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Achieving Functional Appropriateness and Comfort Properties of Treated Cellulosic Fabrics to Be Used in Designing Women's Outwear Clothes

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ABSTRACT

This research aims at achieving functional appropriateness and comfort properties of treated cellulosic fabrics to be used in designing women's outwear clothes so as to indicate to what extent it can be affected by using preparation material (enzyme) .The importance of this research can be seen in determining the most appropriate criteria for cellulosic Fabricsin view of the most suitable (weave construction– enzyme concentration–treatment time). Suitablefabrics for this purpose has been produced with multiple variations where specifications of warp yarn were stable in all fabrics produced under research as they are Linen 100% No. 30/2 and weft 100% cotton NO. 20/1 .Also three weave constructions have been used (plaid twill - traditional reticule - Atlas 8 with moving marks). Fabrics has been implemented according to selected specifications and variables after making the primary preparations on fabrics under research ., Also they have been treated by cellulase enzyme) in three concentrations (1 g / L - 2 g / L - 3 g / L) at time 30 minutes and 60 minutes and then some laboratory tests were made on fabrics produced .Then the results have been statisticallyanalyzed by using variance analysis for correlation coefficients and regression line equations in addition to the use of multi-pronged Radar Chart style) to express assessing the overall quality of fabrics produced under research .Researchconcluded that fabrics produced by plaid twill is the best for all different performance properties after treatment by enzyme at a concentration of 1 g / l ,at the time of 60 minutes and with ideal area 484.98 .And the least samples produced under research were weave construction Atlas 8 with moving marks after treatment by concentration 3 g / l ,at the time of 30 minutes and ideal area 460.59

KEY WORDS: cellulase enzyme**,** Linen, Blended fiber ,plaid twill , traditional reticule , Atlas 8 with moving marks

INTRODUCTION AND RESEARCH PROBLEM

Cotton fabrics with all different kinds and specifications still forefront the consumers' demands, but cotton lacks some qualities that may be found in other materials. So the specialists in the field of fabrics manufacturing and clothes had to give cotton fabrics some qualities that it lacks, either chemically or mechanically or both in order to fix gained capacity in fabrics so as not to be removed either by washing or consumption (1).

Therefore flax can beconsidered the only plant at the top in textile manufacture at the ancient Egyptians era. As both the appearance and touch of the cloth are the first attracting things , we should take all care of it and provide fabrics with materials that help in make it so (2).

Currently properties of fabricsreceive intensive care to researchers and practitioners in the field of developing and improving fabrics to meet the requirements of the end-use as well as to achieve the element of competition with global markets, especially in light of the GATT and the enormous accompanying challenges in front of Egyptian clothes products(3).

With increasing environmental awareness, consumers call for healthy and friendly environmental clothes in the sense that clothes industry should take into consideration the environmental dimension and maintain human health beginning of fiber industry and passing through weave and textile processes ,chemical treatments , ready clothes industry and end with safe disposal of them after use (4).

So after treatment of enzyme in fabrics, the product became eco-friendly. Thisaffirms the success and effectiveness of the enzymes in the treatment of fabrics resulting in improving the of the final product quality (5).

In our present time,fabrics is characterized by more characteristics and advantages better than its predecessor and this due to hard work of and researchers and who work in the field of development and improvement of the of produced fabrics properties in order to meet the requirements of the final use and to achieve elements of competition with global markets under enormous revolution textiles (6).

Ladies'clothes need special care due to the nature of women and what these clothes provide of properties for comfort that represented in the absorption of perspiration, air permeability, and the rest of the elements of quality, such as propertiesof easy care, endurance as well as aesthetic properties of the raw and appropriate of aesthetic appearance resulted from the softness offabrics' texture, warming conductivity and reducing the staticcharge, designing (7)

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The above has led to choose the research topic that entitled:

"Achieving functional appropriateness and comfort properties of treated cellulosic fabrics to be used in designing women's outwear clothes "

So,it aimsat reaching the most appropriate:

1. Effect of variation in weave construction on the functional appropriateness and comfort properties of suitable cellulosic fabrics in women's outwear clothes.
2. Concentration of preparationmaterial (enzyme) on the functional appropriateness and comfort properties of suitable cellulosic fabrics in women's outwearclothes.
3. Treatment time on the functional appropriateness and comfort properties of suitable cellulosic fabrics in women's outwear clothes.
4. Using Applied Statistics to findout different relationships in research variables.

Research Hypotheses:

1. There are statistically significant differences between appropriate functionalappropriateness ofweave constructions and comfort properties of suitable cellulosic fabrics in women's outwear clothes.
2. There are statistically significant differences between functionalappropriateness in concentration of preparationmaterial (enzyme) and comfort properties of suitable cellulosic fabrics in women's outwear clothes.
3. There are statistically significant differences between functionalappropriateness in treatment time and comfort properties of suitable cellulosic fabrics in women's outwear clothes.

Research Borders:

Blended linen fabrics were used (Linen / cotton).

Research Methodology

This research based on the analytical experimental method to achieve the research objectives.

PREVIOUS STUDIES

Linen:

Linen is considered oneof the natural cellulosic fibers. It is also the second important materials directly after cotton .Additionally;it is considered one of the most important lumen plants suitable for spinning. One of the most important features of linen is that it is free of prominentfibers i.e.it is smooth yarns that need special care in at all stages and this can be reflectedon its highprice (8)

Blended fiber:

A combination of more than one kind of fiber with different qualifications. It may include two types of natural fibers (mixture of cotton with linen) or mixing natural with industrial fibers (such as cotton with viscose) and this should be with the proportions that determined by specifications of required product, taking into account some economic aspects of and technical basis in Industry (9)

Some properties acquired from mixing:

- Friction and erosion resistance of Fabrics
- Easy Care of clothes
- Non Shrinking and maintain creases.
- Moths and rot resistance.
- The ability to absorb sweat well.
- Improving the performance of clothesby reducing dirty.
- Improving some properties and increasing consume age (10)

Cotton and linen mixture:

Propertiesof blended fabrics of cottonand linenaffected significantly in view of the percentage of each in the mixture. Ideal mixture is the mixing which gives high quality in the required properties for consumer in use. Because there is no type of textile fiberthat combines all the advantages together, the ideal mixture is excellent in certain properties. Sometimes the other properties may be limited but we can overlook these limitations in order to get the required properties in use .This mixture combines advantages of cotton and linen properties and reduce the disadvantages of each separately (8)

Ladies clothes:

Since clothes constitute the external appearance of the individual and express him andpresent him in private form, it affects the formation of an individual's personality and influence all those who watch or wear.

In addition to the important role that the individuals'clothes may play inhis appearancethat he can change according to his wishes through diversity in his clothes, clothes had a very particular importance for individuals alike as to groups. Otherwise the individual in choosing his clothes may be influenced by the group levels to which he belongs as well as the whole society (11).

Influencing Factors that effect on the selection of women for her clothes:

1 - Sex. 2 – Age 3 –Worknature.
4 - Income. 5 - Social status. 6 - Occasion.
7 - Law, customs and traditions. 8 - Climate. 9 - Culture.
10 - The psychological factor. 11 –Character factor (12).

The needs for clothing for both women and girls as well vary according to the prevailing social life. Ifthe girl isnot sure of her actualneeds or personal sizes, she can achieve this through observation and study to become able to acquire good taste and not mistake in choosing clothes, and it will be easy for her to follow the proper clothing behavior for all occasions (11)

The clothes can be classified as follows:

1 - The nature of use: to:
A –Clothes worn inthe differentfields of work. B-Clothes worn inpracticing sport activities.
C - Clothes worn when receiving guests. D - Clothes worn inspecial occasions (13).

Practical experiments

Samples of research have been produced from blended linen fabrics (Linen / cotton) by installing the type and number of warp yarns(Linen 100% No 30/2 indirect numbering spun by wet spinning style), while weft was 100% cotton 20/1 English numbering Giza 85 carded spun with ring spinning style with number of picks 21 picks / cm, and the variable factors in the weave construction (engraved twill - Atlas 8 with moving marks - traditional reticule)

Then the fabrics produced under research treated by the primary treatments (desizing - boiling in alkali – bleaching) after that fabrics treated by using cellulase enzyme in three different concentrations (1 g / L - 2 g / L - 3 g / L) at two different times two 30 minutes and 60 minutes.

A series of laboratory tests have been tried on researchsamples inorder to find the different relationships among research variables by using Applied Statistics.

These tests included the following:

1 - Tensile strength in the warp and weft direction (kg).
2 -Square meter Weight (g)
3 - Wrinkling angle in the warp and weft direction (º).
4 - Water absorption (by second).

RESULTS AND DISCUSSION

The impact of Study factors on the functional properties of the fabrics produced under research.

Analysis of variance (ANOVA) has been made to study theimpact of Study factors (different factors study, (weave construction – treatment time -enzyme concentration)on Tensile strength in the warp and weft direction , Square meter Weight , Wrinkling angle in the warp and weft direction , Water absorption and extension portion of the fabrics produced under research.

The effect whethersignificant or in significant to the value of calculated significance (P-Level) If its valueis less than (0.01), there will be a significant influence on the studied property. But if it its valueis more than (0.01), there will be an insignificant influence on the studied property.

❖ **Multiple regression linear line equation in the general can be as follows**:

Y = a + a1x1 + a2x2 + a3x3 +

- Where:

Y = express property. **X1** = express the enzyme concentration.
X2 = express time. **X1** = express the enzyme concentration.
X3 = express Weave Construction. **A** = express equation Basics.

<u>First: Test of significance of impact of study factorson Square meter Weight (g):</u>

Table (1): Analysis of unilateral variance in N direction" N - Way ANOVA "of the impact of study factors on the Square meter Weight

Variance source	Squares total	Liberty degree	Squares mean	"f" value	Significance level
Enzyme concentration	0.044	2	0.022	16.29	0.00
time	0.179	2	0.090	65.71	0.00
Weave construction	0.007	2	0.003	2.41	0.115

Table (1) shows that:

All the factors of the study (source of variation) have a significant effect or a statistical significance on the degree of square meter weight, except weave construction that has an insignificant effect on the property of square meter weight in Fabrics produced under research.

The equation of the regression line for the relationship between the study factors and property of square meter weight as:

$Y = 2.62 - 0.04\ x_1 - 0.09\ x_2 - 0.01\ x_3$

R= 0.86

It represents a covariant correlation betweensquare meter weight and study various factors.

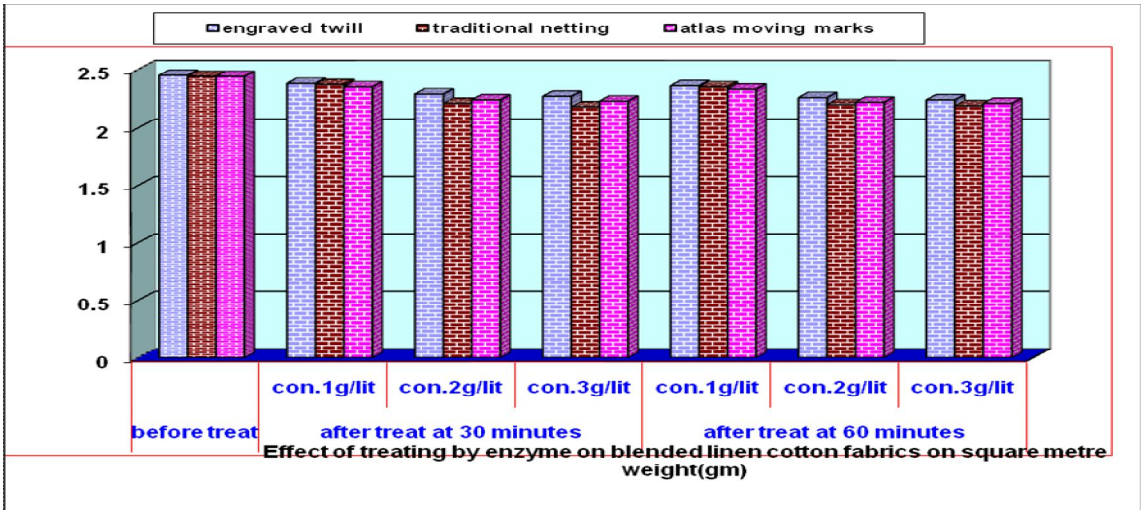


Figure (1) the impact of various factorsof study on the square meter weight

Figure (1) shows that:

There is a reversal relationship between increase of enzymeconcentration and thesquare meter weight as the increasingin the concentration of the enzyme lead to decrease in the square meter weight, because the enzyme leads to cellulose corrosion and thus the square meter weight less weight will decrease.

Second: Test of significance of impact of study factors on wrinkling angle at the warp direction (˚)

Table (2): Analysis of unilateral variance in N direction" N - Way ANOVA "of the impact of study factors on the wrinkling angle at the warp direction.

Variance source	Squares total	Liberty degree	Squares mean	"f" value	Significance level
Enzyme concentration	71.40	2	35.70	11.42	0.00
time	6081.18	2	3040.59	972.70	0.00
Weave construction	200.29	2	100.14	32.03	0.00

Table (2) shows that:

All the factors of the study (source of variation) have a significant effect on the propertyof wrinkling angle at the warp direction.

The equation of the regression line for the relationship between the study factors and property of wrinkling angle at the warp direction as follows:

$Y = 54.07 + 1.66\ x1 + 16.44\ x2 + 1.77\ x3$ **R = 0.98**

It represents a covariant correlation between propertiesof wrinkling angle in the direction of warp and study various factors.

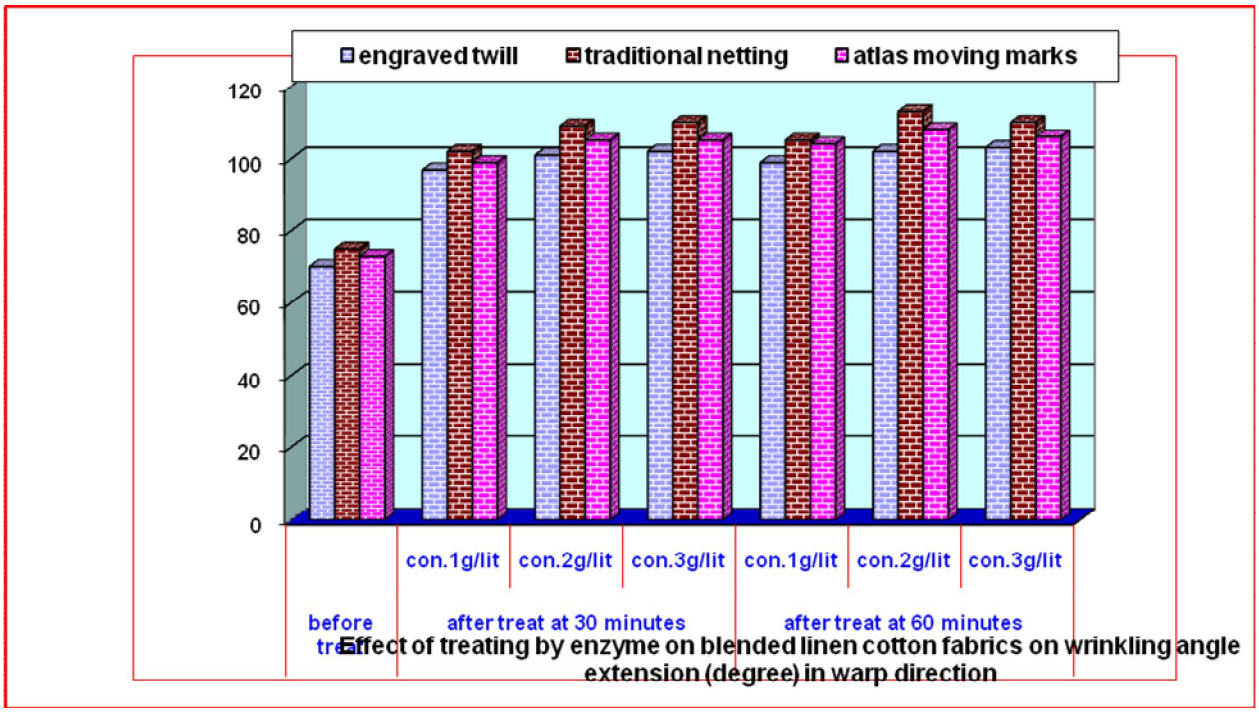


Figure (2) the effect ofstudy various factorson property of wrinkling angle in the direction of warp.

Figure (2) shows that:

There is a covariant relationship between the treatment time and the concentration of enzyme and fabrics produced under Search resistant to wrinkling and creaseas when the concentration of the enzyme increases the resistant of fabrics produced under research against wrinkling and crease will increase as well.

Third: test of the significant impact of the study factors on the property ofwrinkling angle in the direction of weft(°).

Table (3): Analysis of variance in N direction N - Way ANOVA "" to study the impact of factors on the property angle wrinkling in the weft direction.

Variance source	Squares total	Liberty degree	Squares mean	"f" value	Significance level
Enzyme concentration	42.29	2	21.14	13.85	0.00
time	4253.40	2	2126.70	1393.71	0.00
Weave construction	183.63	2	91.81	60.17	0.00

Table (3) shows that:

All study factors (**Variance source**) have astatistical significantimpact on the significant property of wrinkling angle in the **direction of weft.**

The equation of the regression line for the relationship between the study factors and property of wrinkling angle at the weft direction as follows:

$$Y= 68.18 + 1.44\ x_1 + 13.55\ x_2 + 1.94\ x_3 \qquad R= 0.99$$

It represents a covariant correlation between propertyof wrinkling angle in the direction of weft and study various factors.

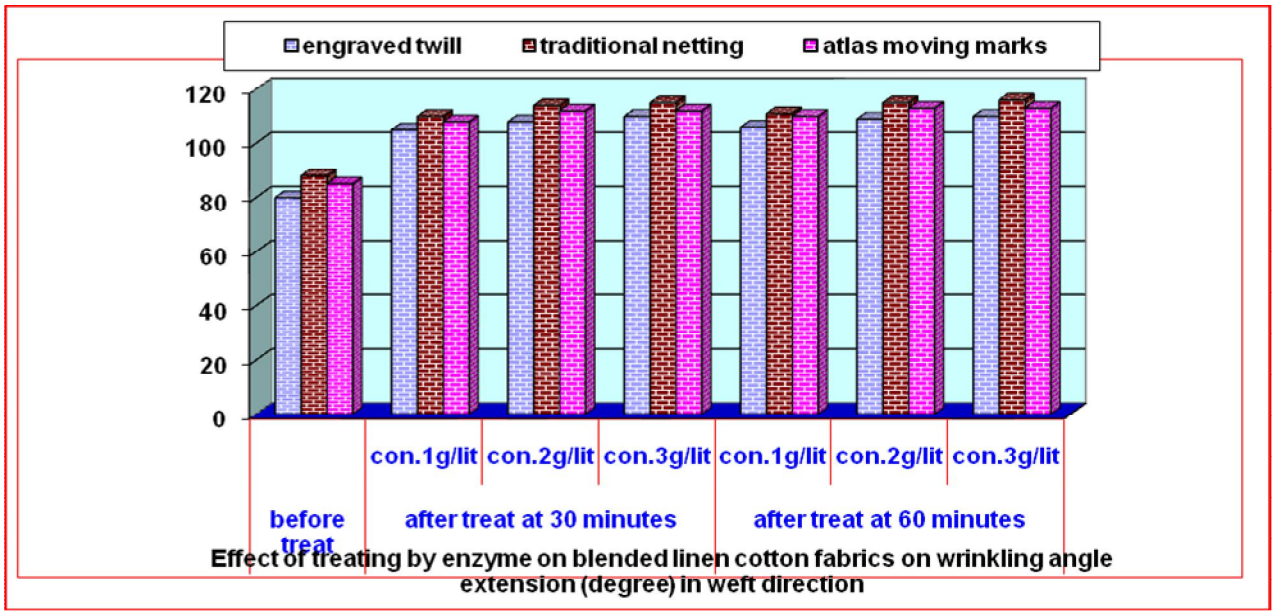


Figure (3) the effect ofstudy various factorson property of wrinkling angle in the direction of weft.

Figure (3) shows that:

There is a covariant relationship between the treatment time and the resistance of fabrics produced under research to wrinkling and crease as when the concentration of the enzyme increases the resistance of fabrics produced under research against wrinkling and crease will increase as well.

Fourth: test of the significant impact of the study factors on the tensile strength in the direction of warp(kg)

Table (4)Analysis of variance in N direction N - Way ANOVA "" to study the impact of factors on the tensile strength in the direction of warp

Variance source	Squares total	Liberty degree	Squares mean	"f" value	Significance level
Enzyme concentration	18.66	2	9.33	15.27	0.00
time	196.22	2	98.11	160.54	0.00
Weave construction	141.55	2	70.77	115.81	0.00

Table (4) shows that:

All study factors (Variance source) have astatistical significant impact on the tensilestrength in the direction of warp.

The equation of the regression line for the relationship between the study factors and property of the tensile **strength in the direction of warp as follows:**

Y= 54.88 - x1 – 3.05 x2 – 1.94 x3 **R= 0.96**

It represents a covariant correlation between the tensilestrength in the direction of warp and studies various factors.

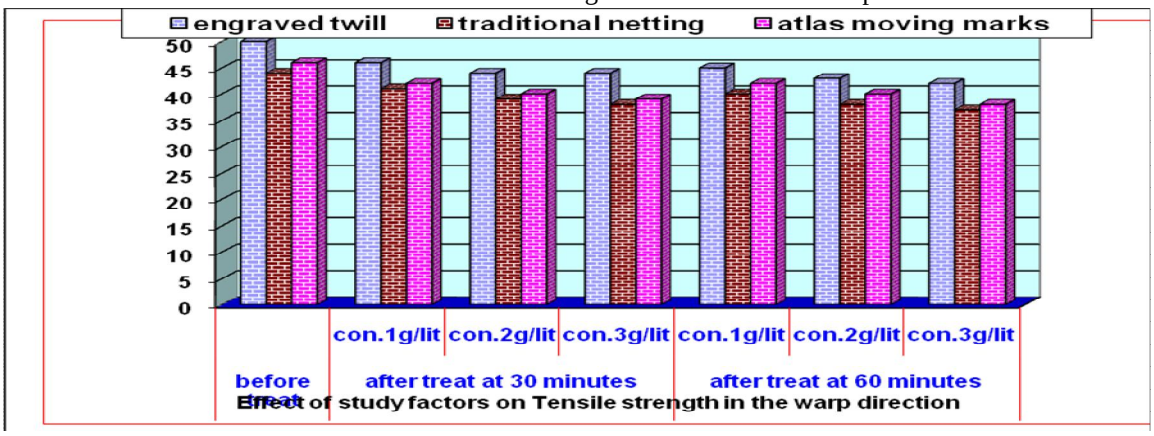


Figure (4)Effect of study factors on Tensile strength in the warp direction

Figure (4) shows that:

There is a reversal relationship between the concentration of the enzyme and the tensilestrength as when the concentration of the enzyme increases, the tensile strength decreases because the enzyme makes corrosion in the cellulose. Also there is a reversal relationship between the treatment time and the tensilestrength.

Fifth: test of the significant impact of the study factors on the tensile strength in the direction of weft (kg)

Table (5)Analysis of variance in N direction N - Way ANOVA "" to study the impact of factors on the tensile strength in the direction of weft .

Variance source	Squares total	Liberty degree	Squares mean	"f" value	Significance level
Enzyme concentration	12.07	2	6.03	7.95	0.00
time	167.18	2	83.59	110.09	0.00
Weave construction	154.29	2	77.14	101.61	0.00

Table (5) shows that:

All study factors (Variance source) have astatistical significant impact on the tensile strength in the direction of weft.

The equation of the regression line for the relationship between the study factors and property of the tensile strength in the direction of weft as follows:

Y= 50.85 -0.77 x_1 – 2.83 x_2 – 2.05 x_3

R= 0.94

It represents a covariant correlation between the tensilestrength in the direction of weft and study various factors.

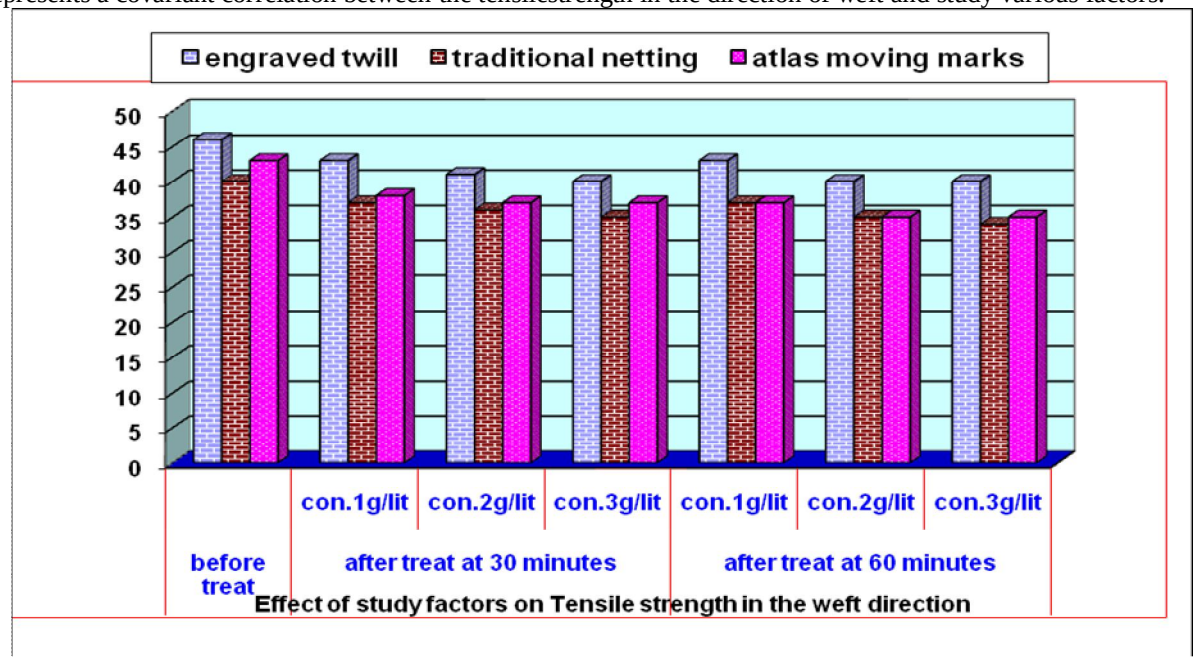


Figure (5)Effect of study factors on Tensile strength in the weft direction

Figure (5) shows that:

There is a reversal relationship between the concentration of the enzyme and the tensilestrength of weft direction as when the concentration of the enzyme increases, the tensilestrength at weft direction decreases because theenzyme makes corrosion in the cellulose. Also there is a reversal relationship between the treatment time and the tensile strength at weft direction.

Sixth:test of the significant impact of the study factors on the strength of water absorption time (by seconds)

Table (6)Analysis of variance in N direction N - Way ANOVA "" to study the impact of study factors on strength of water absorption time.

Variance source	Squares total	Liberty degree	Squares mean	"f" value	Significance level
Enzyme concentration	1.273	2	.636	.300	0.00
time	171.620	2	85.810	40.429	0.00
Weave construction	19.974	2	9.987	4.705	0.00

Table (6) shows that:

All study factors (Variance source) have astatistical significant impact on the tensile strength of water absorption except time treatment it has a significant effect on the strength of water absorption time of fabrics produced under research.

The equation of the regression line for the relationship between the study factors and property of water absorption time as follows:

$$Y= 13.15 - 0.26x_1 - 2.76x_2 - 0.66\ x_3$$

$$R^2 = 0.67$$

It represents a covariant correlation between the **water absorption time**and study various factors.

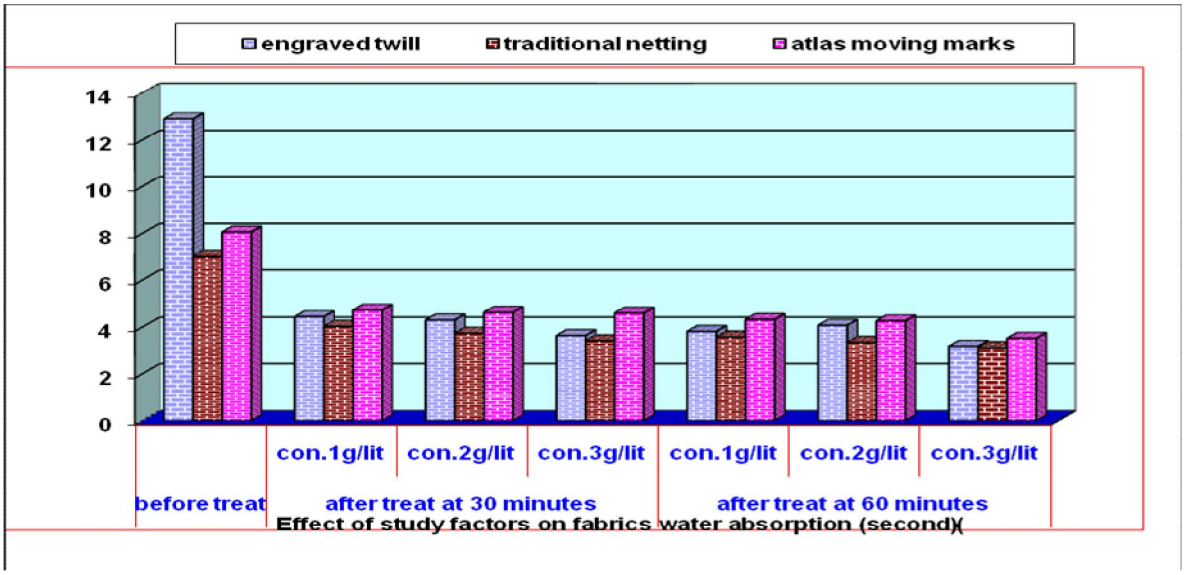
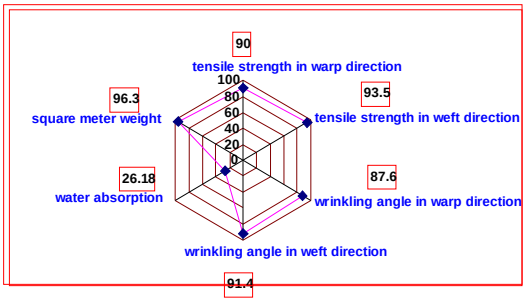


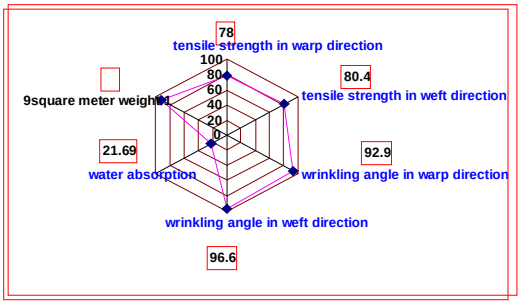
Figure (6) the impact of factors study on the water absorption property

Figure (6) shows the following:

There is a covariant relationship between the enzymeconcentration, time treatment and water absorptiontime of fabrics produced under research as when the concentration of the enzyme increases the availability of fabrics produced under research to absorb water increases as well and this leads to feel comfortable while wearing these clothes.



(7) Best samples produced under research after treating by enzyme



(8) Least samples produced under research after treating by enzyme

Table (7) Evaluating the overall quality of fabrics produced under research to the measured properties by using the study various factors:

treatment time	enzyme concentration	weave structure	Tensile strength		Wrinkling angel		Water absorb(second)	Square meter weight	Overall quality coefficient	Rank
			warp	weft	warp	weft				
Without treat		Engraved twill	100	100	61.9	69.0	7.75	100	438.65	19
		Traditional netting	88.0	87.0	66.4	75.9	14.22	99.6	431.12	21
		Atlas 8	92.0	93.5	64.6	73.3	12.41	99.6	435.41	20
At 30 minutes time	1gm/ 1 liter	Engraved twill	92.0	93.5	85.8	90.5	22.47	97.1	481.37	2
		Traditional netting	82.0	80.4	90.3	94.8	24.75	96.7	468.95	10
		Atlas 8	84.0	82.6	87.6	93.1	21.10	95.9	464.3	14
	2gm/ 1 liter	Engraved twill	88.0	89.1	89.4	93.1	23.20	93.5	476.3	5
		Traditional netting	78.0	78.3	96.5	98.3	26.74	90.2	468.04	11
		Atlas 8	80.0	80.4	92.9	96.6	21.55	91.4	462.85	16
	3gm/ 1 liter	Engraved twill	88.0	87.0	90.3	94.8	27.47	92.7	480.27	3
		Traditional netting	76.0	76.1	97.3	99.1	29.24	89.0	466.74	12
		Atlas 8	78.0	80.4	92.9	96.6	21.69	91.0	460.59	18
At 60 minutes time	1gm/ 1 liter	Engraved twill	90.0	93.5	87.6	91.4	26.18	96.3	484.98	1
		Traditional netting	80.0	80.4	92.9	95.7	27.93	95.9	472.83	7
		Atlas 8	84.0	80.4	92.0	94.8	23.09	95.1	469.39	9
	2gm/ 1 liter	Engraved twill	86.0	87.0	90.3	94.0	24.51	92.2	474.01	6
		Traditional netting	76.0	76.1	100	99.1	29.85	89.8	470.85	8
		Atlas 8	80.0	76.1	95.6	97.4	23.42	90.6	463.12	15
	3gm/ 1 liter	Engraved twill	84.0	87.0	91.2	94.8	31.45	91.4	479.85	4
		Traditional netting	74.0	73.9	97.3	100	32.05	89.4	466.65	13
		Atlas 8	76.0	76.1	93.8	97.4	29.24	90.2	462.74	17

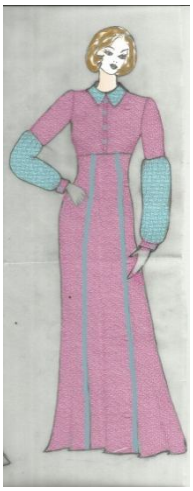
Table (7) and figures (7-8) shows the following:

Fabrics produced from engraved twill weave construction is the best in view of all the various performance properties after treating by enzyme at 1gm/ liter concentration and at time of 60 minutes and with ideal distance 484.98 . The least samples produced under research is Atlas 8 with moving marks weave construction after treating by enzyme at 3gm/ liter concentration at time 30 minutes and with ideal distance 460.59.

(10) Models have been designed that is valid to women's outwear clothes (gown) and these models have been arbitrated by professors in the field. In addition the best four designs and implemented from the produced fabrics under research as the following figure shows:

Model (4)
Gown implemented from engraved twill (moov) and traditional reticule (yellow).

Model (3)
Gown implemented from engraved twill in the two colors.



Model (2)
Gown implemented from atlas 8 with moving marks (fuchsia) and traditional reticule (Ttrickois)

Model (1)
Gown implemented from engraved twill (green) and traditional (reticule (yellow)

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