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LINT REACTIVITY OF SOME EGYPTIAN COTTON VARIETIES AFTER TREATMENT IN ALKALINE AND ACID SWELLING AGENTS

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Abstract

The reactivity of fibers of five Egyptian cotton varieties namely Giza 45, 87, 88, 89 and Giza 86 were measured before and after treatment with three swelling agents i.e NaOH (1, 5, 10 N) for 30 minutes, H_2SO_4 (10%,25%) for 15 seconds and 30 minutes for each concentration and HNO_3 30 % for 30minutes. The results indicated that fiber tenacity decreased with all swelling agents used while the changes in elongation varied according to the category of cotton varieties. On the other hand moisture sorption %, accessibilty % and water retention% varied according to the type of swelling either intrafibrillar or interfibrillar that took place during the swelling.

INTRODUCTION

It is well known that cotton fibers are very heterogeneous in character, with considerable variation in their morphological and structural properties among different varieties and even within a single Variety (Egle, and Grant, 1970). Variations in gross morphology such as fineness, circularity, cell wall thickness and maturity as well as fine structure, namely crystalinity, maturity and orientation are known to influence the tensile properties of cotton fibers. Swelling agents affects tensile properies through; the even distribution of stress in the fiber, the removal of morphological weak points in the structure, and reducing the degree of inter molecular bonding in the fiber and thus tend to decrease the strength of the fiber Warwicker *et al.* (1966). The reagents used to modify cotton generally react only with hydroxyl groups on the crystallite surface or in the accessible region where they can penetrate. More huydroxyl groups become available for reaction if the fiber can be swollen by water or other swelling agents or if the fiber is permanently swollen by mercerization. Meredith (1996), Zeronian and Cabradilla (1972) stated that moisture regain can be taken as a measure of accessibility of cellulose and indication of an crystalinity. Venkatesh and Dweltz (1975) reported that sorption and the extent of swelling depends on many factors; such as the accessibility of the intrafibillar structure, space avilable to accommodate the expanding structure

and viscosity. Rousselle *et al.* (1976) found that immature fibers have a higher moisture regain and greater accessibility than mature fibers. The orientation of cellulose microfibrils in the fiber cell wall is an important structural feature for fiber strength. Cellulose is deposited in a random pattern in the primary cell wall lateral to the main fiber axis. Meredith (1991) has recently shown that the degree of swelling of a cotton fiber is no criterion for the manner in which swelling has been achieved and can not indicate the effect of the treatment on the morphology and fine structure of the cotton. It is possible for the same degree of swelling to be achieved in three different concenration of the swelling reagent the swelling to be interfibrillar in one concentration and intrafibrillar as well as interfibrillar in the other the reactivity of the resulting treated cotton may therefore be expected to be different towards other reagent, according to the type of swelling acheived during the swelling treatment rather than the degree of swelling achieved. Shishonok *et al.* (1987) stated that treatment with HNO_3 may be of interest as an effective method for the activation of cellulose in processes for its esterfication. Parikh *et al.* (1989) found that acid has been an effective as a reagent, however care must be exercised to prevent hydrolytic damage by using very dilute acids where the extent of degradation is far less and the degradation partiucally non existent. Safy *et al.* (1993) stated that the treatment of unrefined fibers with alkali resulted in an increase in water retention values. Amount of water increased with alkali concentration up to12% and 14% NaOH respectively, then decreased with further increase in alkali concentration.

MATERIALS AND METHODS

Five Egyptian cotton varieties, grade G/FG, namely; Giza45, Giza87 and Giza 88 (Extra long staple varieties), Giza 89, Giza 86 (long staple varieties), 1999 crop, were used in this study. Lint samples were purified by Shirely analyser.

The following swelling treatments were used

Swelling agent	Concentration	time of swelling
Control	—	—
NaOH	IN	30 minutes
NaOH	5N	30 minutes
NaOH	10N	30 minutes
H_2SO_4	10 %	15 seconds
H_2SO_4	10 %	30 minutes
H_2SO_4	25 %	15 seconds
H_2SO_4	25 %	30 minutes
HNO_3	30 %	10 seconds

The solutions were made up by weight and chekced by measure of the specific gravity. After the treatment, samples were washed in running tap water at room temperature and then neutralized with acetic acid 1% and finally washed with distilled water and dried at room temperature. Four replicates (5gr.) from each treatment were used to determine the following characteristics:

Fiber mechanical properties: Fiber tenacity at 1/8" gauge length according to ASTM (D,1445-64), and fiber elongation % according to ASTM (D,1445-67).

Chemical properties : Moisture regain (M.R) expressed as follows

M.R%=A- B\B 100

Where A:conditioned weight at 21°c and 65%R.H.

B:dry weight at 105 c in oven. Moisture sorption (M. S) number of moles of water per anhydro glucose units was calculated as :

M.S =M.R% 160/1800.accordind to Valentine (1954) .

Accessibility % is calculated by using the constant value of Gibbons (1953) : Accessibility % = M.S *100/1.53

Water retention % was measured for samples of cotton soaked in water for 1hr at 25°C, then centrifuged for 7 min.at a speed of /3800rpm in closed tubes with a sintered disk ,wich was found to correspond to a relative centrifugal force of 1300. The cotton was then weighed in the tube, dried for 3hr at 110°C and reweighed to determine the water retention% of the dry weigth, according to clayton (1969).

Statistical analysis was carried out according to Duncans (1955).

RESULTS AND DISCUSSION

The reactivity after treatment by alkaline and acid swelling agents of five Egyptian cotton varieties are shown both in Tables and Figures 1 to 7 which represent, fiber tenacity, fiber elongation%, accessibility%, water retention%, moisture sorption%, and moisture regain %.

It is clear that all treatments significantly affect the studied properties, also results indicated that significant differences had been found between varieties under study.

A- Fiber mechanical properties :

Fiber tenacity at 1/8" gauge length Data in Table 1 and Fig. 1, showed that the tenacity was affected by all treatments and there were decrease in values, comparing with the control, with 1N and 5N (NaOH). The maximum decrease (18.32%), in fiber tenacity obtained with Giza 88 after being treated by H_2SO_4 25% for 30 min. could be explained by swelling and decrystallization which result in more freedom of movement between fiber segments (fibrils)in such amorphus regions. The different cotton varieties differed in their response to the chemical treatments. Change in fiber tenacity, for fibers treated with NaOH ranged from (-3.69) to (3.11%), while in acid treatments it ranged from (-4.53) to (14.98). These results are in agreement with Hollen and Saddler (1964), Wakeham and Spicer (1951) and Egle and Grant (1970), who mentioned that variation in gross morphology such as length, fineness, circularity, cell wall thickness and maturity as well as, fine structure namely crystallinty and orientation are known to influence the tensile and mechanical properties of cotton fibers.

Fiber elongation%: It seems from Table (2) and Fig.(2) that there were sharp increases in elongation percent values with the NaOH treatments with increasing concentrations from 1N up to 10N,with the maximum value of elongation %, about 130%, given by Giza 88 variety, while the minimum increase was 0.14% for Giza 86 variety treated by (1N) NaOH. These increases in elongation were in harmony with those obtained by Ahmed (1981), and Warwicker *et al.* (1966). On the other hand the H_2SO_4 treatments decreased the elongation % depending upon the variety and the concentration used. The percentage of decrease ranged from 0.53% up to 12.20%. Furthermore HNO_3 treatments showed negative and positive effects in elongation% according to the fine structure of the varieties used in this study as the extra long staple varieties showing an increase while the long staple varieties decreased. These results are in agreement with Warwicker et al (1970) and Poter *et al.* (1972), who found large changes following treatments with NaOH in structure and fibrillar aggregation without concomitant change in crystallinity.

B- Chemical properties:

The type of swelling that takes place during swelling treatment, can be classified into interfibrillar swelling where no penetration of fibrils takes place and the fibrils move apart, and intrafibrillar swelling where penetration of the fibrils also takes place. It is conceivable to have intrafibrillar swelling without any interfibrillar swelling and indeed such swelling might reduce the interfibrillar spaces and lead to a compacting of

Table 1. Fiber tenacity at 1/8 gauge length of five Egyptian cotton varieties after treatment with alkaline and acid swelling agents at 25°C.

Varieties / Treat.	Cont.	NaOH IN	± %	NaOH 5N	± %	NaOH 10N	± %	H_2SO_4 10 % 15 Sec.	± %	H_2SO_4 10 % 30 min.	± %	H_2SO_4 25% 15 Sec.	± %	H_2SO_4 25 % 30 min.	± %	HNO_3 30 % 15 Sec.	± %
Giza 45	34.39	33.12	-3.69	32.57	-5.29	30.93	-10.06	31.35	-8.83	30.45	-11.45	30.39	-11.63	29.11	-15.35	32.83	-4.53
Giza 87	34.00	31.66	-6.88	30.57	-10.08	29.54	-13.11	29.88	-12.11	29.77	-12.44	29.20	-14.11	28.66	-15.70	31.27	-8.02
Giza 88	33.84	31.57	-6.7	29.64	-12.41	30.43	-10.07	30.57	-9.66	28.77	-14.98	28.84	-14.77	27.47	-18.82	31.19	7.83
Giza 89	31.84	29.29	-8.00	28.84	-6.28	29.10	-8.6	30.85	-5.99	29.93	-5.99	29.75	-6.56	28.02	-11.99	28.17	-11.52
Giza 86	32.21	30.66	-4.81	30.57	-5.68	30.38	-5.68	30.02	-7.35	29.84	-7.35	29.12	-9.59	29.04	-9.84	28.60	-11.20
MEAN	33.25	31.26	-6.01	30.43	-7.94	30.07	-9.5	30.53	-8.78	29.75	-10.44	29.26	-11.33	28.46	-14.34	30.41	-8.62

L.S.D. at 0.05 % for varieties 0.418
for treatments 0.561

Table 2. Elongation % of five Egyptian cotton varieties after treatment with alkaline and acid swelling agents at 25°C.

Varieties / Treat.	Cont.	NaOH IN	± %	NaOH 5N	± %	NaOH 10N	± %	H_2SO_4 10 % 15 Sec.	± %	H_2SO_4 10 % 30 min.	± %	H_2SO_4 25% 15 Sec.	± %	H_2SO_4 25 % 30 min.	± %	HNO_3 30 % 15 Sec.	± %
Giza 45	6.52	6.96	6.79	12.49	91.56	11.10	70.24	5.75	-11.8	6.33	-2.9	6.33	-2.9	6.33	-2.91	6.77	3.83
Giza 87	5.65	5.94	5.13	11.92	110.97	11.72	107.74	5.62	-5.53	5.33	-566	5.33	-5.66	5.2	-7.96	5.89	4.24
Giza 88	5.80	6.38	10.0	12.63	117.75	13.38	130.68	5.62	-3.10	5.47	-568	5.47	-5.68	5.65	-2.58	6.00	-3.44
Giza 89	6.30	6.89	9.36	12.35	96.03	13.00	106.34	5.49	-12.85	6.59	4.6	6.59	4.60	6.24	-0.95	5.45	-13.49
Giza 86	6.97	6.98	0.14	12.78	83.35	12.58	80.48	6.69	-4.01	7.28	4.44	7.28	4.44	6.84	-1.86	6.92	-0.71
MEAN	6.26	6.32	6.27	12.43	99.93	12.35	99.11	5.83	-6.45	6.2	0.18	6.20	0.18	6.05	-3.25	6.20	-0.53

L.S.D. at 0.05 % for varieties 0.014
for treatments 0.020

the morphological structure. These processes clearly lead to modified properties of the morphology and fine structure that profoundly affect the reactivity of the cotton to different reagents.

Moisture regain:

Moisture regain of the five cotton varieties treated with different concentrations of NaOH , H_2SO_4 and HNO_3 at different periods are given in Table 3 and Fig. 6. From the data it is clear that NaOH 5 N and 1O N caused the highest increases in moisture regain with the maximum increase percentage 80.47%, while 1N of NaOH caused a slight increase, all H_2SO_4 treatments increased moisture regain with different percentages depending on the varieties and concentration used, ranging from (1.24% to 33.12%) while HNO_3 treatment caused different action due to its effect on the fine structure of the fibers. These changes follow the moisture sorption and support the marked change in cellulose accessibility with NaOH, H_2SO_4 and HNO_3. Further examination of the results shows that drying samples that has been swollen interfibrillary produces a water retention not much different from that of the control sample. This case can be explained by the reformation of hydrogen bonds broken during the swelling treatment. On the other hand samples in which a high water retention has been achieved via intrafibillar swelling process, retain some of the extra capacity for water even on drying in the oven. The nature of the final morphology and fine structure of these samples is clearly different from those of the control, whereas in samples where interfibrillar swelling has taken place only a small modification of the morphology and fine stucture seem to have been achieved .

Moisture sorption:

Moisture sorption and related data of cotton varieties treated with different concentrations of NaOH, H_2SO_4 and HNO_3 are given in Table 4 and Fig. 4. From these data it is observed that samples treated with 5N and 10N NaOH showed appreciable change in sorption more than any other treatment, but slight increase in sorption capacity of the fiber is noted with 1N NaOH. Treatment with H_2SO_4 showed an increase in moisture sorption, while nitric acid gave a decrease ranged from – 0.16% to 4.16%. It is interesting to note the effect of concentration and period of treatment on moisture sorption values.

Accessibility%:

From data in Table 5 and Fig.5 it is seen that the accessibility was greater than

Table 3. Moisture regain % of five Egyptian cotton varieties after treatment with alkaline and acid swelling agents at 25ºC.

Varieties / Treat.	Cont.	NaOH IN	± %	NaOH 5N	± %	NaOH 10N	± %	H_2SO_4 10 % 15 Sec.	± %	H_2SO_4 10 % 30 min.	± %	H_2SO_4 25% 15 Sec.	± %	H_2SO_4 25 % 30 min.	± %	HNO_3 30 % 15 Sec.	± %
Giza 45	6.295	6.677	6.06	9.774	55.26	9.928	57.71	7.435	18.10	6.980	10.88	7.349	16.74	6.632	5.35	6.601	-4.85
Giza 87	6.531	7.027	7.94	9.883	51.64	10.231	56.65	7.167	9.73	7.039	7.77	6.980	6.87	7.319	12.06	6.311	-3.36
Giza 88	6.940	7.300	5.18	9.727	40.15	7.664	10.43	7.348	5.87	7.344	5.82	7.130	2.73	7.649	10.21	6.424	-7.43
Giza 89	5.950	6.603	10.97	10.738	80.47	10.305	73.19	6.894	15.86	7.235	21.59	7.150	20.16	7.921	33.12	5.627	-5.42
Giza 86	6.815	6.935	1.76	9.588	40.68	10.793	58.37	6.900	1.24	7.099	4.16	6.920	1.54	7.190	5.50	6.395	-6.16
MEAN	6.506	6.908	6.38	9.942	53.64	9.784	51.26	7.148	10.16	7.139	10.04	7.105	9.61	7.342	13.24	6.392	-3.43

L.S.D. at 0.05 % for varieties 0.044
for treatments 0.0591

Table 4. Moisture sorption 5 of five Egyptian cotton varieties after treatment with alkaline and acid swelling agents at 25ºC.

Varieties / Treat.	Cont.	NaOH IN	± %	NaOH 5N	± %	NaOH 10N	± %	H_2SO_4 10 % 15 Sec.	± %	H_2SO_4 10 % 30 min.	± %	H_2SO_4 25% 15 Sec.	± %	H_2SO_4 25 % 30 min.	± %	HNO_3 30 % 15 Sec.	± %
Giza 45	0.591	0.601	1.69	0.878	48.56	0.833	40.94	0.669	13.19	0.628	6.26	0.661	13.19	0.596	0.84	0.590	-0.16
Giza 87	0.587	0.632	7.66	0.889	51.44	0.920	56.72	0.645	9.88	0.633	6.98	0.628	7.83	0.658	12.09	0.567	-3.41
Giza 88	0.624	0.692	10.89	0.875	40.22	0.986	58.01	0.661	5.92	0.660	2.72	0.641	5.92	0.688	10.25	0.598	-4.16
Giza 89	0.535	0.594	11.02	0.866	43.86	0.927	73.27	0.620	15.88	0.651	2.01	0.643	21.68	0.712	33.08	0.520	-2.80
Giza 86	0.613	0.624	1.79	0.862	36.60	0.971	58.40	0.621	1.30	0.638	1.46	0.622	4.07	0.647	5.54	0.595	-2.93
MEAN	0.590	0.616	6.66	0.894	47.73	0.868	57.46	0.643	9.23	0.642	3.95	0.639	10.53	0.660	12.36	0.574	-2.07

L.S.D. at 0.05 % for varieties 0.0073
for treatments 0.0098

73.17% with NaOH 10 N are not generally achieved without intrafibillar swelling taking place, it would seem, therefor,that intrafibrillar swelling must cause extra internal surface to be exposed in the treated samples, and one simple mechanism where this can be achieved is by the spliting of the fibrils during the intrafibrillar swelling process. Accessibility values obtained at different concentractions and time of treatment by acids and alkalines, showed a different trends, it is found that NaOH and H_2SO_4 and HNO_3 produce different degrees of swelling or decrystalization, further, it may be stated that these data show inter – and intra fibrillar swelling in cotton indicating marked increase in cellulose accessibility. Generally, NaOH and H_2SO_4 treatments caused an increase in the accessibility % with all varieties and the percentage ranged from 4.72% to 73.17%, while HNO_3 treatment had different effects of increase and decrease in accessibility due to the fine structure of the varieties used in this study without specific trend. These results are in agreement with Somashekar *et al.* (1977) Warwiker and Clayton (1969).

Water retention%:

Consideratation of the retention of liquid water Table 6 and Fig. 6 veals similar patterns of events although there are anomalies. In general when only interfibrillar swelling has taken place only comparatively small increase in water retention is attained, except with a sample treated with H_2SO_4 10% for 15 second which become hard and horny after treated (65,43%). It is suspected that the high water retention shown by the sample treated by 10% H_2SO_4 may be partly caused by horny capillary retention of water between fibers in the the mass. Intrafibirillar swelling led to much greater capacity for the retention of water, but the samples treated with nitric acid 30% had a lower water retention than any sample examined(36.23%) comparing with (42.3%)for the control Giza 86 variety. These samples have suffered partial nitration during the swelling process and it is therefore probable that this is the cause of the drop in water retention despite the opening up of the structure by intrafibrillar swelling. However, no spcific trend could be observsd either in increasing or decreasing, the water retention with different varieties and various chemical treatments, it depend on the degree of pentration of swelling agents to the inter or intra fibrilles of celluluse units of the varieties.

Relation of cellulose accessibility with other properties:

The relationship between accessibility and tenacity at 1/8 inch gauge length (Fig 7) showed a negative correlation between the two properties b= 0.016, -0.063,

Table 5. Accessibility% of five Egyptian cotton varieties after treatment with alkaline and acid swelling agents at 25°C.

Varieties / Treat.	Cont.	NaOH IN	± %	NaOH 5N	± %	NaOH 10N	± %	H_2SO_4 10 % 15 Sec.	± %	H_2SO_4 10 % 30 min.	± %	H_2SO_4 25% 15 Sec.	± %	H_2SO_4 25 % 30 min.	± %	HNO_3 30 % 15 Sec.	± %
Giza 45	37.03	39.27	6.04	57.49	55.25	58.4	57.7	43.73	18.09	41.05	10.85	43.22	16.71	38.95	5.18	38.82	4.83
Giza 87	38.41	41.33	7.60	58.13	51.34	60.13	56.54	42.15	9.73	41.40	7.78	41.20	7.26	43.05	12.08	39.05	1.66
Giza 88	40.82	42.75	4.72	57.21	40.125	45.08	10.43	43.22	5.87	43.20	5.93	41.99	2.86	44.99	10.21	37.77	-7.47
Giza 89	35.00	38.84	10.97	53.16	51.88	60.61	73.17	40.55	15.85	42.55	21.57	42.05	20.14	46.59	33.11	34.6	-1.14
Giza 86	36.08	38.79	7.51	56.4	40.71	63.48	58.38	40.58	1.24	41.75	4.16	40.70	1.54	46.99	17.24	37.58	-6.23
MEAN	37.46	40.19	7.36	58.47	47.92	57.54	51.24	42.04	10.15	41.99	10.03	41.82	9.7	44.11	15.56	37.56	-2.33

L.S.D. at 0.05 % for varieties 0.234
for treatments 0.314

Table 6. Water retention % of five Egyptian cotton varieties after treatment with alkaline and acid swelling agents at 25°C.

Varieties / Treat.	Cont.	NaOH IN	± %	NaOH 5N	± %	NaOH 10N	± %	H_2SO_4 10 % 15 Sec.	± %	H_2SO_4 10 % 30 min.	± %	H_2SO_4 25% 15 Sec.	± %	H_2SO_4 25 % 30 min.	± %	HNO_3 30 % 15 Sec.	± %
Giza 45	42.5	40.3	-5.17	44.7	5.17	62.2	46.35	67.35	58.47	41.48	-2.4	35.18	-17.22	39.92	-6.07	39.94	-6.02
Giza 87	42.6	42.2	-0.02	49.7	17.6	65.5	53.75	65.79	54.43	41.93	-12.69	37.19	-12.69	40.73	-4.38	38.76	-9.01
Giza 88	43.2	40.4	-6.48	57.8	23.54	64.36	48.98	64.98	50.41	40.73	-5.71	36.07	-16.5	42.09	-002	38.60	-16.45
Giza 89	41.4	42.5	2.65	53.8	29.95	61.13	47.65	46.82	13.09	39.29	-5.09	37.34	-9.80	40.23	-2.82	37.89	-8.47
Giza 86	42.3	43.7	3.31	54.4	28.67	59.7	41.13	45.76	8.17	38.38	-9.03	37.5	-11.34	36.46	-13.80	36.23	-14.34
MEAN	42.4	41.82	-0.91	52.93	20.98	60.57	47.57	57.14	36.9	39.96	-6.98	36.65	-13.51	39.88	-5.41	38.28	-10.85

L.S.D. at 0.05 % for varieties 0.033
for treatments 0.044

-0.02, -0.063 for Giza 45, G.87, G.88 and G.89 varieties respectively, while Giza 86 variety had positive correlation b=+0.004.

This could be explained as the varieties are different in both their cellulose crystainity percentage and degree of polymerization, higher increase in accessability is associated with lower strengh and vice virsa.

The relationship between cellulose accessibility and elongation percent (Fig.8), illustrates that the two properties are highly and positively correlated (b =+0.278, +0.328, +0.408. 0.328 and + 0.260 for Giza 45, G.87, G.88, G.89 and Giza86 varieties respectively. It is worth to mention that, as the accessability % increased elongation % increased, it may therefore, be concluded that the reaction which causes fiber swelling affects tenacity or elongation or both.

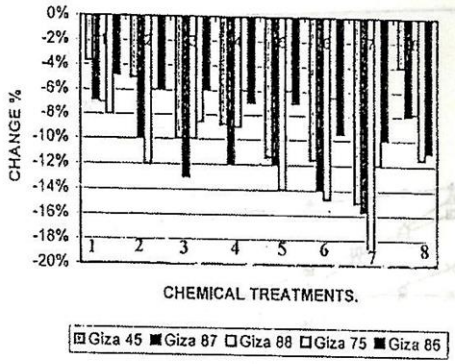

Fig. 1. Fiber tenacity at 1/8 IN.

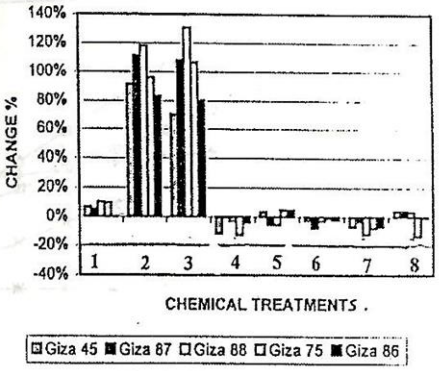

Fig. 2. Elongation %.

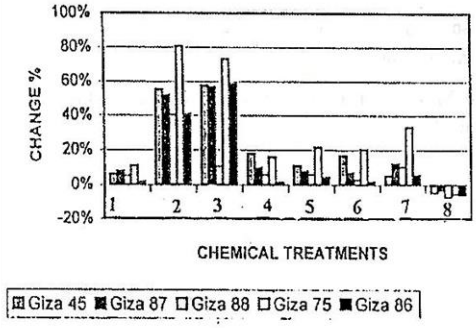

Fig. 3. Moisture regain %.

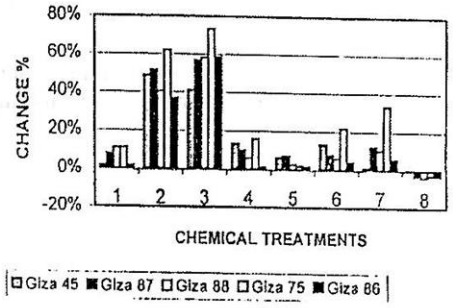

Fig. 4. Moisture sorption.

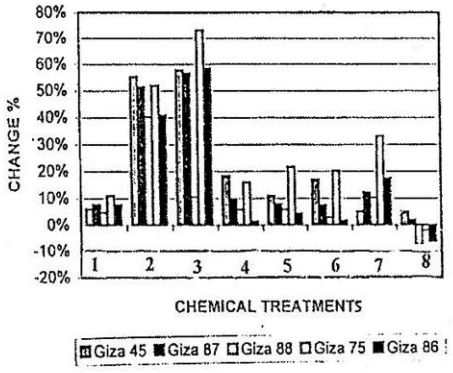

Fig. 5. Accessibility.

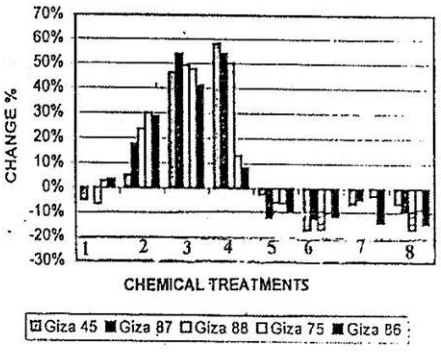

Fig. 6. Water retention %.

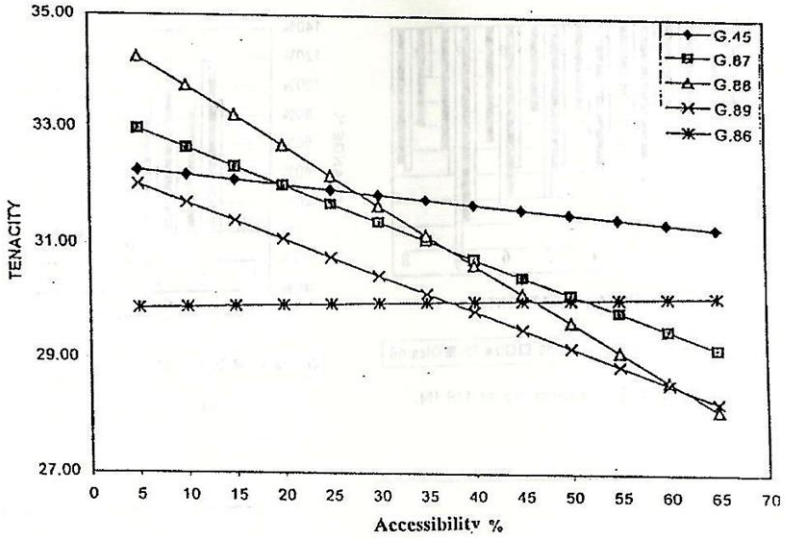

Fig. 7. Relationship between accessibility % and tenacity (9/tex) for five Egyptian cotton varieties after chemical treatments.

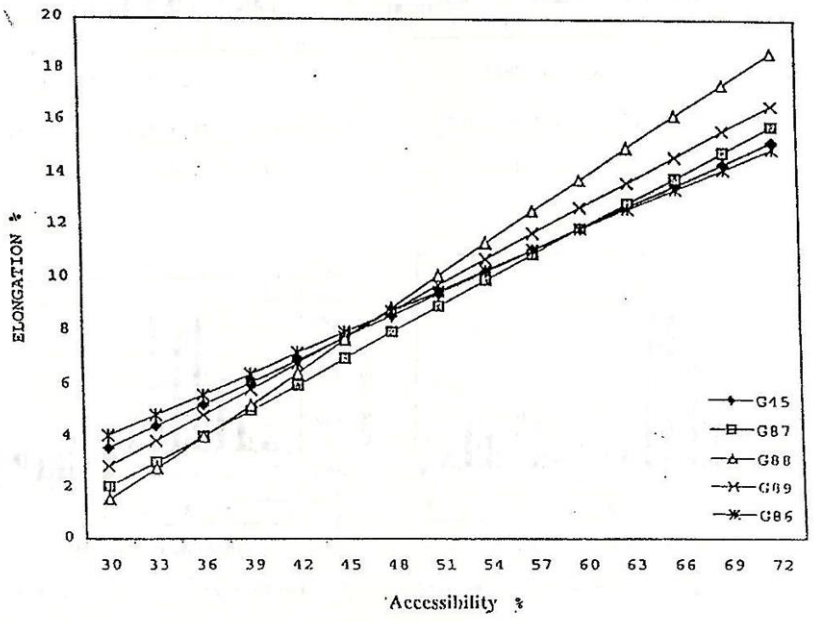

Fig. 8. Relationship between accessibility % and elongation for five Egyptian cotton varieties after chemical treatments.

REFERENCES

1. Ahmed, N.B. 1981. Studies on fiber structural weak points in Egyptian cotton and their potential strengthening by chemical treatment. Ph. D. Thesis, Fac. Agric, Ain. Shams. Univ.

2. American Soceity For Testing and Materials (ASTM). 1998. (D-1445-64) and (D-1445-67).

3. Duncan, D.B. 1955. Multiple range test and multiple F test Bio metrics. 11:1—42.

4. Egle, C.J. and J.N. Grant. 1970. Interrelations of structure and physical properties of untreated cotton. Text. Res. J., 40: 138-168.

5. Gibbons, G.C. 1953. The moisture regain of methyl cellulose and cellulose acetate, J.Text. Inst, 44: T201-208.

6. Hollen N. and J. saddler. 1964. Textiles. macmillan company, New York, Callier macmillan limited, London.

7. Meredith, W.R. Jr. 1991. Associations of maturity and perimeter with micronaire. Proceedings of the Beltwide cotton production research conferences, ed. J.M. Brown, memphis.TN: National Cotton Council, p.569.

8. Meredith, W.R., R.D.E. Sasser and S.T. Rayburn. 1996. Regional high quality fiber properties as measured by conventional and AFIS methods. Proceeding of the Beltwide cotton production research confernce, ed.P.Dugger and P.A. Richter, Memphis TN:National Cotton Council, pp 1681-1684.

9. Parikh, D.V. and J.H. Karami. 1989. Use of acid in bleaching cotton textiles. Am. Dyest. Rep., V.78n 8 Aug. 1989 p. 7.

10. Porter, B.R. and M.L. Rollins. 1972. Changes in porosity of treated lint cotton fibers I: Purification and swelling treatments,J.Appl. Polymer Sci., 16,217-336.

11. Rouselle M.A, M.L Nelson, C.B. Hesenboehler and D.E. Egendre. 1976. Liquid ammonia and caustic, mercerization of cotton fibers. I-Change in fine structure and mechanical properties .Text. Res.J.,304-310.

12. Safy-el-din, M.Nabil 1993. Water retention values of newer dried alkali treatment cellulose polymer. International V.32No.1, P 14-17.

13. Shishonok-N.V. E.V Gert, Fillan eluk T.I., and N. Koputskii F. 1987. Strucuctural modification of various forms of cellulose by nitric acid solutions. J. of Appl. Chem., USSR. v.60 no5 pt2 pp 1086-1090.

14. Valentine; I. 1954. Moisture regain and accessibilty of cellulose derivatives. Text Res.J.,124, 670-6721.

15. Venkatesh, G.M and N.E. Dwelt. 1975. A new method for determinining maturity of cotton fibers.Text.Res J., 45:230-235.

16. Wakeham H.and N.Spicer.1951. The strength and weakness of cotton fibers. Text.Res J., 21:187:194.

17. Warwicker J.O., R. Jeffries, R.L. Colpron and R.N. Robison. 1966. A review of the literature on the effect caustic soda and other swelling agents on the fine structure of cotton. Shirley Institute Pamphlet No.93, pp 247.

18. Warwicker. J.O. and J.W. Clayton. 1969. Reacitivity of cotton after treatment in alkaline and acid swelling agents J.Appl polymer Sci., 13; 1037-1048.

19. Warwicker, J.O. and Halan Patricia. 1970. Action of alkli metal by hydroxides on cotton . J. Appl. Poly.Sci.,16:113-12.8

20. Warwircker J.O. and Halan patricia. 1970. The effect of alkaline and acid swelling agent on the mechanical properties of cotton fibers. J. Text Inst., 61.61-67.

21. Zeronian, S.H. and K.E. cabradilla. 1972. Action of alkali metal by hydroxides on cotton. J. App. Poly. Sci.,16:113-128.

تقدير النشاط الكيميائي لألياف بعض أصناف القطن المصري بعد المعاملة بالقلويات والأحماض

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الهدف من البحث هو تقدير النشاط الكيمائي لتيلة خمسة من أصناف القطن المصري هي جيزة ٤٥ ، ٨٧، ٨٨، ٨٩، ٨٦ من رتبة ح/ فولي جودة قبل وبعد المعاملة بثلاثة محاليل كيمائية اساسية هي الصودا الكاوية بثلاثة تركيزات هي ١، ٥، ١٠، عياري لمدة ٣٠ دقيقة وحمض الكبريتيك بتركيزات ١٠٪ و ٢٠٪ لمدة ١٥ ثانية، ٣٠ ثانية دقيقة لكل تركيز وحمض النتريك بتركيز ٣٠٪ لمدة ٣٠ دقيقة ولقد وجد أن المتانة على مسافة ١/٨ بوصة، قد نقصت مع جميع المعاملات لكل الأصناف بينما زادت نسبة الاستطالة ٪ مع الصودا الكاوية فقط واتجاه الزيادة والنقص اختلف تبعا للأصناف.

واختلفت الأصناف في نسبة السليولوز المتاح وامتصاص الرطوبة والاحتفاظ بها (accessibility %, moisture regaine %, water retention %, moisture sorption %).

حيث تزيد أو تقل هذه الصفات طبقاً للمعاملة الكيمائية وذلك لاختلاف تأثير الكيماويات على الألياف سواء كانت النفاذية فيما بين اللبيفات Intrafibrillar أو بين اللبيفات Interfibrillar ولقد وجد ارتباط معنوي سالب بين المتانة والسليولوز المتاح وارتباط معنوي موجب بينها وبين الاستطالة ٪.