by Hessler and Workman (1959), Brushwood (1988) and Azza (1990). Also, the results indicated that wax content decreased as the micronaire level increased. This decline in wax content could be ascribed the decrease in the primary wall thickness which contain most of the wax content. These results are in agreement with those of Brushwood (1990), Salwa et al. (1995) and Abdel Aziz et al. (1996).

The results had a practical use in the cotton finishing industry since wax and non-cellulosic substances are the main components extracted during the boiling, kiering and bleaching treatments and also affect the dyeing efficiency of the end product.

Physical properties and chemical constituents statistical correlations with heat treatment

It is clear from Table (6) that all studied physical properties of cotton fiber were negatively correlated with temperature treatments except for degree of yellowness which exhibited positive relationship with different temperature treatments. With regard to chemical constituents of cotton fibers, it is clear that fiber sugar content was positively associated with temperature treatments. On the contrary, fiber wax content was negatively correlated with temperature treatments. The infered results were so true for all studied cultivars.

Table 6. Physical properties and chemical constituents of cotton fibers as afffected by different temperature treatments.

Fiber character	Giza 76	Giza 77	Giza 70	Giza 75	Giza 80
Degree of yellowness (+b)	0.929**	0.905**	0.917**	0.894**	0.847**
Reflectance percent, (Rd%)	-0.910**	-0.936**	-0.908**	-0.921**	-0.909**
50% S.L. (mm)	-0.693**	-0.809**	-0.856**	-0.970**	-0.843**
2.5% S.L. (mm)	-0.764**	-0.845**	-0.757**	-0.933**	-0.938**
Fiber length uniformity ratio (%)	-0.075	0.107	-0.615*	-0.096	0.121
Fiber strength at zero (g/tex)	-0.883**	-0.905**	-0.931**	-0.905**	-0.936**
Fiber strength at 1/8 (g/tex)	-0.868**	-0.935**	-0.903**	-0.915**	-0.903**
Fiber strength uniformity ratio(%)	-0.760**	-0.833**	-0.841**	-0.844**	-0.645*
Fiber elongation (%)	-0.758**	-0.658*	-0.876**	-0.754**	-0.602**
Fiber sugar content (%)	0.677**	0.803**	-0.827**	0.879**	0.885**
Fiber wax content (%)	-0.861**	-0.853**	-0.843**	-0.585*	-0.546*

REFERENCES

1 . Abdel-Aziz, M.A.; M.T. Abdel Fattah and Salwa A.Abd El-Rehim. 1996. Noncellulosic materials and fiber properties of Egyptian cotton in relation to micronaire reading. Egypt. J. Appl. Sci., 11 (5): 142-153.

2 . ASTM. 1984. American Society for testing and materials. Standards on Textile Materials. D: 2253-76, D: 1447-83, D: 1448-59 and D: 1445-70.

3 . Azza, A.M. 1990. Chemical studies on fibers and yarns of Egyptian cotton. M.S. Thesis, Fac. Agric. Cairo Univ.

4 . Brushwood, D. 1988. Effect of heating on chemical and physical properties and processing quality of cotton. Text. Res. J. 6: 309-317.

5 . Conrad, C.M. 1944. Determination of wax in cotton fiber. A new alcohol exlraction method. Ind. Eng. Chem. Anal. 16 : pp 745.

6 . Hessler, L.E. and W. Workman. 1959. Heat induced chemical changes in cotton fiber. Text. Res. J. 29: 487-492.

7 . Nickerson, D. and J.J. Tomaszeuski. 1958. Color change in raw cotton related to conditions of storage. Text. Res. J. 28: 485-497.

8. Perkins, H.H. 1971. Some observations on sticky cottons. Indian, Textile J. 135: 49-64.

9. Salwa, A. Abd El-Rehim, Fawkia K. Al Khatib and Zeinab M.Askalamy. 1995. Effect of boll age on physical properties and structure of fiber of two Egyptian cotton cultivars. Egypt. J. Appl. Sci., 10 (11): 241-251.

10. Smith, F.G. 1956. The sucrose content of the Western Australian Honey. J. Agric. Res. (2) 4: 177-184.

11. Sundaram, V. 1979. Hand Book of Methods of Tests for Cotton Fibers, Yarn and Fabrics. Indian, Council of Agric. res., p. 71-76.

تأثير المعاملة بدرجات الحرارة المختلفة على الخواص الفيزيائية وبعض المكونات الكيمائية لأصناف القطن المصرى المختلفة فى درجة نضج التيلة

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الغرض الأساسى من هذه الدراسة هو معرفة إلى أى مدى تؤثر المعاملات الحرارية المختلفة على الصفات الطبيعية والتركيب الكيماوى لشعيرات القطن من مستويات نضج متباينة وقد اختير لهذه الدراسة ثلاثة أصناف من طرز القطن المصرى الفائق طول التيلة (جيزة ٧٦ وجيزة ٧٧ وجيزة ٧٠) وصنفين من طرز الطويل التيلة (جيزة ٧٥ وجيزة ٨٠) وقد أخذ من كل صنف ثلاثة مستويات مختلفة من قراءات الميكرونير وعوملت هذه العينات بأربع معاملات مختلفة من درجات الحرارة وهى صفر ، ٥٠ ، ١٠٠ ، ٢٠٠ ٥م.

وتشير النتائج المتحصل عليها إلى أن استعمال درجة الحرارة ٢٠٠ ٥م كان الأكثر ضرراً لشعر القطن بالمقاونة بدرجات الحرارة المستعملة الأخرى. حيث لوحظ عند هذه الدرجة نقص فى كل من درجة البياض (Rd%) وطول التيلة عند نسبتى توزيع ٥٠٪ و ٢,٥٪ ومتانة التيلة على مسافتى صفر و ١ / ٨ ودرجة انتظام المتانة ونسبة الاستطالة والنسبة المئوية للشمع، وعلى العكس من ذلك فقد لوحظ زيادة فى درجة الاصفرار (+b) والنسبة المئوية للسكريات بالشعر كلما ارتفعت درجة الحرارة.

ومن الجدير بالذكر القول بأن التأثير الضار للمعاملات الحرارية المختلفة كان أكثر وضوحاً فى ألياف القطن المنخفضة فى قراءة الميكرونير. لم تأخذ صفة درجة الانتظام فى الطول اتجاهاً ثابتاً من الزيادة والنقصان كما لم تتأثر قرادة الميكرونير بالمعاملات الحرارية المختلفة.

وتشير النتائج أيضاً إلى وجود علاقة سالبة بين جميع الصفات الطبيعية والتركيب الكيماوى لتيلة القطن مع درجات الحرارة. فيما عدا درجة الاصفرار (+b) ونسبة السكريات فقد وجدت علاقة موجبة بين كل منها وبين درجات الحرارة.

وعموماً يتوقف التأثير الضار لدرجات الحرارة على قراءة الميكرونير لتيلة القطن حيث أن الأقطان المنخفضة فى قراءة الميكرونير كانت أكثر قابلية للتدهور.