Effectiveness of Lycra material in improving the comfort properties of shirt

Dr. Ghada Barakat

Apparel Department, Faculty of Applied Arts, Helwan University, Giza, Egypt

radabarakat@gmail.com

Dr. Uosery Rashad

Textile Department, Faculty of Applied Arts, Helwan University, Giza, Egypt

uosefmohammed92@gmail.com

Summary:

Textiles are an important part of the psychological and physiological needs of humans; they are playing a key role in providing body isolation from inappropriate physical environments. Quality of textile products is measured by the product's ability to meet the usage requirements. Feeling of comfort varies from one person to another, due to the physiological and psychological differences between them; this comfort is represented in the ability of clothing fabrics to maintain temperature body constant, absorption of sweat and evaporation to the external environment, as well as the appropriate size of the body which provides freedom of movement.

Clothing comfort is divided into three types:

1- Psychological comfort, expresses the suitability of clothing for the person himself, and the occasion of the wear. psychological comfort is often associated with fashion trends, in terms of the form and color of clothing.

2 - Physiological comfort is specialized in the functions of the body organs, and expresses the ability of man to adapt to the surrounding weather and maintain body temperature through the transfer of heat and sweat away from the body.

3- Touch Comfort is associated with the surface properties of the fabric, according to the sensation of texture, and texture on the skin (may cause itching or sensitivity).

The most important characteristics affecting the consumer feeling of physiological comfort:

Clothes play an important role in achieving comfort in use, which increases the efficiency of its performance. Comfort is the result of a variety of properties and various structural factors. One of the most important properties that contribute to the feeling of comfort is the ability of fabrics to absorb moisture or sweat, as well as the ability of fabrics to air permeability to provide an appropriate degree of ventilation to the body, and also help to evaporate that moisture. (6) It is worth mentioning that there are four properties of fabric directly related to the thermal comfort of the consumer are air permeability, weight per square meter, thickness, and absorption speed. The aim of this research is to improve the comfort properties of shirts using Lycra material, in order weft, 1Lycra: 1 cotton, 1 Lycra: 3 cotton, 1 Lycra: 5 cotton, using 1/1 plain weaving structure for all samples.

DOI: 10.21608/mjaf.2020.20813.1425

Table (1) Specifications of Fabrics Produced

Sample	Arrange weft	Weft number
1	1 Lycra: 1 cotton	40 Lycra
2	1 Lycra: 3 cotton	40 Lycra
3	1 Lycra: 5 cotton	40 Lycra
4	1 Lycra: 1 cotton	30 Lycra
5	1 Lycra: 3 cotton	30 Lycra
6	1 Lycra: 5 cotton	30 Lycra
7	1 Lycra: 1 cotton	20 Lycra
8	1 Lycra: 3 cotton	20 Lycra
9	1 Lycra: 5 cotton	20 Lycra

The weight, thickness, tensile strength and elongation of the warp and weft, water absorption time, air permeability, wrinkle resistance in the warp and weft, friction resistance and wrinkle resistant were tested on all samples at the National Research Center in Dokki. In a standard atmosphere (relative humidity 65% +2, temperature 20 5 m + 2). The results of the tests are as shown in Table (2). The results were analyzed statistically to illustrate the effect of weft numbers of Lycra, and arrangement of Lycra wefts on the rest and some other important functional characteristics in the end use.

Pilling	Friction resistance (Cycle)	Wrinkle degree of weft (o)	Wrinkle degree of warp (o)	Elongation of the weft (%)	Elongation of the warp (%)	Weft tensile Strength (kg)	Warp tensile Strength (kg)	Moisture absorption time (min)	Air permeability $cm^3/cm^2/sec.$	Thickness (mm)	Weight per square meter (gm)	رقم العينة
A	390	106	118	20	16	39	56	2.14	15.47	0.42	180	1
A	680	106	109	20	14	48	57	1.28	19.6	0.44	181	2
A	720	87	105	18	13	55	59	0.9	21.04	0.45	185	3
A	345	89	97	22	16	40	60	3.78	24.22	0.46	210	4
A	580	82	99	21	15	54	61	3.27	25.22	0.45	198	5
A	590	81	103	19	15	58	61	2.35	26.4	0.44	195	6
A	250	83	89	23	16	55	60	7.14	32.6	0.45	199	7
A	550	75	88	22	16	62	61	6.17	33.5	0.46	203	8
A	570	71	79	21	16	64	62	4.51	42.01	0.47	214	9

Table (2) shows the results of fabrics tests

Table (2) shows that, there is an inverse relationship between the percentage of Lycra in the cm, and the weight of fabric. The density of Lycra is less than cotton, where the density of Lycra ranges between 1.21 to 1.35, while the density of cotton ranges between 1,54- 1,56 and thus increases the weight per square meter of the cloth when reduced the proportion of Lycra in cm.
There is also an inverse relationship between the weft Lycra number and weight of the fabric, that mean, the highest number Lycra weft, give the less weight of the fabric, where the highest weft number of Lycra, is the finest in cross-section area, and therefore contains fewer fiber in the cross-section and therefore less weight.
Table (2) shows that, there is an inverse relationship between the percentage of Lycra wefts in cm and the thickness of the cloth. It is also evident that there is an inverse relationship between the number of Lycra weft and the thickness of the cloth, meaning that the greater number of Lycra, provide less area in its cross section, and so less thickness of the cloth.
Table (2) shows that there is an inverse relationship between the percentage of Lycra wefts in cm and air permeability of the cloth, as fabrics that contain a higher percentage of Lycra are more integrated, less porous and less permeable to the passage of air.
It is also evident that there is a direct correlation between the number of Lycra and air permeability of the cloth, that means, the greater number of Lycra, i.e., the less cross-sectional area, the greater the air permeability of the cloth to increase the distances among yarns.
It is clear from Table (2) that there is a direct correlation between the proportion of the presence of Lycra and the time of absorption of moisture, meaning that the higher the proportion of Lycra, the greater the time of absorption of moisture, (where moisture in Lycra may reach 0.6%, while cotton reaches 8.5%).
The thicker Lycra weft has the ability to absorb moisture more than the thin weft, that due to the increased number of filaments in the cross-section of the weft in addition to the poetic property.
It is clear from table (2) that there is an inverse relationship between the number of Lycra yarns in cm and the strength of both warp and weft, that means the lower the proportion of Lycra in the wefts, the higher the tensile strength in both directions. The tensile strength of cotton is much higher than Lycra, where the tensile strength of cotton between 3 - 5 g / JD, while the tensile strength of Lycra up to 0.7 g / denier.
Also note that the increase of Lycra number increases the tensile strength in both directions.
It is clear from Table (2) that there is a direct relationship between the number of Lycra wefts with poison and the elongation of both the warp and the weft. This is because Lycra has the potential to elongate five to seven times its original length. Lycra tigers increase elongation in both directions.
Table (2), shows a direct correlation between number of Lycra weft in cm and the degree of wrinkling of the warp and weft, that means the greater the number of Lycra wefts in cm, the greater resistance of the cloth to wrinkle in both directions of the warp and weft. This is due to the flexibility of Lycra.
There is also an inverse relationship between the Lycra number and the degree of wrinkles in both directions of warp and weft, i.e. lower number of weft of Lycra, the greater the degree of wrinkle or in other words the greater resistance of the cloth to wrinkle, because decrease of the number of weft means increasing the degree of porosity of the thread and thus increase the degree of resistance wrinkle.

As shown in table (2), the higher the percentage of Lycra in the cloth, the less the resistance of the fabric to friction, i.e., there is an inverse relationship between them, as it is known, Lycra lack resistance of friction, which was a major factor in the negative impact on durability. However, this has been improved by use of Lycra wefts where Lycra fiber are present in the core and wrapped in cotton fiber.

It is also noted that the greater the Lycra wefts number, the less the resistance of the fabric to friction, due to the small number of filament cross-section area of the thread, and therefore less resistance to friction.

All fabrics have excellent resistance to pilling, even those with a higher percentage of Lycra in wefts, because these wefts were coated with cotton fibers which are known to be highly resistant to pilling.

Figure (1) show that, the best sample that achieved best properties and best performance when used was sample number (7), which has number of Lycra 20 and the order of 1 Lycra: 1 cotton, where gave the highest area up to 10.84, followed by the sample used by Lycra number 30 is an area of 8. 90, then number 40 is an area of 8. 80.

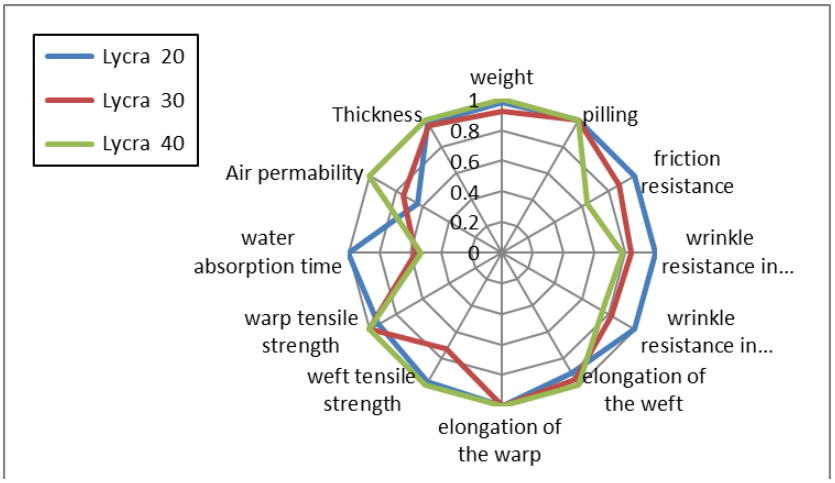

Figure (1) Radar shapes of executed specimens in order of 1 Lycra: 1cotton

Figure (2) shows that, the best sample achieved the best properties and best performance when used was sample number (8) which has number of Lycra yarns 20 cotton, and the order of 1 Lycra: 3 cotton, where gave the highest area up to 10.90, followed by the sample used by the Lycra number 40 is 10.56, then 30 is 10.10.

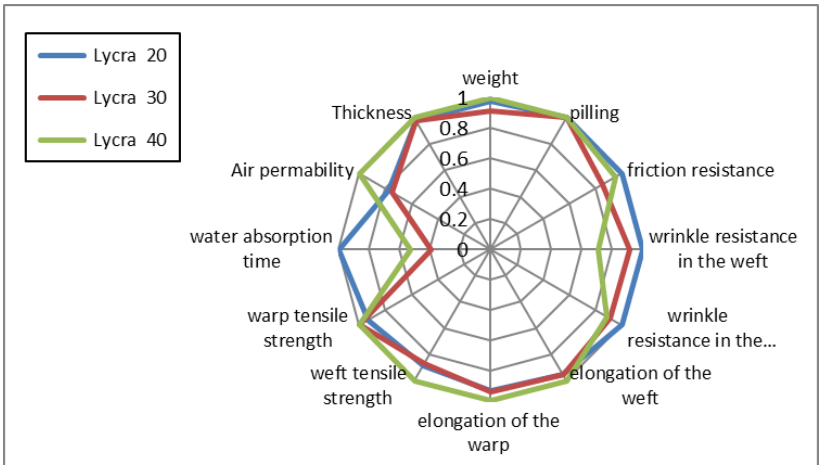

Figure (2) Radar shapes of executed specimens in order of 1 Lycra: 3cotton

Figure (3) show that, the best sample achieved the best properties and best performance when used was sample (9), which used number of Lycra 20, and the order of 1 Lycra: 5 cotton, which gave the highest area up to 10.99, followed by Lycra 40 from 10, 26 and 30 by 7.72.

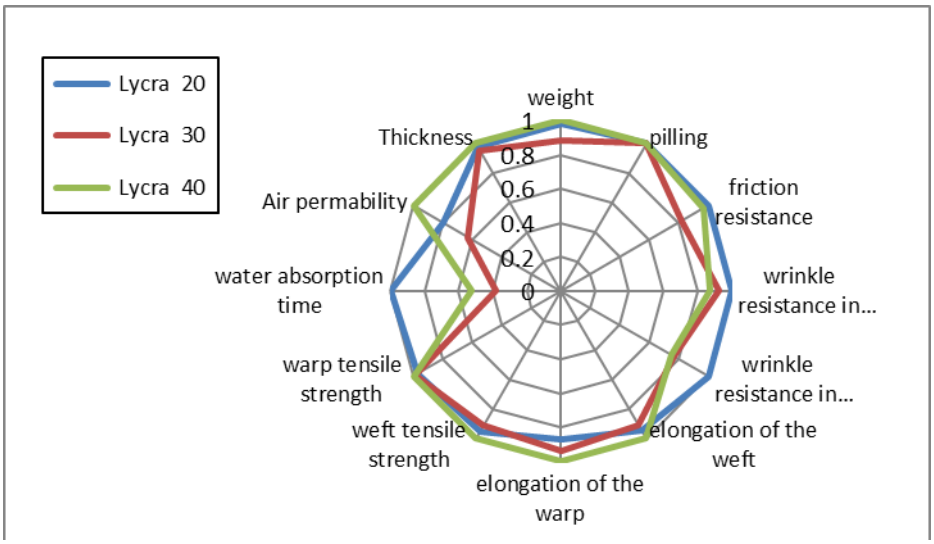

Figure (3) Radar shapes of executed specimens in order of 1 Lycra: 5 cotton

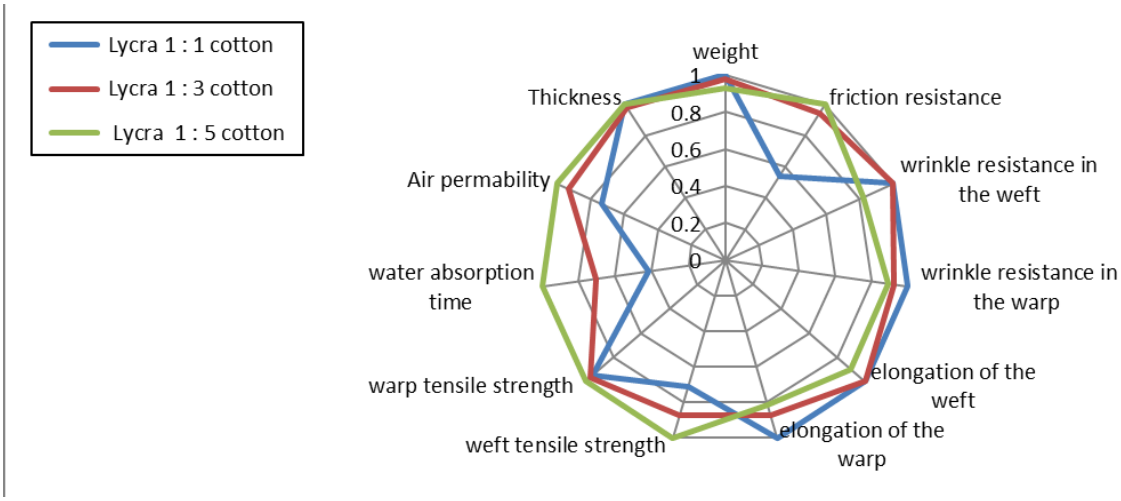

Figure (4) shows the radar shapes of the best implemented samples from number of 20 in different order.

From the above, the radar figure (4) shows that the best sample achieved the best properties ever and best performance when used number of Lycra 20, and the order of 1 Lycra: 5 cotton where the highest area reached 10.99.

References:

- ibrahim, sadiya omar- tathyr ikhtilaf nowe alkham ala alkhuas altabyia wa lmuykanikiay: 'awla: khawas alraaha- majalat eulom wafunon- dirasat wabihawath- jamieat hulwan - 2002
- salum , frial - diraset khuas al'ada' alwazifii libaed 'akmushat almalabis alriyadia alhaditha- International Design Journal Volume 8, 2018 - Issue 3
- husayn, 'ahmad muhamed - tathir ikhtilaf tartib alriyb ala bad khawas alrraha li'akmshat tariko allahma- majalat eulum wafunon - dirasat wabihawth - 2003

- salman ,'ahmed ali - aldesuki, hiba asem- eabd ale, fatma shathily - dirasat tahkik 'afdal alkhawas alwazifiay waljamalia li'akmshat triko alluhma almualga limukawamat numo elbuktria 2018- International Design Journal, Volume 8, Issue 1
- qashqariun, khadija ruzi - alrraha almalbasia: dirasat mkarna bayn 'akmusha alghazl alhulky waltarf almaftuh - majalat eolum wafununa- dirasat wabihawath- jamieat hulwan - 2008
- alsyad, ghadat 'ahmad - tathir 'iikhtilaf altarkib alnusjii wanowe alkhamat ala khawas al'ada' alwazifii li'akmshat aldiynim almuzdawija - majalat aleamara walfunown -aleadad aleashir
- aljamlu, fyroz 'abu alftoh- alsyd, husam aldiyn - aldderuni, iman mahmud - diraset mokaranh bayn nisab khalt al'asbindkis ala alkhamat waltarakib albinaiya almukhtalifat li'aqmshat truko alluhmat almontaja lilmalabis alkharijiaya- majalat aleamara walfunon - aleaded alhadi eshr aljuz' al'awl-
- juda, eabd alezyz- juber, bahira jebaly - kamal, samih - al'orjunomia wa tasmim almalabis
- mustafaa ،'ahmad bha'- khadari, khalid albadri - rashid, tariq 'ahmad - alkhawas almumayaza li jawdat al'adaa' walrraha albiyiya li'akmshat malabis al'atfal
- eabd alrhmn, ghada abd elftah- tahqiq 'afdal alkhawwas alwazifia lilrraha alfisyulojia litonasib al'ada' alwazifii llmalabis aljahiza fi alzuruf almunakhia alhara - majalat eulom wafunon - dirasat wabhwth- jamieat hulwan- 2013
- madi, najdat 'iibrahim - diraset litathir alkhuwas alfiziakya walmikanikia li'aqmshat alkursihat alddaghita ala 'adaa' alrraha - Alex. J. Agric. Res. 2015, No. 2, Vol. 60,
- muhamed, wesam muhamed 'iibrahim - mistafiun, fatamah ebdalhmid - tathir aikhtilaf nisbat khalt al'akmisha alkatnia almakhluta bialliykra alaa jawdat alhiakat, majalat al'iiskandaria liltabadul aleilmay) - mujalad 37 aladad 1 (ynayr- mars 2016
- Sitotaw , D., and Adamu, B., Tensile Properties of Single Jersey and 1×1 Rib Knitted Fabrics Made from 100% Cotton and Cotton/Lycra Yarns - Journal of Engineering- Volume 2017
- Pamuk, o., - Clothing Comfort Properties in Textile Industry, e-Journal of New World Sciences Academy, Volume: 3, Number: 1, 2008
- Shaid, A., Furgusson, M,.and Wang, L., Thermophysiological Comfort Analysis of Aerogel Nanoparticle Incorporated Fabric for Fire Fighter’s Protective Clothing,
- Chemical and Materials Engineering, 2014
- Song, G., Improving comfort in clothing, Woodhead Publishing Limited, 2010.
- Medcrave, The Effect of Textiles on Clothing Physiological Comfort While Backpacking in the Cold, Journal of Textile Engineering & Fashion Technology, 2017.
- Oğulata, R., The Effect of Thermal Insulation of Clothing on Human Thermal Comfort, Fiber&Textile in Eastern Europe,Vol.15, No.2, 2007.
- Auliciems, A., and Szokolay, S., Thermal Comfort, Passive and Low Energy Architecture International, 2007.
- Eltahan, E., Effect of Lycra Percentages and Loop Length on the Physical and
- Mechanical Properties of Single Jersey Knitted Fabrics, Journal of Composites, 2016.
- Özdemir, H., Thermal Comfort Properties of Clothing Fabrics Woven With Polyester/Cotton Blend Yarns, AUTEX Research Journal, Vol. 17, No 2, June 2017.