Innovative Coverlets production method utilizing four layered production technique on conventional jacquard nets

Mostafa E. AL-EBIARY
Department of textile, spinning and knitting, Faculty of Applied Arts

Abstract

The Spinning, weaving and knitting industry is considered one of the most important industries in A.R.E and despite that there are a lot of obstacles holding it back In the recent years, Egypt is still an undivided part of the international community, and textile Industry in standing on a rocky ground against the foreign competition with its high quality products whether in material or design. Home fabrics are one the important types of fabrics because it has to be manufactured elaborately to achieve high quality both in design and performance.

Home Textiles are different in nature than all other fabric types due to several factors; one of which is the nature of the used material and its influence on the final employment of the product. Coverlet fabrics are considered as essential part in home textiles, it's not only used as a beautiful bed spread sheetsor a decorative part of bed rooms but it's also used as a light soft cover in summer. Despite the fact that it's very popular, its design prospect behind it lack the variability in weft and warp repetition which is believed to be the main reason behind its typical unattractive demeanor.In addition to that, manufacturing coverlets require special specification and equipped looms with specific Jacquards net which make it impossible to develop any other fabric on the same machines.

To sum up, the paper aims at establishing a whole new prospect for manufacturing a coverlets fabrics which can be achieved with different method that is new and modern, away from conventional designs that the market is soaked in, one of which the single piece design. The new method allow the application of the four fold cloth weaves style which opens a whole new field for design innovation and development for material and manufacturing style.

In summary, the paper targets at two important techniques in the fabrication of coverlets.The first one is the application of normal (conventional) Jacquard net looms (single colored warp) to manufacture coverlets , which is considered , if achieved , a major evolution in coverlet industry because the same machines used in producing coverlets can be used to produce other fabrics without the need to change the jacquard net. The second one is the use of the four layered production techniquewhich allows multiple colored wefts within the same product, and facilitates the discard of the remainder of the spun in the weft. Utilizing these two techniques in manufacturing the coverlets is considered a major economical advantage.

In this article, several coverlet samples have been produced using a Polyester warp No.1/150 and two different weft materials, one is cotton No. 1/10 and the other is acrylic No. 2/28 which is equivalent to 8.25 in English numbering, with the application of the percentages shown in Table 1.

The proposed product has been tested to achieve the best result whereas the paper is not only bound by the aesthetic value but also with its integration with the standard specification of the final product. There are specific tests to ascertain the appearance and value of the product during usage, those are: 1. weight, 2. thickness and 3. Tensile strength and elongation.

The artistic proposed design is shown in Fig. 1. Also, the weaving structures used for realizing each weft color is shown in Fig. 2. The five fabricated samples are shown in Figs. 3 to 12.

The proposed five samples are prepared before testing with a specific apparatus according to the American Specs ASTM, 53776.64 El 1975.

The first and second experimental tests are the fabric weight and thickness determination. Here, the five samples weights are measured utilizing electronic sensitive balance with sensitivity of 0.001 gram. Also, thickness is measured according to the American Specs ASTM D 1777 using the Digital Thickness Gauge for Textile Structure.

The results of the fabric weight and thickness for the five samples are shown in Table 2. It is clear that the thickness is varying from 1.6 mm to 2.1 mm. Also, the square meter weight varies from 591 gr/m2 to 639 gr/m2. These weights results are better and greater than that can be obtained with the standard coverlet fabrication process.

Figures 13 and 14 shows the effect of the different percentages of the cotton and acrylic on the square meter weight and thickness. As shown from these figures, as the cotton percentage increases, the weight decreases. The correlation factor is equal to 0.9969 which means that one can control the coverlet weight and price according to the acrylic percentage with preserving the other coverlet properties.

The third experimental test is the tensile strength and elongation test. It is well known that the tensile strength and elongationaffects the proposed age and the aesthetic appearance of the coverlet. This test is applied according to the Egyptian standered Specification No. 1506 – 1981.

The tensile strength and elongation test results are shown in Table 3. The effect of cotton and acrylic weft yarns blending ratio on the warp tensile strength and on the weft tensile

strength are shown in Figures 15 and 16 respectively. It is clear that the warp and the weft tensile strengths are increased as the cotton blending ration increases.

Figures 17 and 18 show the effect of cotton and acrylic weft yarns blending ratio on the warp and weft elongations respectively. It is proved that the warp and weft elongations increase as the cotton blending ration increases.

According to the results that has been achieved by tests and based on the cover factor calculated and finally the statistical analysis presented in this work, the advantages of the research can be concluded as in the next section.

Results and discussions:

To verify the proposed manufacturing technique, five coverlet samples are fabricated and tested.

The proposed manufacturing technique advantages can be concluded as follows:

1. The proposed product (research subject) can be manufactured by normal Jacquard net machinery with single colored warp, row type is most recommended because it does not affect the weft color. That is considered an evolution in coverlet manufacturing compared to the conventional design method which needs specific machinery made only for this purpose.
2. The whole width of net Combed repeti**tion** has been used to achieve the ornamental geometrical design.
3. Using the 1/1 combination in the four fold manufacturing style added to the endurance of the fabric in comparison with other coverlet production including the double faced one that has a major problem that wrinkles appearing because of the contrast in the weaving combination used in the two sides of the fabric .
4. The use of four layered production technique extends the durability of the product; corrosion in one of the layers is replaced by the under lying one with same color effect in all layers.
5. Increasing the tensile strength rate in the proposed product more than any other coverlet fabric that is produced using the conventional methods. This is due to the utilization of four fold fabric weave, density, and combination. All these factors produce a highly tensile strength bed spread which is lab tested and proven.
6. The four fold fabric weave allows diversity in color in each of the fabric sides.
7. The remainder of the spun can be inserted in the interior of layers of the fabric what is considered to be an economical advantage because spun residue, resulted due to

weaving in the factors, could accumulate to tons a year making its disposal a worrisome operation.

8. Exploiting four layered production technique in implementation of the applied product allows three aerial gaps in between the four folders which is considered as an extra advantage compared with the conventional coverlets, giving the proposed coverlet extra warming quality.
9. The geometrical design applied is considered revolutionary bed spread design, which differs from the current conventional designs in the market based on one piece design (border and field).
10. The proposed product can be used in summer or in autumn due to its light weight yet warm quality.
11. Comparing the proposed coverlet fabrication technique with theEgyptian Organization for Standardization and Quality (2009/7059) width and length given in Table 4, one can conclude that the proposed coverlet can be fabricated with varying width and length, whereas the standard coverlet cannot have this varieties.
12. Comparing the proposed weight test results with the standard coverlet weight given in Table 5, it is seen that the proposed coverlet has a superior weight.The greatest weight obtained according to the Egyptian Organization for Standardization and Quality (2009/7059) is 285 gram, the greatest weight obtained according to the local market is 450 gram, whereas the greatest weight obtained for the proposed coverlet is 639 gram.
13. Comparing the proposed tensile and elongation test results with the standard coverlet tensile and elongation given in Table 5, it is seen that the proposed coverlet has a superior performance. The greatest warp tensile strength obtained according to the Egyptian Organization for Standardization and Quality (2009/7059) is 145, whereas the proposed coverlet samples have a maximum warp tensile strength of 244.6. The greatest weft tensile strength obtained according to the Egyptian Organization for Standardization and Quality (2009/7059) is 60, whereas the proposed coverlet samples have a maximum weft tensile strength of 64.
14. The design permits a multi dimension bed spread depending on customer needs which increases the sales rates.
15. The equal distribution of warp threads in every single layer attributed to the smooth production operation that is by keeping the augmentation ratio between the threads.
16. Swab in between layers contributed in a more generous soft product if compared with other weaving combination that normally result in tougher material that contrast with the required smoothness and softness of a coverlet.

Table (1) : Samples Parameters

Samples	The blended percentage for wefts
Sample (1)	100% acrylic
Sample (2)	75% acrylic : 25%cotton
Sample (3)	50% acrylic : 50%cotton
Sample (4)	25% acrylic : 75%cotton
Sample (5)	100%cotton

Fig. (1) : Artistic design

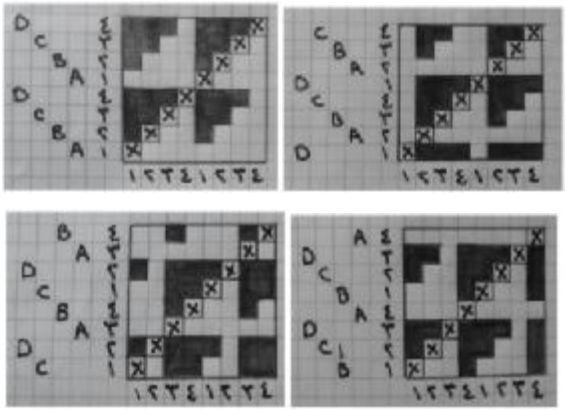

Fig. (2) Weaving structures used for realizing each weft color

Fig. (3) The front of the sample (1)

Fig. (4) The back of the sample (1)

Fig. (5) The front of the sample (2)

Fig. (6) The back of the sample (2)

Fig. (7) The front of the sample (3)

Fig. (8) The back of the sample (3)

Fig. (9) The front of the sample (4)

Fig. (10) The back of the sample (4)

Fig. (11) The front of the sample (5)

Fig. (12) The back of the sample (5)

Table (2) : Weight and thickness results

sample	Fabric square meter weight. gm	Thickness p. mm
1	639	2.1
2	625	2
3	614	1.8
4	604	1.68
5	591	1.6

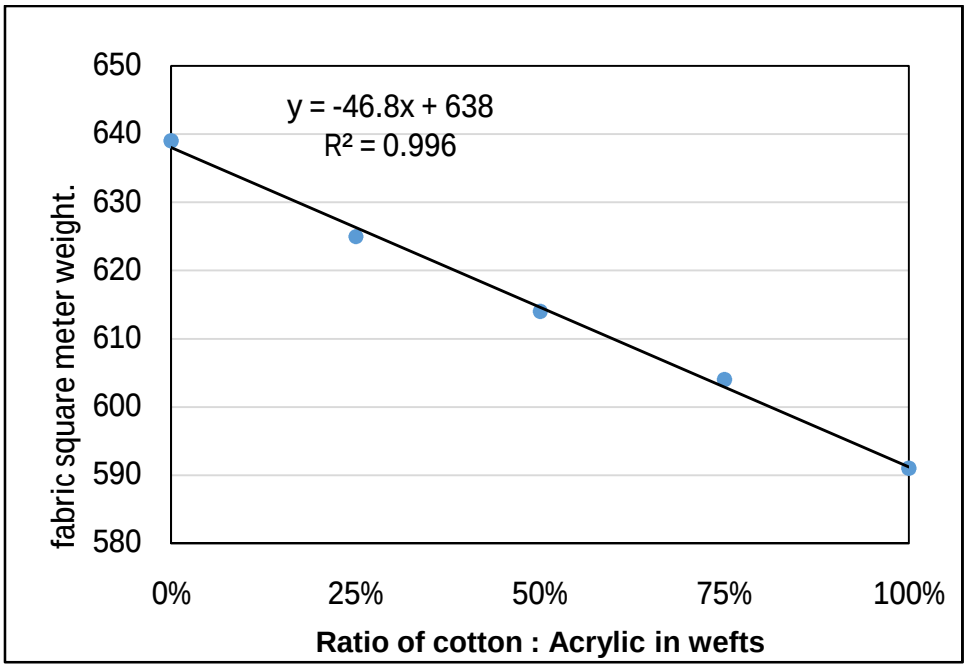

Fig. (13) Relation between cotton and acrylic weft yarns blending ratio and fabric square meter weight.

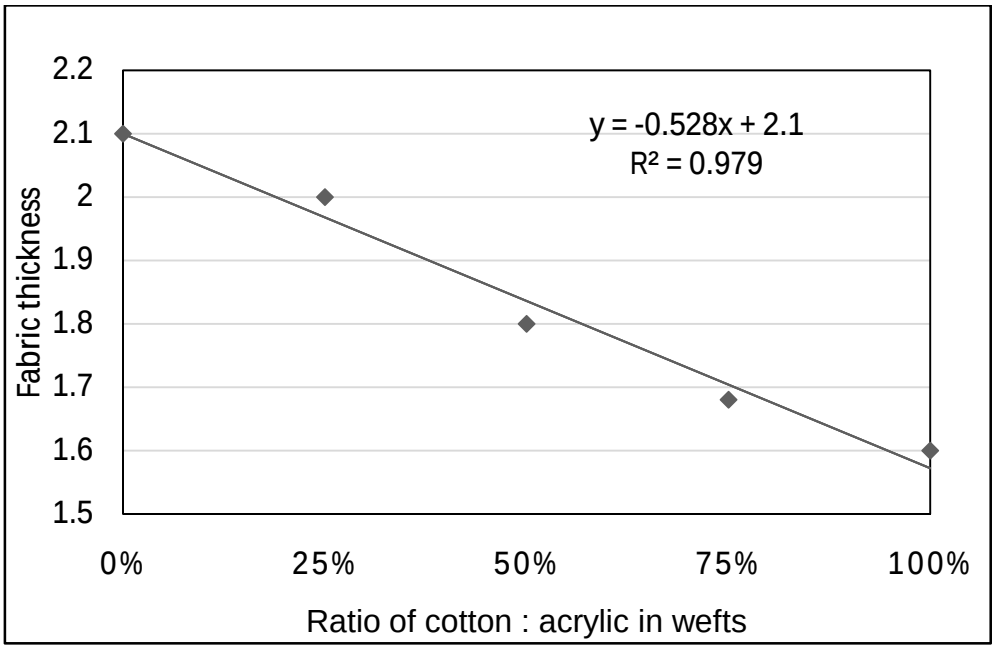

Fig. (14) Relation between cotton and acrylic weft yarns blending ratio and fabric thickness

Table (3) : Tensile strength and elongation results

samples	warp tensile strength kgm	weft tensile strength kgm	elongation warp	elongation weft
1	215	176.6	57.33	13.6
2	229.3	195	59.66	15.5
3	235	220	61	19
4	239	246	62.33	22.33
5	244.6	259	64.3	25

Linear regression equations that connects the factors subject to study to tested properties have been determined, as well as the incorporeal ties in between them.

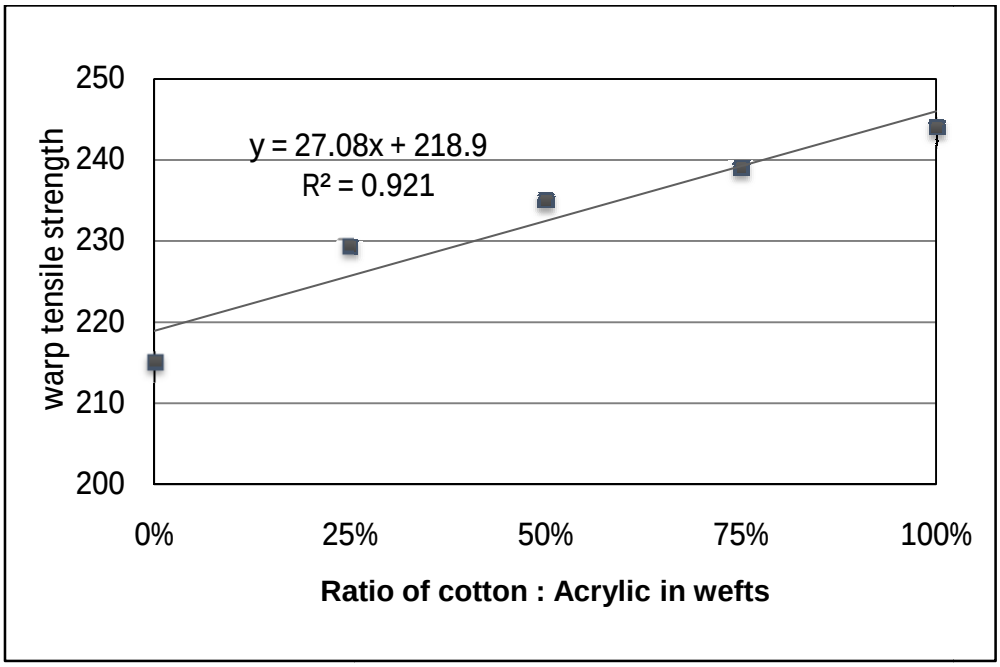

Fig. (15) Relation between cotton and acrylic weft yarns blending ratio and warp tensile strength

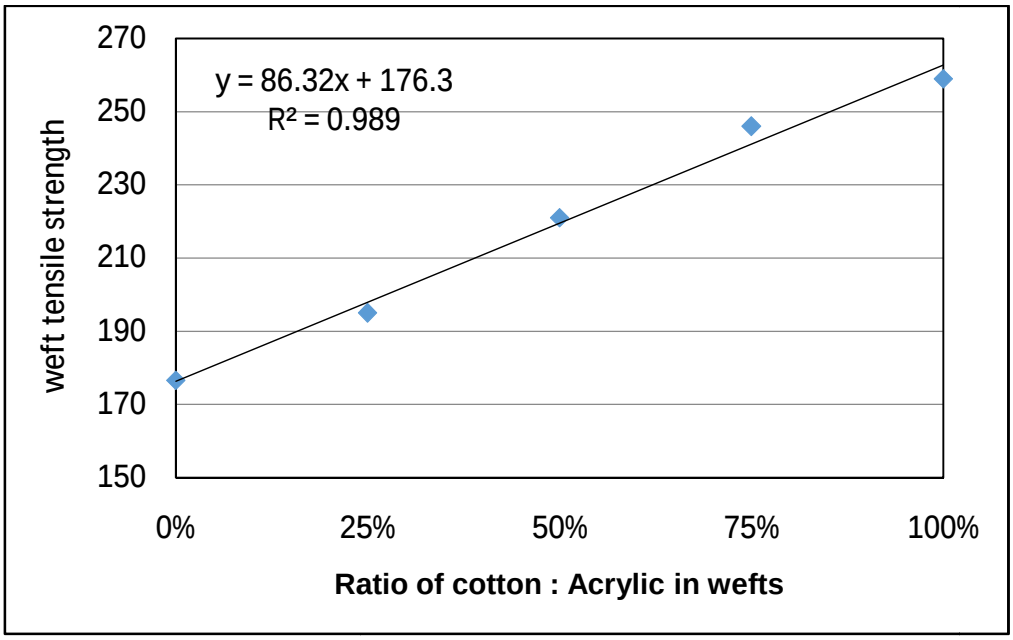

Fig. (16) Relation between cotton and acrylic weft yarns blending ratio and weft tensile strength

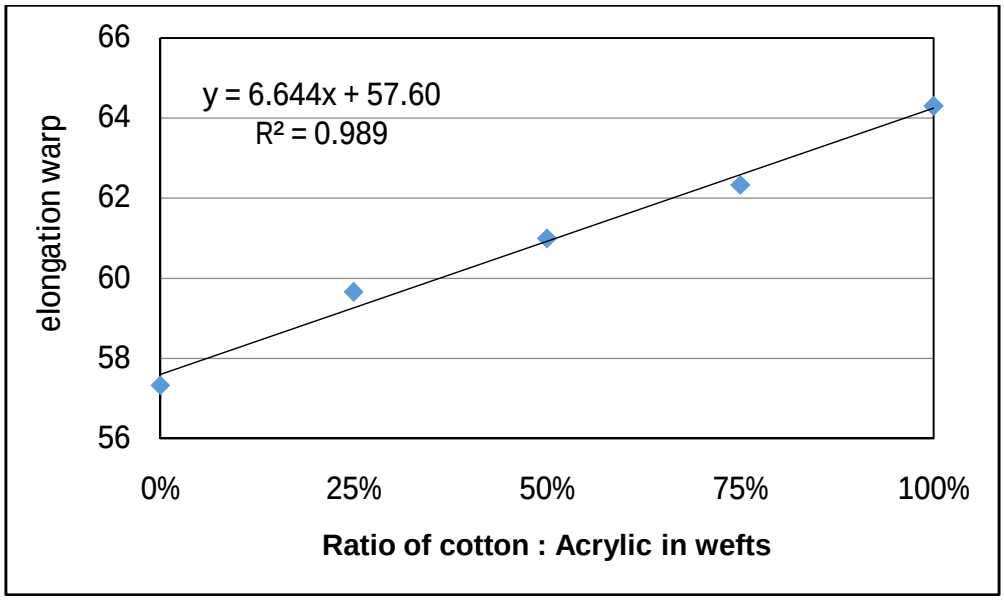

Fig. (17) Relation between cotton and acrylic weft yarns blending ratio andwarp elongation

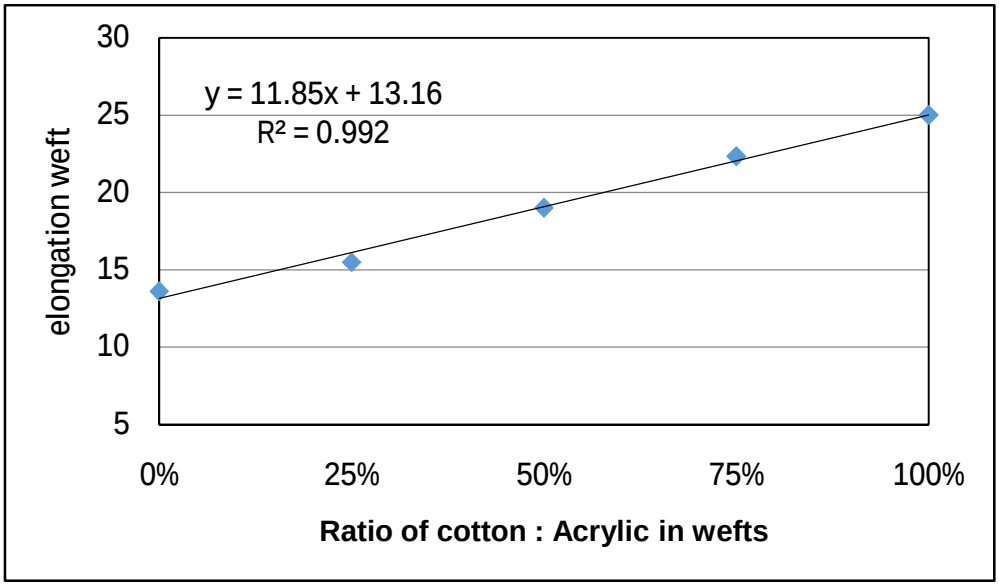

Fig. (18) Relation between cotton and acrylic weft yarns blending ratio and weft elongation

Table (4) : Common dimensions for blended woven coverlets

The length p. cm	The width p. cm
240	150
240	180
240	200
240	220
240	240

Table (5) : Physical and mechanical properties for blended woven coverlets

Sample	Count E		Density		Fabric square meter weight.	Tensile strength	
	warp	weft	warp	weft		warp	weft
1	20/2	10	18	13	285	110	45
2	20	16	20	18	190	80	45
3	14/2	6	20	14	310	80	45
4	6/2	6/2	9	9	350	145	60
5	30/2	14	37	17	220	100	55

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Address of corresponding author:

Mostafa E. AL-EBIARY

Lecturer in Department of textile, spinning and knitting

Faculty of Applied Arts

Mostafaez95@gmail.com