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Effect of Nano Silca on Garment Appearance

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ABSTRACT

Viscose, polyester fabrics and its blends are treated with nano silicon dioxide (SiO_2) (12.5g/l) at temperatures (130°C), for 10 min to study the effect of treatment on some fabric properties. As a first step towards objective evaluation of garment appearance, the present work considered dimensional stability which simulate actual garment surface. In this survey, thickness and fabric mass per unit area are the studied factors. The obtained results will surely help to identify the design criteria for clothing so as to produce high quality garments.
KEYWORDS: Viscose, polyester fabrics and its blends, thickness, and fabric mass per unit area.

1. INTRODCTION

Garment appearance or aesthetic quality is one of the most important aspects of garment quality. Aesthetics is a very complicated subject because what one person would define as appealing may not necessarily be another person's view. It is therefore almost impossible to universally define garment aesthetic appeal. Nevertheless, people do have a reasonably common notion or concept of what is good or bad appearance. With the exception of some deliberate use of "puckered" or "wrinkled" surface, nicely smooth and curved garment surface is regarded as desirable[1, 2]. The term blend is used by the yarn manufacturer to describe specifically the sequence of processes required to convert two or more kinds of staple fibers into a single yarn composed of an intimate mixture of the component fibers [3].Today blended fabrics with different combination can be produced which are suitable for performance of specific blending make it possible to build in a combination of desirable properties. Not only are blends and fabrics used for better serviceability of fabrics but are also used for improved appearance and hand. Blends of synthetic fibers such as polyester, nylon, viscose, acrylic etc.with natural fibers like wool, cotton, silk etc.offer the most valuable possibilities for combining desirable physical properties. In blends of polyester or acrylic fibers with cotton or viscose the synthetic component provides crease recovery,dimentional stability tensile strength,abrasion,resistance and easy care properties, whilst the cellulosic fibers contributes moisture absorption, antistatic characteristics and reduced pilling[4].

Mark et al., [5] studied the application of hybrid (SiO_2/Ag) silica particles with nanosilver introduced into the polymer matrix and deposited on the textile surface. Microbiological tests were carried out on these textiles and confirmed their good antimicrobial activity. The role of silica spheres in SiO_2/Ag is as Ag metal carriers and effective matrix causing good dispersion of silver nanoparticles in polymer matrix. In this study effect of treatment with nano silica on viscose and polyester fabrics and its blends is not to try to define garment appearance, but to try to objectively evaluate garment appearance in terms of the smoothness of surface contours.

2. MATERIALS AND METHODS

2.1 Materials

Viscose fabrics are supplied from Misr Spinning and Weaving Co. El- Mehalla El- Kobra, Egypt, polyester fabrics and its blend are used. Polyester and polyester/viscose 40/60 and viscose/polyester 30/70 were supplied from Golden Tex, El Asher Ramadan, Egypt, The fabrics were washed with an aqueous solution containing 2g/l nonionic detergent (Egyptol) for 45 min at 60°C, followed by thorough washing in water and air-dried.

2.2. Treatment condition

First polyester fabric was treated with sodium hydroxide at 95°C for 30 min. then fabric was rinsed with water and air dried. Viscous, polyester and its blend fabric were treated with nano silicon dioxide concentration (12.5g/l) L: Raito (1:10 fabric : ethanol) the fabrics were immersed in solutions for 1hr., then pick up 100%, fixed at 130°C for 10 min., Finally the fabrics were washed thoroughly with tap water and air dried.

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2.3 Methods

All the fabrics were tested for their dimensional stability and compression by using Fabric Assurance by Simple Testing System (FAST) [6]**.**It measures fabric properties which are closely related to the ease of garment making up and the effectiveness of finishing processes including the stability of finishing.

3. RESULTS AND DISCUSSION

3.1. Dimensional Stability

The dimensional stability of a given fabric is a measure of the extent to which it keeps its original dimensions subsequent to its manufacture. Fabric shrinkage can cause problems into main areas, either during garment manufacture or during subsequent laundering by the ultimate customer. Shrinkage is rated as one of the leading quality problems in the garment industry. Dimensional change may be due to relaxation or hygral expansion.

3.2 Relaxation Shrinkage

Relaxation shrinkage is the irreversible change in fabric dimensions. Excess fabric relaxation shrinkage may cause sizing problems, as the finished garment will be smaller than it was planned. It also leads in formation of puckered seams in final pressing. Also, problems are often caused by fabrics, which have insufficient (or negative) relaxation shrinkage as the fabric is relaxed in manufacture or when worn[7] Fig.(1&2) show the relaxation shrinkage of untreated and treated fabrics. The values of relaxation shrinkage warp (RS-1) of treated samples increased in(**100%v**),(4**0%p:60%v**)and(**100%p**) ranged **4.9%,4%and4%** percent, but decreased in (**30%v:70%p**) ranged **1.2%.**While the values of relaxation shrinkage weft (RS-2) of treated samples increased in(**100%v**),(**30%v:70%p)** and (**100%p**) ranged **3.6%,0.8%and0.4%** percent ,as decreased in (**40%p:60%v**) ranged **-1.6%.** It's clearly show that the treated (**100%v**), (4**0%p: 60%v**) and (**100%p**) fabrics which their relaxation shrinkage is above about 3%can arise problems in tailoring .Individual panels or entire garments will shrink, making them a smaller size than planned. This can be critical if the matching panels have different proportions. The treatment improved the RS-2(**30%v: 70%p**) and (**100%p**) which have zero relaxation shrinkage, before treatment and may arise around the sleeve head and shoulder seam. The treated RS-2(4**0%p:60%v**) fabric which has negative relaxation shrinkage can cause fabric in order to prevent bubbling in the pleat formation process[7].Problems during fusing because the fused parts of the garment are unable to change dimensions along with the surrounding fabric, resulting in puckering at the interface. Most garment makers require a small amount of relaxation shrinkage to be present in a fabric residual fullness in the garment during final pressing .If a fabric is to be pleated then a certain amount of relaxation shrinkage must be present in.

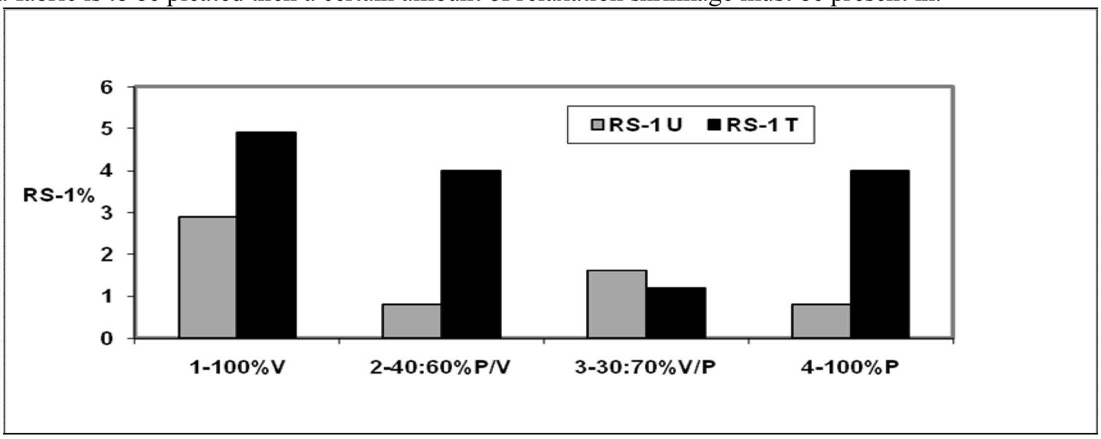

Fig.1: Relaxation Shrinkage (warp) of the untreated and treated fabrics

RS1-U: Relaxation Shrinkage warp of untreated
RS1-T: Relaxation Shrinkage warp of treated
Treatment: The fabrics were immersed in a solution containing 12.5g/l (1:10 ethanol) (o. w .f) of Nano silicon oxide (at room temperature for 1h, then padded to pick up 100% and then fixed at 130°C for 10 min. Finally the fabric is washed thoroughly with tap water and air dried.

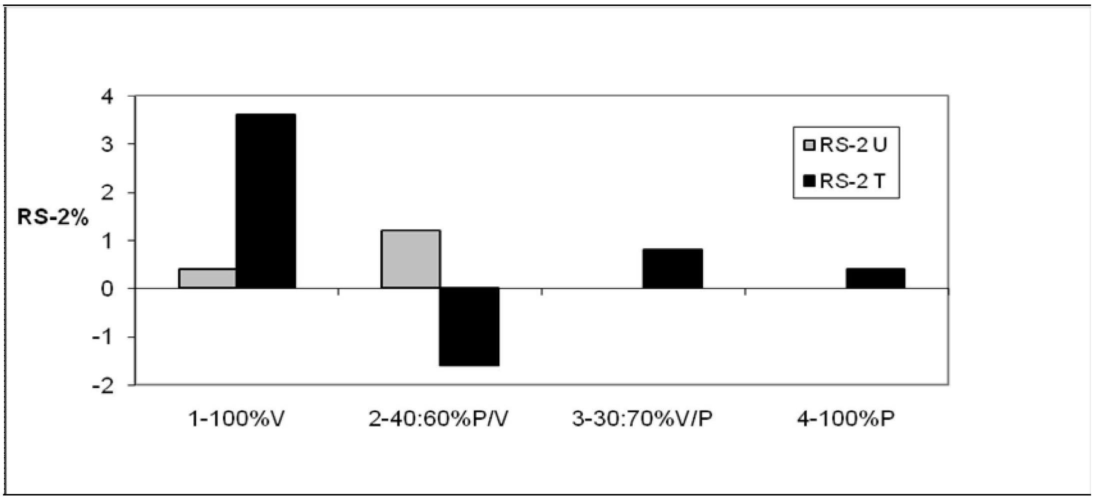

Fig.2: Relaxation Shrinkage (weft) of the untreated and treated fabrics

RS2-U: Relaxation Shrinkage weft of untreated
RS2-T: Relaxation Shrinkage weft of treated
Treatment: The fabrics were immersed in a solution containing 12.5g/l (1:10 ethanol) (o. w .f) of Nano silicon oxide (at room temperature for 1h, then padded to pick up 100% and then fixed at 130°C for 10 min. Finally the fabric is washed thoroughly with tap water and air dried.

3.3 Hygral Expansion

Hygral Expansion is the reversible change in the dimension of the fabric. Excessive hygral expansion may result in poor garment appearance because the garment panels increase in dimensions as the moisture content of the fibers increase .In some cases, seam puckering may also occur if different panels receive different expansion[7]. Fig.(3&4) show the hygral expansion of untreated and treated fabrics Values of hygral expansion warp (HE-1) of treated samples increased in(**100%v**),(4**0%p:60%v**)and(**100%p**) ranged **3%,0.8%and1.6%** percent, but decreased in (**30%v:70%p**) ranged **0%.** While the values of hygral expansion weft (HE-2) of treated samples decreased in(**100%v**),(4**0%p:60%v**)and(**30%v:70%p)** ranged **1.2%,0.8%and0.4%** ,as still without any change in(**100%p**) ranged **0%.** All the values in warp & weft direction having hygral expansion were within the acceptable rang before and after treatment .Thus there is no seam puckering problem occur. Fabrics (**100%p**) **1.6%** percent in warp having hygral expansion higher than 1.53 leads to garment appearance problems [8].

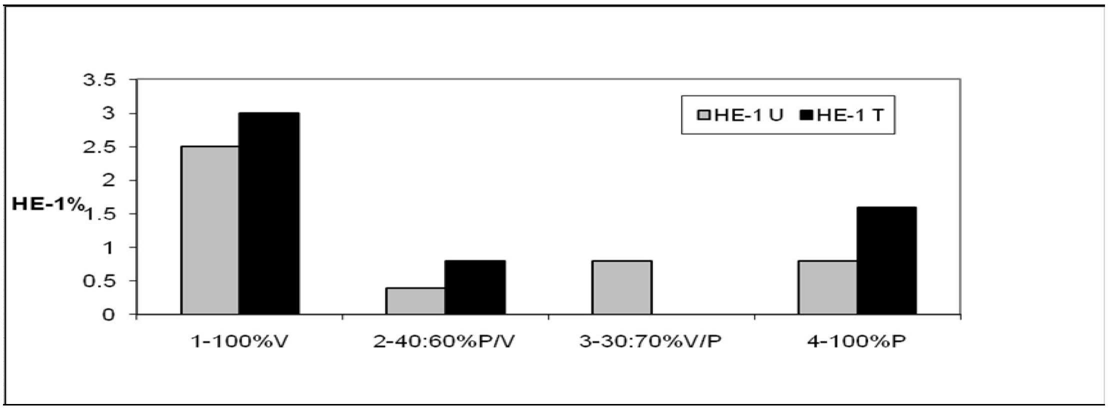

Fig.3: Expansion (warp) of the untreated and treated fabrics

HE 1-U: Hygral Expansion warp of untreated, **HE 1-T** Hygral Expansion warp of treated
Treatment: The fabrics were immersed in a solution containing 12.5g/l (1:10 ethanol) (o. w .f) of Nano silicon oxide (at room temperature for 1h, then padded to pick up 100% and then fixed at 130°C for 10 min. Finally the fabric is washed thoroughly with tap water and air dried.

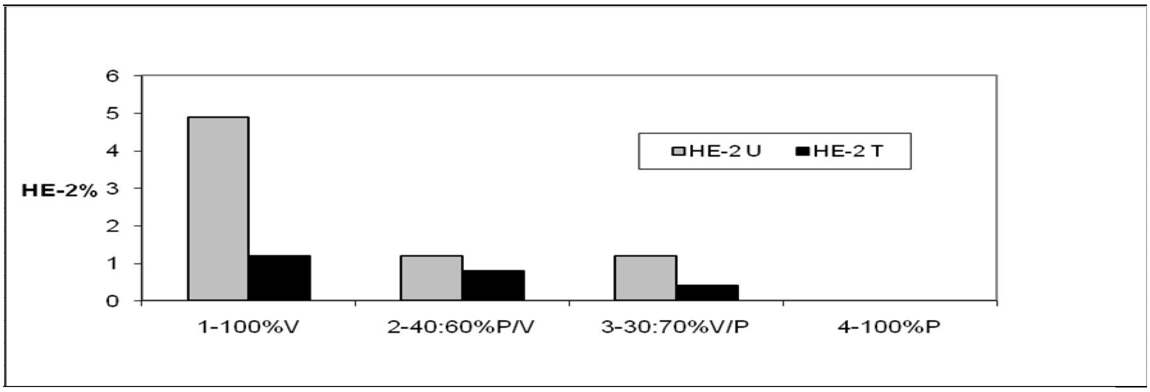

Fig.4: Expansion (weft) of the untreated and treated fabrics

HE2-U: Hygral Expansion weft of untreated, **HE2-T:** Hygral Expansion weft of treated **Treatment:** The fabrics were immersed in a solution containing 12.5g/l (1:10 ethanol) (o. w .f) of Nano silicon oxide (at room temperature for 1h, then padded to pick up 100% and then fixed at 130°C for 10 min. Finally the fabric is washed thoroughly with tap water and air dried.

3.4 Thickness & Surface Thickness

Thickness and surface thickness do not themselves have any great impact upon the tailoring performance of a fabric but are useful indicators of any change or variation in fabric handle [7]. Thickness and surface thickness samples values after treatment were still within limits which indicating the finish on the fabric is stable. Fig.(5) shows the thickness of untreated and treated fabrics.

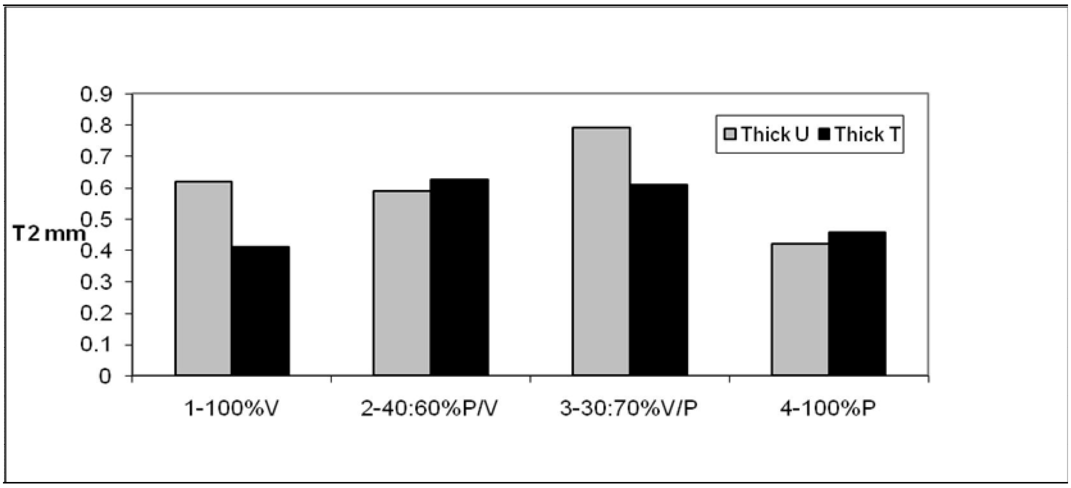

Fig.5: Thickness of the untreated and treated fabrics

Treatment: The fabrics were immersed in a solution containing 12.5g/l (1:10 ethanol) (o. w .f) of Nano silicon oxide (at room temperature for 1h, then padded to pick up 100% and then fixed at 130°C for 10 min. Finally the fabric is washed thoroughly with tap water and air dried.

3.5. Formability

Fig. (6&7) show the formability of untreated and treated fabrics. Fabric formability can be used to predict the limit of overfeed buckling. The lower of formability cause more seam pucker because a fabric is unable to accommodate the small compression placed on the fabric by the sewing thread. The values of formability ranged from 0.18 mm^2 to 0.54 mm^2 in treatment fabric warp (F-1) and 0.16 mm^2 to 0.46 mm^2 in weft (F-2). The maximum and minimum limits of fabric formability will also depend on the sewing thread, needle size and thread tension, as well as the skill of the operators. Puckering or sleeve-setting problems are known to occur easily only in fabrics with formability less than 0.25mm^2 in both direction.

Polyester and blends fabrics recorded values less than 0.25 mm^2 in both the direction after treatment, which might result in serious problems in seam puckering and sleeve setting. As the warp formability is more important than weft formability in fabric manufacturing. All the fabric samples previously are expected to pose problems in garment manufacturing as the values of the (viscose/polyester (60/40)) (Viscose) and (polyester) in both direction.

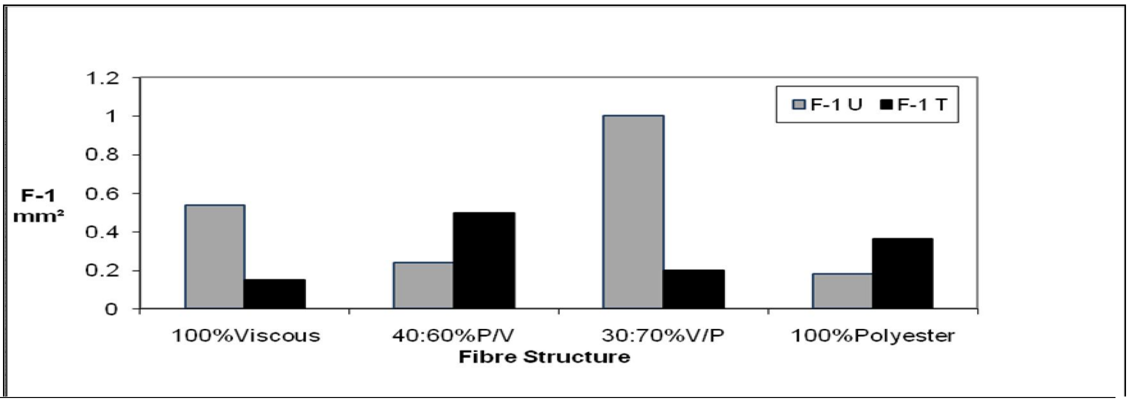

Fig. 6: Formability warp of the untreated and treated fabrics

F-1 U: Formability warp of untreated **F-1 T:** Formability warp of treated
Treatment: The fabrics were immersed in a solution containing 12.5g/l (1:10 ethanol) (o. w .f) of Nano silicon oxide (at room temperature for 1h, then padded to pick up 100% and then fixed at 130°C for 10 min. Finally the fabric is washed thoroughly with tap water and air dried.

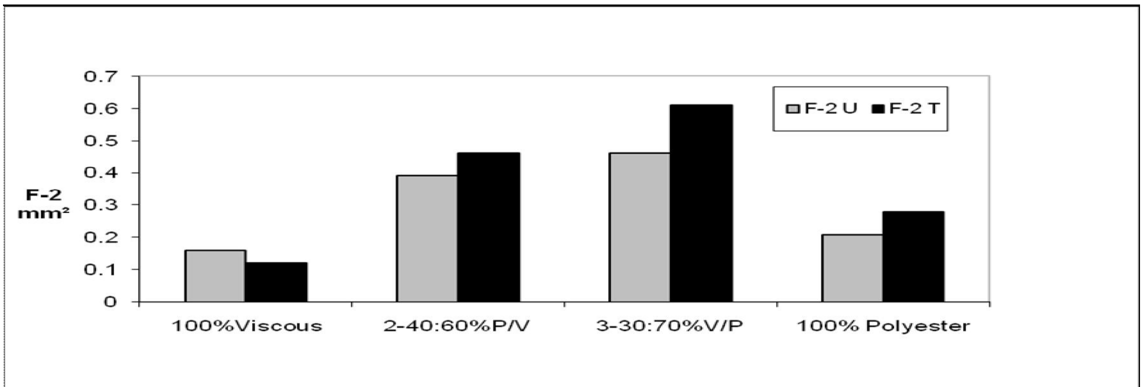

Fig. 7: Formability weft of the untreated and treated fabrics

F-2 U: Formability weft of untreated **F-2 T:** Formability weft of treated
Treatment: The fabrics were immersed in a solution containing 12.5g/l (1:10 ethanol) (o. w .f) of Nano silicon oxide (at room temperature for 1h, then padded to pick up 100% and then fixed at 130°C for 10 min. Finally the fabric is washed thoroughly with tap water and air dried.

3.6 Extensibility

Fig. (8 & 9) show the extensibility of untreated and treated fabrics. Extensibility is a measure of the fabric's ability to be stretched during making up. Both excessive and insufficient extensibility is known to cause problems during the manufacture of the garment[7].The values of Extensibility in treatment fabric ranged from 1.6% to 5.1% warp and 3.8% to 5.6% weft directions. Though the minimum limit is 2% in both directions and maximum limits are 4 and 6% in warp and weft[6]. The fabrics less than 1.84% are known to cause difficulties during seam overfeeding. Extensibility greater than 2.53% in warp and 4.07% in weft allows the fabric to be easily stretched during spreading and sewing unsupported. Fabric may shrink or relax after being cut. The higher the extensibility the more difficult will be the laying up, cutting and sewing [8]. The fabrics are found to have values less than the minimum limit in warp direction. Samples (100%V) and (30:70%V/P) recorded the lowest in warp after treated which cause difficulties during seam overfeeding. The treatment improves the fabric extensibility warp. Samples(40:60%P/V)and(100%P) recorded high values in fabrics which cases problem during laying up, after treatment the problem improves in weft direction .Extensibility of all the fabrics tested did not exceed the maximum limits both in warp and weft direction, thus producing problem during laying up. Fig.(8&9) show the extensibility of untreated and treated fabrics.

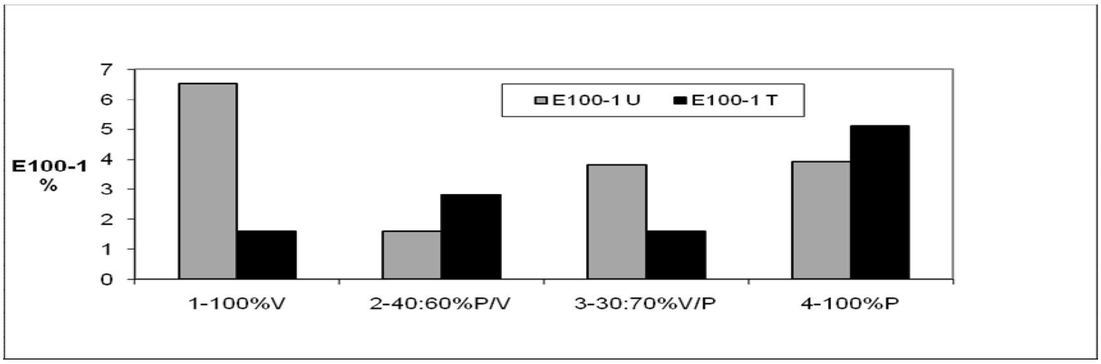

Fig.8 : Extensibility warp of the untreated and treated fabrics

E100-1 U: Extensibility warp of untreated **E100-1 T:** Extensibility warp of treated
Treatment: The fabrics were immersed in a solution containing 12.5g/l (1:10 ethanol) (o. w .f) of Nano silicon oxide (at room temperature for 1h, then padded to pick up 100% and then fixed at 130°C for 10 min. Finally the fabric is washed thoroughly with tap water and air dried.

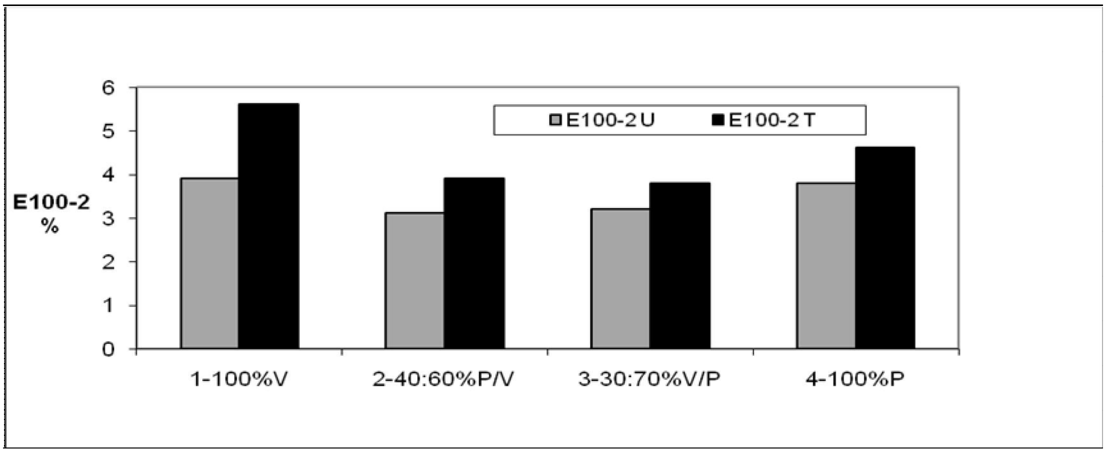

Fig.9: Extensibility weft of the untreated and treated fabrics

E100-2 U: Extensibility weft of untreated **E100-2 T:** Extensibility weft of treated
Treatment: The fabrics were immersed in a solution containing 10g/l (1:10 ethanol) (o. w .f) of Nano silicon oxide (at room temperature for 1h, then padded to pick up 100% and then fixed at 130°C for 10 min. Finally the fabric is washed thoroughly with tap water and air dried.

3.7 Bending Rigidity

Bending Rigidity of untreated and treated fabrics shown in fig. (10 &11). Fabrics with high of bending rigidity will not generally cause problems in making up, but will feel stiffer and so bending rigidity can be a useful indicator of changes or variations in fabric handle[7].The values of bending rigidity ranged from 2.9µNm to 12.2µNm in warp and 3.2µNm to 8.8µNm in weft direction. Fabrics with 2.9 µNm in warp and 3.2,3.6 µNm in weft were regarded as soft and easy to bend, and the fabrics are known to be difficult to handle and cut[6];samples (100%polyester,100%viscose treated) have low values in both warp and weft directions and expected to give a number of difficulties in the tailoring process. Fabrics can be difficult to cut as they distort easily. The treatment improves the lower values but the problem for those makers who do not have the benefit of vacuum cutting tables. In sewing operation low bending rigidity can be a major contributor cause of seam pucker.

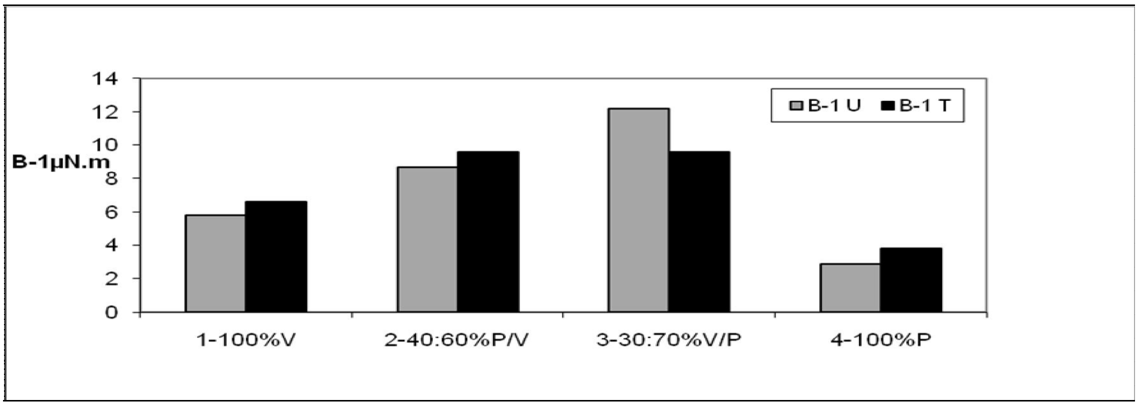

Fig. 10: Bending Rigidity warp of the untreated and treated fabrics

B-1 U: Bending warp of untreated **B-1 T:** Bending warp of treated
Treatment: The fabrics were immersed in a solution containing 10g/l (1:10 ethanol) (o. w .f) of Nano silicon oxide (at room temperature for 1h, then padded to pick up 100% and then fixed at 130°C for 10 min. Finally the fabric is washed thoroughly with tap water and air dried.

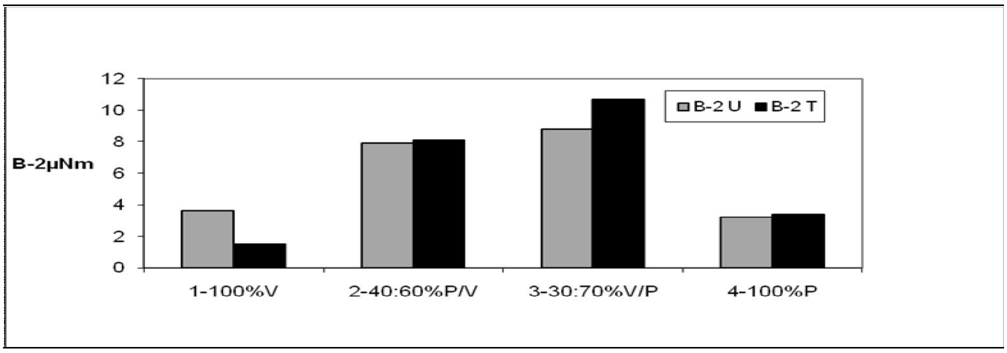

Fig. 11: Bending Rigidity weft of the untreated and treated fabrics

B-2 U: Bending weft of untreated **B-2 T:** Bending weft of treated
Treatment: The fabrics were immersed in a solution containing 10g/l (1:10 ethanol) (o. w .f) of Nano silicon oxide (at room temperature for 1h, then padded to pick up 100% and then fixed at 130°C for 10 min. Finally the fabric is washed thoroughly with tap water and air dried.

3.8 Shear Rigidity

Fabric shear ability is one of the major concerns when making-up a garment, as the fabric needs to be stretched and sheared to a certain degree in order to conform to the intended garment shape. If the shear rigidity is too low, then the fabric is easily distorted and can skew or bow during handling, laying up and sewing. The shear rigidity of untreated and treated fabrics shown in fig. 10. If the shear rigidity is too high, the fabric will be difficult to form, mould, or shape at the sleeve head [7]. The values of shear rigidity of the treated samples tested ranged from 27.5 to 63.1N/m. Fabrics having shear rigidity than 55.3N/m are known to cause shaping and moulding difficulties [8], though the maximum limits for lightweight fabrics is 80 N/m and the minimum is 30 N/m [8].The treatment improves the lower values in sample (100% polyester) but in sample (100% viscose) the values recorded were less than limit after treatment. Hence fabric sample (100% viscose) is expected to make problems during lying up and sewing. Shear rigidity of untreated and treated fabrics shown in fig. (12).

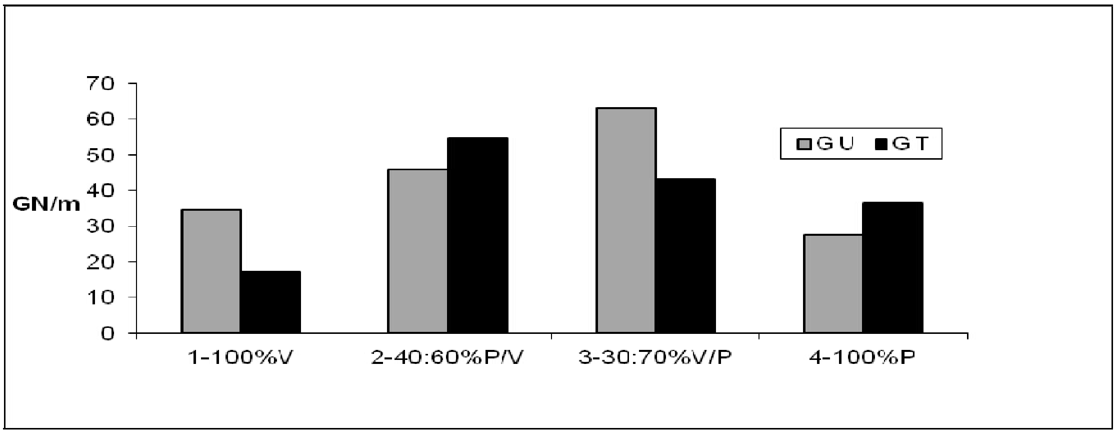

Fig. 12: Shear Rigidity of the untreated and treated fabrics

Treatment: The fabrics were immersed in a solution containing 10g/l (1:10 ethanol) (o. w .f) of Nano silicon oxide (at room temperature for 1h, then padded to pick up 100% and then fixed at 130°C for 10 min. Finally the fabric is washed thoroughly with tap water and air dried.
G U: Shear Rigidity of untreated **G T:** Shear Rigidity of treated

Conclusion

Fabric's behavior and appearance during garment manufacture can be assessed the adoption of objective of fabric dimensional and compression properties. The present study has clearly demonstrated a profound influence of nano treatment on dimensional and compression properties of viscose, polyester and their blend fabrics. After treatment, as the **relaxation shrinkage** of all the fabrics in warp and weft directions were found some values within the limit and leads to improve fabric sizing and fusing treated, while (**100%v**), (4**0%p: 60%v**) and (**100%p**) fabrics which their relaxation shrinkage is above about 3%can arise problems in tailoring .The results illustrates that treated samples (RS-1)**of (100%v**),(**100%p**) and RS-2(4**0%p:60%v**) fabric which has negative relaxation shrinkage can arise problems in tailoring. The treatment demonstrated a profound improved in the RS-2(**30%v:70%p**) and (**100%p**) which have zero relaxation. The best improvement in 100%viscose. The **hygral expansion** values were in the acceptable range before and after the treatment which improve seam puckering.

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