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A STUDY ON THE IMPROVEMENT OF DYIENG PROCESS USING SOME LEVELING AGENTS IN SOME EGYPTIAN COTTON CULTIVARS .

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ABSTRACT

One of the most important drawbacks for the international marketing is the lack of color homogeneity of some cotton fabrics. The main target of this work is to study the effect of change in color strength K/S and mechanical properties using different leveling agents before and after dyeing for cotton fiber (Giza 85,Giza 86,and Giza 70) to achieve the optimum way and economical cost of dyeing that gives the equivalent values of K/S for the different cotton cultivars or decrease the differences between the values of K/S for the dyed cotton cultivars .It was found that Giza 70 resulted a higher strength followed by Giza 86 and finally Giza 85 ,where as the elongation property is following the strength but in the negative way .While for the K/S value Giza 86 recorded the highest value and then Giza 85 and the last was Giza 70 .

INTRODUCTION

Cotton is commercially classified according to the staple length of fibers . Since various valuable fiber properties are directly related to length (Trotaman 1984& Nelsson (1990). Most of cotton cultivars are white in color; sometimes they are creamy or dark creamy. Many of Egyptian cotton varieties have a yellowish brown color due to the pigment in the fiber ,lightness increasing with increasing grade number while yellowness decreasing with increasing grade number(Hess 1979).

The chemical composition of the cotton fiber reflects its nature as a plant cell. Cellulose being the main constituent, and other constituents normally present in vegetable cells are ,also, present such (oil, wax, pectin, protein , sugar, ash , organic acids, minerals and natural coloring matter which all represent less than 5% of weight (Nojissal 1998)

Cotton is not harmed by alkali , solution where sodium hydroxide, for instance , used to mercerize cotton, making it stronger, smoother, and more lustrous (Gohl 1987 & Omar 2003). Scouring, also, is a very important process preceding chemical treatment of cotton. It removes non-cellulosic material from the surface of cotton fiber such as wax , pectin and other impurities naturally occurring in its growth (Jun Lu, *et.al* (1995).

One of the main constituents of a scouring bath is a surfactant that helps to keep the impurities in suspension and helps in removing oil and other hydrophobic substances by emulsifying them. However, as with all other textile fibers, the dye molecules can only enter the amorphous region of the polymer system of cotton . The small inter-polymer spaces in the crystalline regions of the polymer system prevent the entry of the relatively large and bulky dye molecules (Youghua & Handin 1998) . Theory of leveling ,denotes that there are essentially two modes of action by which they can function. For example, leveling agent contains chemical groups similar to those to which

the dye is attached to the fibers. This results in competition between the dye and leveling agent molecules adsorbed by the fibers. Alternatively, the leveling agent may be capable of forming a weak complex with the dye. As dyeing proceeds, the complex gradually breaks down, allowing the dye to be adsorbed slowly by the fibers. Whatever the mode of action is operating; the leveling agent is able to reduce the rate at which the dye is adsorbed. Dye can, therefore, be applied in a controlled manner (Kamakar 2001) .

There is a problem with soluble types of dyeing, related to the incompatibility between dye brightness and washing fastness where, chromophores with small molecule weight are necessary to give low washing fastness where it is only possible to establish few secondary bonds between the fiber and the dye molecule . The sub stativity depends on the concentration of the reactive dye , electrolyte in the solution, temperature, pH of the medium, which all determine the dye fixation on the cellulose fiber (Bradbury 1982) . The substantive can be increased by increasing the standard of dye affinity, electrolyte concentration in dye bath, increasing pH of the dye bath, and by decreasing dye concentration, temperature ,and liquor ratio (Heibeish 1990&Huang 1997).

MATERIALS AND METHODS

The present investigation was carried out using three Egyptian cotton cultivars i.e, named Giza 85, Giza 86, and Giza 70 having almost the same micronaire reading (3.9 ,4.2 ,4.0) respectively . They were spun in two English counts(30s", 40s") and the twist factor was 3.6 . The sample were taken from Misr / Sheben for Spinning & Weaving Company,Sheben Elkom – Egypt . (season 2004) .

*Pretreatments :- Scouring with nonioning surfactant (hospital 1%) , NaOH 3% , Triton X 100 3% , boiling for 90 min. dried at room temperature .

*Dyed with reactive dye three types of (remazol) :- reactive yellow 176 (3RS) reactive red 106(PGG) , reactive blue 133(BB) , dyeing with 3% of dye, 60g/l sodium sulphate ,15g/l soda ash and fixation at 60 mim., according to conventional exhaustion method Mahmoud *et al.*2001

*Leveling agents were added in dyeing process with different concentrations, i.e.

1- Knit leveler ML : 1%, 2%, 3%, 4%, 5% (O.W.F.)
2- Tanaleve K-DC : 0.5ml/L, 1ml/L, 1.5ml/L, 2ml/L, 2.5ml/L .
3- Sarabid LDR : 0.5ml/L, 1ml/L, 1.5ml/L, 2ml/L, 2.5ml/L .

*Measurements : color strength (K/S) was automatically calculated from reflectance (R.1.) using the kubelka Munk equation .

$$K/S = \frac{(I-R)2}{2R} - \frac{(I-Ro)2}{2Ro}$$

R = decimal fraction of the reflectance of dyed samples
Ro = decimal fraction of the reflectance of undyed samples .
K = absorption coefficient .
S = scattering coefficient .

* Single yarn tensile strength and elongation %: - tensile strength and elongation at break were determined according to A.S.T.M 1999 D-1442, 1446 .

RESULTS AND DUCUSSIONS

The mechanical properties of scoured dyed cotton varieties with the same yarn count:

The effects of chemical treatments of scouring and dyeing single yarn on mechanical properties of three cotton cultivars (G70, G86 and G85) dyed in the same dyeing bath using 3% Remazol dye named: C.I. reactive yellow (3RS)176, C.I. reactive red (PGG)106 and C.I. reactive blue(BB)133 and the same conditions were applied for yarn count 40s" .

From the previous tables (1-3) , it is seen that for both yarn counts (30s" & 40s") tensile strength of scouring and dyed yarns increased in aii the three cultivars and decreased in the elongation involved in the study ,regardless of the dye type applied ranged from (2.6%-5.7%)also with yarn count 40s" increased in tensile ranged from (5.8%-26.8%) while the elongation decrease ranged from (3.77%- 7.14%) & (3.84% -10.71%) . G 70 show a higher increase.

Table (1): The tensile strength (g/tex) and elongation % of dyed and gray of cotton cultivars (Dyed with Remazol yellow 3RS dye)

Yarn count	Scour.	Cotton cultivar	Tensile strength g/ tex			Elongation %		
			Gray	Dyed	+-%	Gray	Dyed	+-%
30/1	Non ionic	G 86	18.2	19.3	**+6.04**	5.2	5.0	-3.84
		G 85	18.7	20.3	**+8.5**	5.6	5.2	-7.14
		G 70	19.2	22.3	**+16.1**	5.3	5.0	-5.66
40/1	Non ionic	G 86	17.2	19.5	**+13.4**	5.2	5	-3.84
		G 85	17.4	18.2	**+4.6**	5.0	4.9	-2.00
		G 70	17.5	20.5	**+17.0**	5.0	4.5	-10.00

Table (2): The tensile strength (g/tex) and elongation % of dyed and gray of cotton cultivars (Dyed with Remazol Red PGG dye)

Yarn count	Scour	Cotton cultivar	Tensile strength g/ tex			Elongation %		
			Gray	Dyed	+-%	Gray	Dyed	+-%
30/1	Non ionic	G 86	18.2	19.1	**+4.9**	5.2	5.0	-3.84
		G 85	18.7	18.2	**+10.1**	5.6	5.3	-5.66
		G 70	19.2	22.3	**+16.1**	5.3	4.8	-9.43
40/1	Non ionic	G 86	17.2	18.8	**+9.3**	5.2	5	-3.84
		G 85	17.4	17.5	**+0.57**	5.0	4.8	-4.00
		G 70	17.5	20.2	**+15.4**	5.0	4.6	-8.00

Table (3): the tensile strength (g/tex) and elongation % of dyed and gray of cotton cultivars (Dyed with Remazol Blue BB133 dye)

Yarn count	Scour.	Cotton cultivar	Tensile strength g/ tex			Elongation %		
			Gray	Dyed	+-%	Gray	Dyed	+-%
30/1	Non ionic	G 86	18.2	19.2	**+5.4**	5.6	5.2	-7.14
		G 85	18.7	19.2	**+2.6**	5.2	5.0	-3.84
		G 70	19.2	20.3	**+5.7**	5.3	5.1	-3.77
40/1	Non ionic	G 86	17.2	18.2	**+5.8**	5.2	5	-3.84
		G 85	17.4	20.2	**+16.1**	5.6	5.0	-10.71
		G 70	17.5	22.2	**+26.8**	5.4	5.0	-7.14

The increase in the tensile strength may be related to that alkaline liquor assists the polymers to align themselves in a better way, leading to an increase in hydrogen bond formation. This explains the increase in tenacity achieved during mercerizing under tension and decrease the elongation (Kamakar, 2002) .

The effect of(Knit leveler ML) as leveling agent :

K/S measurement :

There are three types of leveling agents :Anionic agent – nonionic agent – cationic agent .There are essentially two modes of action by which they can function ,it may contain chemical groups similar to those by which the dye is attached to the fibers and make competition between the leveling agent and forming a weak complex with the dye . This complex gradually breaks down allowing the dye to be adsorbed slowly by the fibers which ever mode of action is operating and reduce the rate at which the dye is adsorbed .

The tables (4-6) show the use of leveling agent affects the color strength expressed as K/S values and how it makes the color strength close values among the different cultivars of cotton by controlling the dye adsorption into fibers, however, it was found that the 3% concentration was the best and economical uses that given a higher increase in K/S value in comparison with the control cultivars .

Table (4): Effect of using leveling agent (Knit leveler ML) dyeing with yellow dye on the colour strength (K/S).

Cultivars	Without leveling agent	Conc. Of leveling agent (knit leveler)					
		1 %	2%	3 %	- +%	4 %	5 %
G 85	4.45	4.64	4.69	5.03	+13.0	5.47	5.51
G 86	4.06	5.02	5.13	5.18	+27.5	5.33	5.84
G 70	3.90	4.21	4.34	4.96	+27.2	4.98	5.04

Table (5): Effect of using leveling agent (Knit leveler ML) dyeing with red dye on the colour strength (K/S)

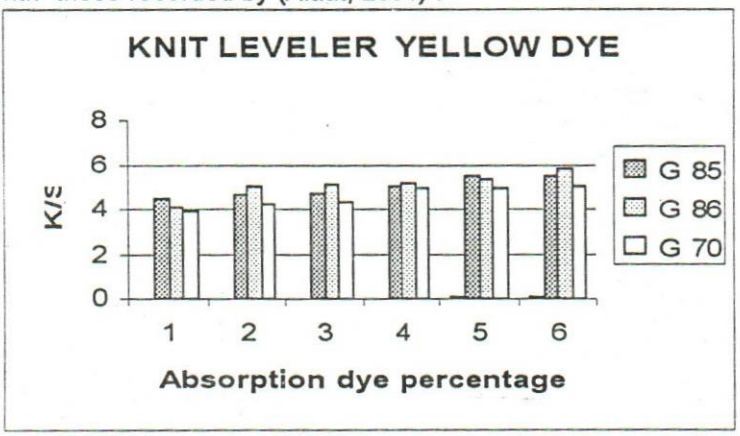
Cultivars	Without leveling agent	Conc. of leveling agent (knit leveler)					
		1 %	2%	3%	+ - %	4 %	5 %
G 85	3.41	3.28	3.42	3.43	+0.6	3.44	2.76
G 86	3.42	3.54	3.64	3.65	+6.7	3.47	2.97
G 70	3.38	3.4	3.56	3.62	+5.3	3.91	3.56

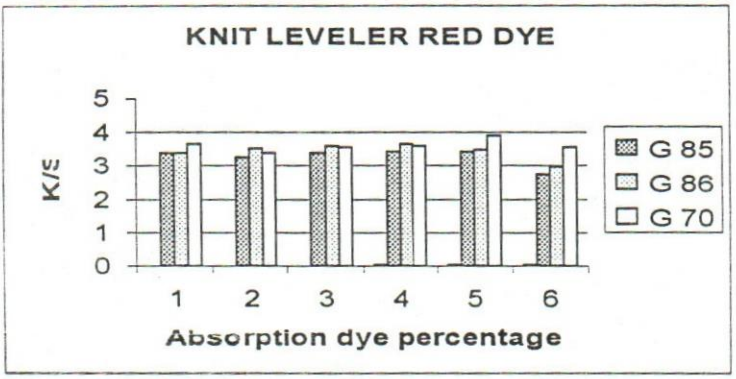
Table (6): Effect of using leveling agent (Knit leveler ML) dyeing with blue dye on the colour strength(K/S)

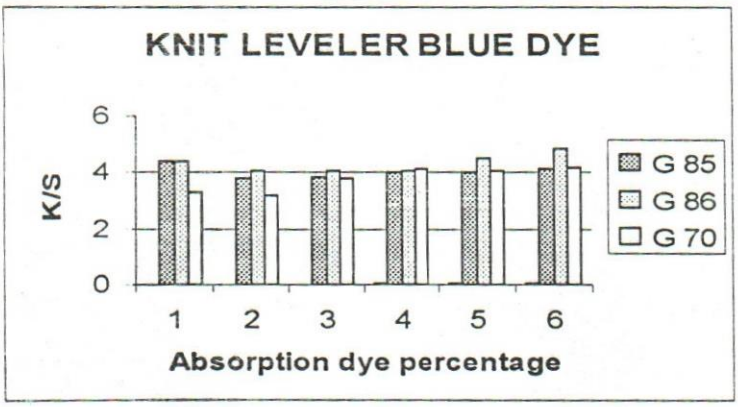
Cultivars	Without leveling agent	Conc. of leveling agent (knit leveler)					
		1 %	2 %	3%	+ - %	4 %	5 %
G 85	3.42	3.81	3.83	4.00	+18.1	4.02	4.11
G 86	3.41	4.08	4.09	4.10	+20.2	4.50	4.83
G 70	3.28	3.22	3.8	4.00	+24.6	4.06	4.21

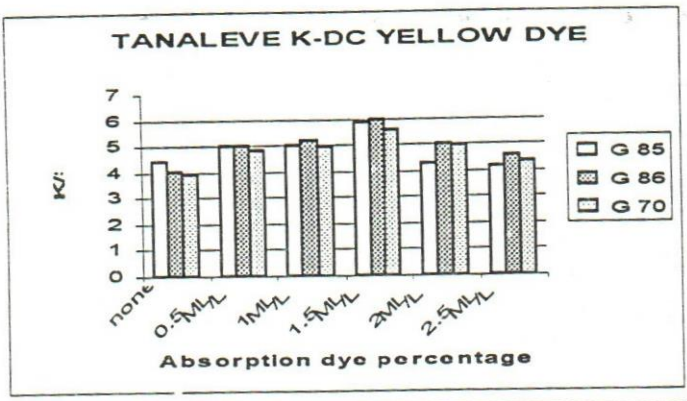
As shown from the three dyes used the dye uptake compare with without leveling agent it is less difference because of the micronaire that affect processing performance and the quality of the end product in several

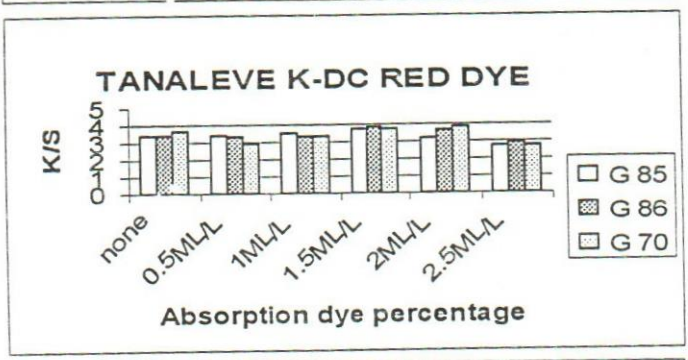
way of dye absorbency and retention varies with the maturity of the fibers ,the better absorption as shown in Giza 86 the greater followed by Giza 85 and finally Giza 70 . Cotton ,whether present as fiber or yarn or hosiery or woven fabrics, requires some form of pretreatment to make it suitable for drying and finishing . Use of leveling as pretreatment to impart uniform and good absorbency of dye without chemically damage of the cotton .These results agree with those recorded by (Alaat, 2001) .

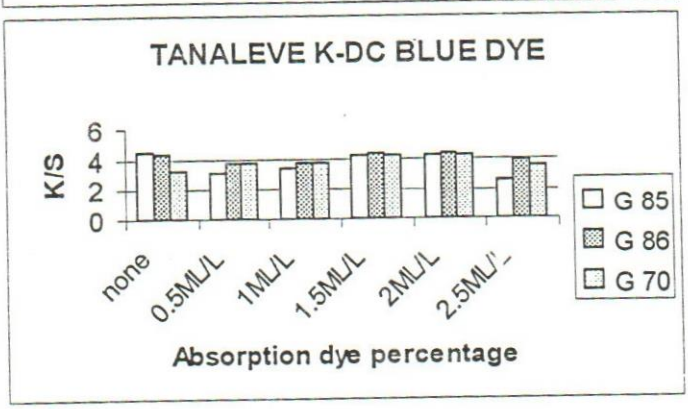












The effect of Tanaleve K-DC as leveling agent :-

K/S measurement :

The tables (7,8,9) show the effected of color strength expressed in K/S values and how it make the color strength close between every cultivar of cotton by controlling the dye adsorption into fibers .It is evident that the 1.5 ml/l of the leveling used is the best one that give higher increase in K/S values in comparison with the control i.e., untreated cotton .

The concentration of 1.5ml/l resulted in a higher increase in K/S value as compared with the control (without leveling) for the three dyes used .This is because the chemical structure of the Tanaleve leveling progress the

dyeability of yarn and the fiber. So the use of dyeing conditions that allow the progress of rapid reactions between the dye and the fiber may easily result in even dyeing .It was found that yellow and red dyes showed higher response for Giza 86 , while in the blue dye Giza 70 resulted in a higher value .

Table (7): Effect of using leveling agent (Tanaleve K-DC) dyeing with yellow dye on color strength

Cultivars	Without leveling agent	Conc. of leveling agent (Tanaleve K-DC)					
		0.5 mi/l	1 ml/l	1.5 ml/l	+ - %	2 ml/l	2.5 ml/l
G 85	4.45	4.98	5	5.89	+31. 2	4.27	4.13
G 86	4.06	5.00	5.16	5.97	+47. 0	5.03	4.55
G 70	3.90	4.82	4.94	5.60	+43. 5	4.93	4.33

Table (8): Effect of using leveling agent (Tanaleve K-DC) dyeing with red dye on the color strength

Cultivars	Without leveling agent	Conc. of leveling agent (Tanaleve K-DC)					
		0.5 mi/l	1 ml/l	1.5 ml/l	+ - %	2 ml/l	2.5 ml/l
G 85	3.42	3.4	3.47	**3.78**	**+10.5**	3.2	2.74
G 86	3.41	3.31	3.37	**3.87**	**+13.4**	3.66	2.89
G 70	3.38	2.93	3.37	**3.77**	**+11. 5**	3.81	3.74

Table (9): Effect of using leveling agent (Tanaleve K-DC) dyeing with blue dye on the colour strength

Cultivars	Without leveling agent	Conc. of leveling agent (Tanaleve K-DC)					
		0.5 mi/l	1ml/l	1.5 ml/l	+ - %	2 ml/l	2.5 ml/l
G 85	3.42	3.22	3.46	3.83	+11. 9	4.2	2.63
G 86	3.41	3.74	3.81	3.87	+13. 5	4.34	3.87
G 70	3.28	3.77	3.79	3.85	+17 .3	4.22	3.58

The effect of Sarabid –LDR as leveling agent :-

K/S measurements

Table (10,11,12) illustrate that Sarabid LDR increased the K/S value for all cultivars with Giza 70 resulted in the higher increase. This is because the chemical effect of Sarabid leveling with the cellulose content ,(Kamakar 2001) ,It was found that 1ml/l gave the higher K/S values with the red and blue dye ranged from (8.77%-28.20%) (28.15%-37.07%), respectively, while it ranged from (13.25%-28.20%)for the yellow dye .

Table (10): Effect of using leveling agent (Sarabid LDR) dyeing with yellow dye on the color strength

Cultivars	Without leveling agent	Conc. of leveling agent (Sarabid LDR)					
		0.5 mi/l	1 ml/l	1.5 ml/l	+ - %	2 ml/l	2.5 ml/l
G 85	4.45	4.83	4.86	5.04	+13.3	4.56	3.74
G 86	4.06	4.43	4.93	4.98	+22.6	3.73	3.51
G 70	3.90	4.58	4.79	5.00	+28.2	4.25	3.08

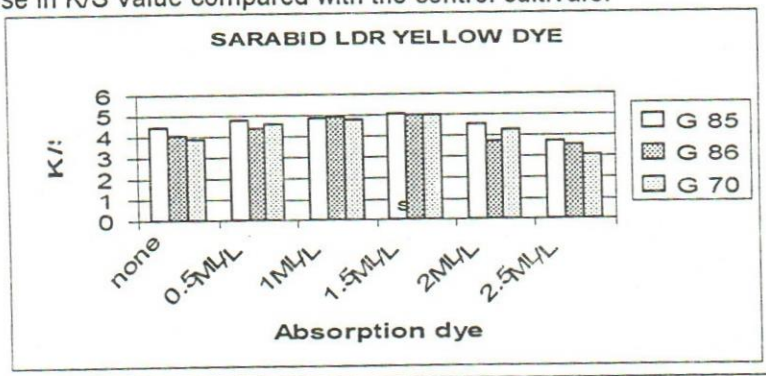
Table (11): Effect of using leveling agent (Sarabid LDR) dyeing with red dye on the color strength

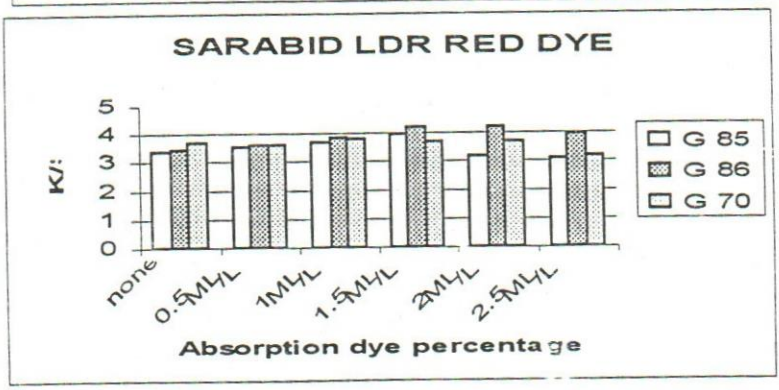
Cultivars	Without leveling agent	Conc. of leveling agent (Sarabid LDR)					
		0.5 ml/l	1 ml/l	+ - %	1.5 ml/l	2 ml/l	2.5 ml/l
G 85	3.42	3.56	3.72	+8.7	3.96	3.19	3.05
G 86	3.41	3.60	3.83	+12.3	4.20	3.98	3.96
G 70	3.38	3.59	3.80	+12.4	3.71	3.43	3.18

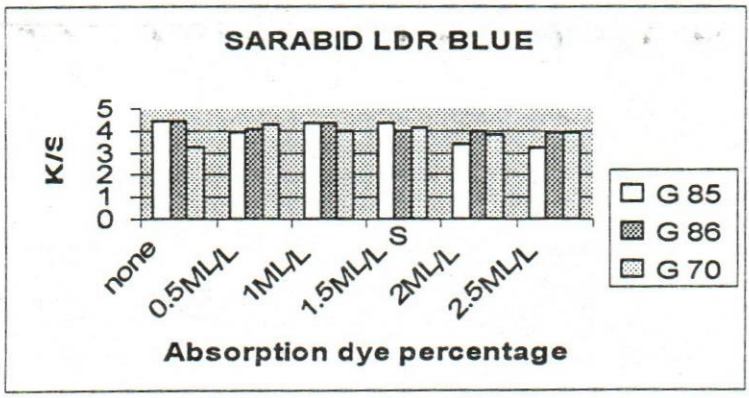
Table (12): Effect of using leveling agent (Sarabid LDR) dyeing with blue dye on the color strength

Cultivars	Without leveling agent	Conc. of leveling agent (Sarabid LDR)					
		0.5 mi/l	1 ml/l	+ - %	1.5 ml/l	2 ml/l	2.5 ml/l
G 85	3.42	3.90	4.32	+24.2	4.34	3.41	3.27
G 86	3.41	4.07	4.37	+28.2	4.00	4.00	3.91
G 70	3.28	4.29	4.40	+34.1	4.10	3.82	3.89

It was found that Giza 70 in yellow and red dye showed a higher response while in the blue dye Giza 86 resulted in a higher response . The tables (10,11,12) found the 1.5 ml/l of show the leveling in the yellow dye used is the best one that gave a higher increase in K/S value compared with the control cultivars ,while the 1ml/l in the red and blue dyes gave a higher increase in K/S value compared with the control cultivars.







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دراسة تحسين عملية الصباغة باستخدام مواد التجانس في بعض الأقطان المصرية

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تهدف هذه الدراسة إلى دراسة تحسين استجابة بعض أصناف القطن المصري لبعض الصباغات النشطة وذلك كمدخل إلي حل بعض المشاكل التي تحدث نتيجة خلط بعض الأقطان لأسباب اقتصادية في بعض مصانع الغزل والنسيج وقد تم استخدام ثلاثة أصناف من الأقطان المصرية وهى جيزة ٨٥ ،جيزة ٨٦، جيزة ٧٠ ، حيث إنها متقاربة في درجة النضج وعلى نمرتى غزل ٣٠ ،٤٠ وأجراء عملية الغلي باستخدام الصودا الكاوية وميرسرول ومادة غير انيونية ثم عملية الصباغة باستخدام الصبغة المباشرة ريمازول (ثلاث ألوان اصفر ،احمر ،ازرق) ثم استعمال المعالجة الكيميائية وهى استخدام المادة التجانس (المغلفة) لسطح خيوط الغزل بأسماء تجارية وهى Knit leveler ML ,Tanaleve K-DC, Sarabid LDR.: بتركيزات مختلفة ١% و٢%و٣%و٤%و٥% ثم قياس المتانة والاستطالة بعد عملية الغلي والصباغة وكذلك بعد استخدام المواد المغلفة ثم قياس قوة أو شدة امتصاص الصبغة.

وتشير أهم النتائج إلى ما يلي :

* زادت المتانة بعد عملية الغلي والصباغة حيث إن هذه العملية تعمل على إزالة كل المواد الغير سليلوزية وتقل الاستطالة .
* وجد ان نيت لفلر بتركيز ٣% سجل أعلى قوة امتصاص مع الثلاث صبغات المستخدمة .
* أما مع تناليف بتركيز ١,٥%مل/لتر سجل أعلى قوة امتصاص مع الثلاث صبغات المستخدمة .
* أما مع سرابيد بتركيز ١,٥مل/لتر سجل أعلى قوة امتصاص مع الصبغة الصفراء و ١مل/لتر مع الصبغتين الحمراء والزرقاء .

وقد تقاربت استجابة الأصناف للصباغة نتيجة لاستخدام هذه المواد لزيادة تجانس الصباغة بينها وتظهر هذه الدراسة أنة إمكانية التغلب على بعض المشاكل الناتجة في الصباغة نتيجة خلط بعض الأصناف المختلفة من القطن وباستخدام مواد التجانس الصباغة المذكورة في البحث ونوصى بدراسة وبحث هذا الموضوع لأصناف ورتب مختلفة من القطن المصري علميا وكذلك يمكن تلبية احتياجات السوق مع توفر خواص جودة المنتج .