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Research Article

Evaluation of Comfort Property of Fabric by Subjective and Objective Measurement

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Abstract

Clothing is an important aspect for human being next to food and shelter. Fabric handle is the outcome of a complex phenomenon determined by fabric mechanical and surface properties and it is very important for a customer in assessing fabric quality while shopping, as well as for the end-use and prospective performance of a textile product. Ten different samples were used among however all samples were knitted fabric. The results were displayed in graphical and statistical manner and the hand value and total hand value of the test results were on acceptable range the primary values of stiffness which was lies between 4.75 to 6.76, smoothness between 5.85 to 8.53 ,softness and fullness also lies between 8.49 to 10.17 .The tested functional properties of different finished fabric type the highest total hand value is found on sample four (Prani) and also it have better fullness, softness and smoothness and also it is the best sample for ladies winter cloth from different functional properties of fabric.

Keywords: Comfort property; Functional property; Handle; quality; Fullness and softness.

Introduction

Fabric handle, which is simply defined as "all feelings when you touch a fabric", is the outcome of a complex phenomenon determined by fabric mechanical and surface properties, and it is very important for a customer in assessing fabric quality while shopping, as well as for the end-use and prospective performance of a textile product. In general, fabric hand is primarily assessed subjectively in a few minutes. Although this is a fast and convenient sort of quality control, the subjective nature of fabric handle leads to serious variations in quality assessment. Not only do the consumers use subjective evaluation techniques, but these techniques are also used in textile production, and consequently discrepancy between textile products' quality or hand-feel and the consumer's demand may result in serious quality variations [1,18].

In this situation, objective measurement of fabric handle is desirable to allow more accurate quality comparisons between different types of fabrics. Although there are a lot of studies about fabric handle, because of its complexity, researches are still on going. Many researchers have defined comfort in relation to clothing. According to [7, 17], comfort is not easy to define because it covers both quantifiable and subjective considerations. Comfort is a situation where temperature differences between body members are small with low skin humidity and the physiological effort of thermal regulation is reduced to a minimum. [3] Comfort is not only a function of the physical properties of materials and clothing variables, but also must be interpreted within the entire context of human physiological and psychological responses [9, 10]. Personal expectation or stored modifiers that sort out or influence our judgement about comfort based on personal experiences must be also considered [5].

Comfort as wellbeing and fundamental to that wellbeing is the maintenance of the temperature of our vital organs within a few degrees of 37^{o}C for them to function properly, otherwise the metabolic system can be extensively disrupted and sustained abnormal temperature will lead to death [11]. Temperature control is achieved by changing skin temperature through changes to blood flow and by evaporation of water at the skin surface [6] Comfort in a physical sense as the body being in a heat balance with the environment (thermal comfort), that the body is not being subject to

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pressure from narrow or badly designed clothing (movement comfort) and that skin irritation does not occur from unpleasant contact with clothing (sensorial comfort). [4] Clothing comfort is governed by the interplay of three components: body, climate and clothing. The human body, its microclimate and its clothing form a mutually interactive system. The body and its microclimate are invariable; the clothing system is the only variable [12, 14].

People wear clothing to protect their body from environment. As clothing is being worn, the human body interacts dynamically with it and the surrounding environment [13]. There are four processes occurring interactively that determine the comfort status of the wearer. The processes are: physical processes in clothing and surrounding environments, physiological processes in the body, neurophysiological and psychological processes [2]. These four types of processes occur concurrently. The laws of physics are followed by the physical processes in the environment and clothing, which determine the physical conditions for the survival and comfort of the body. The laws of physiology are followed by the thermoregulatory responses of the body and the sensory responses of skin nerve endings. The thermoregulatory and sensory systems react to the physical stimuli from clothing and the environment to create certain appropriate physiological conditions for the survival of the body and to inform the brain of various physical conditions that influence comfort status [2]. The psychological processes are the most complicated. The brain needs to formulate subjective perceptions from the sensory signals from the nerve endings in order to evaluate and weigh these sensory perceptions against past experiences, internal desires and external influences. Through these processes, the brain formulates a subjective perception of overall comfort status, judgements and preferences [15,16]. Alternatively, the psychological power of the brain can influence the physiological status of the body through various means such as sweating, blood-flow justification and shivering. These physiological changes will alter the physical processes in the clothing and external environment [2]. On the basis of integration of all of these physical, physiological, neurophysiological and psychological processes and factors, the comfort status as the subjective perception and judgement of the wearer is determined [3].

Materials and methods

Materials

For conducting this research ten different samples were used however all samples were knitted fabric. Those samples were used for subjective and objective measurement technique as shown table 1.

Table 1. Specification of samples

S/N	Fabric	Sample Name	Composition
01	knitted	SIN 999	17.5% cotton,65% viloft and 17.5 % smatcel clima
02	knitted	VUB45	45.5% Seacel pure/ 54.5 % cotton
03	knitted	VUB46	29.4 % Viscose /70.6 cotton
04	knitted	Prani	67 % seacel pure and 33 % cotton
05	knitted	VUB43BP	67 % seacel pure and 33 % cotton
06	knitted	VUB43BP	60% Pes Trevira bio, 30% viloft and 10% polyester
07	knitted	VUB44BP	65% PES Dacron and 35% cotton
08	knitted	VUB47	50% smartcel clima and 50% cotton
09	knitted	VUB44BP	65% Polyester and 35% cotton
21	Knitted	S-25VP	80% cotton,15% polyester and 5% viscose

Methods

Tensile. Shear, bending, compression, surface, and friction properties of the functional textile fabrics were measured using tensile and shear stress (KES-FB1), bending tester (KES-FB2), compression tester (KES-FB3), surface and friction tester (KES-FB4). All low stress-mechanical properties of fabric were measure in weft and warp direction. The average results in weft and warp direction were reported and the results were displayed in graph form to see the effects of finishing process.

Results and discussion

The basic mechanical properties of textile fabric such as Tensile. Shear, bending, compression, surface, and friction properties under low stress condition were measured by using Kawabata evaluation system under standard testing temperature and pressure conditions.

Changes in the tensile properties of the fabric under low load condition are shown in figure 1. the tensile properties of the fabric which was tested on Kawabata machine indicates that there is only slight change on properties of linearity, tensile strain and tensile energy per unit area but the high variation of resiliency value between each other. But the highest resiliency value is found on sample six (VUB43BP) and the lowest resiliency of fabric sample is found on sample nine (VUB44BP) in warp direction of fabric test. But for sample five (VUB43BP) the fabric extensibility in the initial load range is high: this provides or indicates the fabric more comfortable in wearing the functional fabric. The higher the extensibility is the better the quality of the textile product in terms of tactile property.

As shown in figure 2 the tensile properties of 10 different sample test results were expressed in graph form and as compared with the results in warp direction the resiliency value is higher in weft direction. The higher resiliency and tensile strain weft direction found on sample six (VUB43BP) and sample nine (VUB44BP) respectively. But for sample four (Prani) the fabric extensibility in the initial load range is high: this provides or indicates the fabric more comfortable in wearing the functional fabric. The higher the extensibility is the better the quality of the textile product in terms of tactile property .therefore the load elongation curve of the functional fabric could provide information regarding the tactile comfort behavior of the product.

As can be observed from the figure 3 at low load the S-25VP (sample 21) is more hysteresis at shear angle 0.5 and high hysteresis at shear angle 5 degree quite high as compared with other functional properties of fabric. Which shows the higher shearing property reduced the resiliency of functional property fabric.in sample six (VUB43BP) the resiliency of the fabric was very high as compared with other finished property of fabrics but its shearing property is too much less. But the change of shear stiffness on functional property of a fabric which is finished by different techniques shows insignificant effect. As can be observed from the figure 4 at low load the S-25VP (sample 21) is more hysteresis at shear angle 0.5 and high hysteresis at shear angle 5 degree quite high as compared with other functional properties of fabric. But the change of shear stiffness on functional property of a fabric which is finished by different techniques shows insignificant effect.

As can be seen in figure 4 the hysteresis at shear angle 0.5 and high hysteresis at shear angle 5 degree quite high as compared with other functional properties of fabric. But the change of shear stiffness on functional property of a fabric which is finished by different techniques shows insignificant effect.

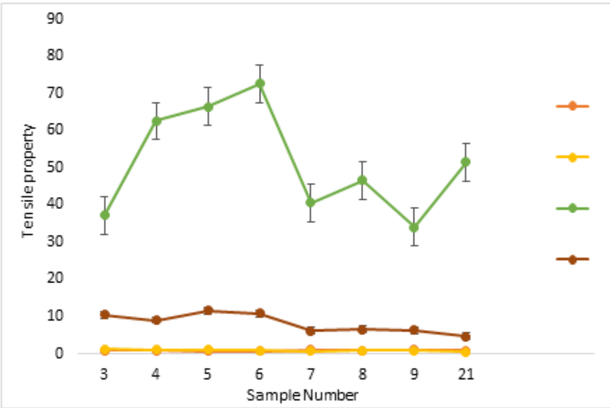

Figure 1. Tensile property of different samples in warp direction

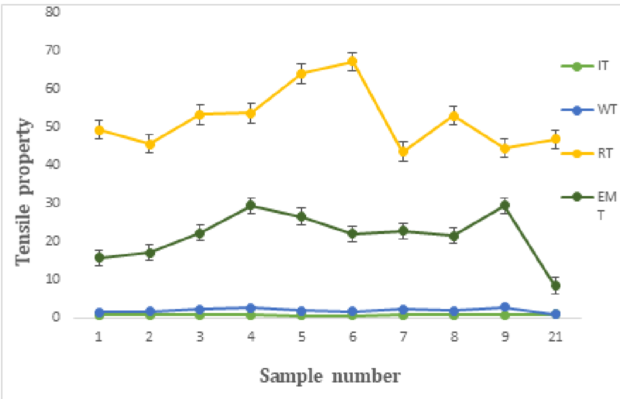

Figure 2. Tensile property of different samples in weft direction

As shown in figure 5 saws two different things; the first thing is the bending rigidity of functional fabric which are treated by different finishing process shows lowest value in weft direction in terms of bending rigidity per unit length and moment of hysteresis per unit length and the second thing is: sample six (VUB43BP)which have lower bending rigidity and moment of hysteresis in both weft and warp direction but highest value is found on sample nine (VUB44BP) in weft direction and sample 21(S-25VP) in weft direction.

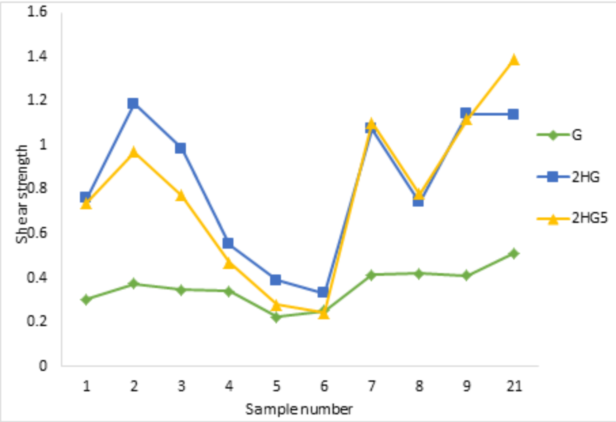

Figure 3. Shear property of different samples in warp direction

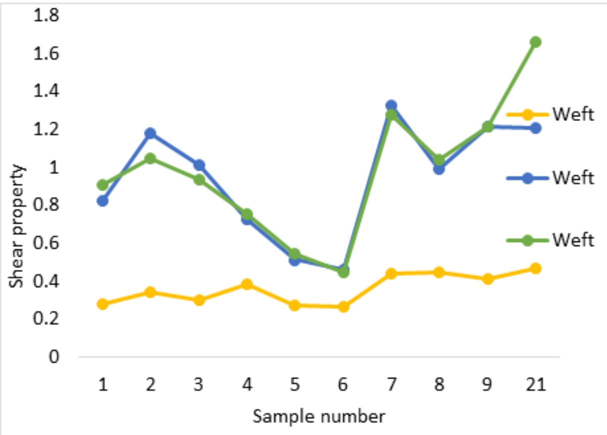

Figure 4. Shear property of different samples in weft direction

As shown on the figure 6 the resiliency values found to be more on sample six (VUB43BP) and five(VUB43BP) but the change of thickness linearity ,energy required for the compression and thickness at maximum pressure shows in significant effect due to finishing process. As shown in figure 7 the quite high value of mean deviation of surface roughness is found on sample one (SIN 999), and the lowest value of surface roughness is found on sample two (VUB45) but the clearly illustrates the change of functional property of fabric samples in terms of mean value of coefficient of friction and mean deviation of coefficient of friction found to be insignificant.

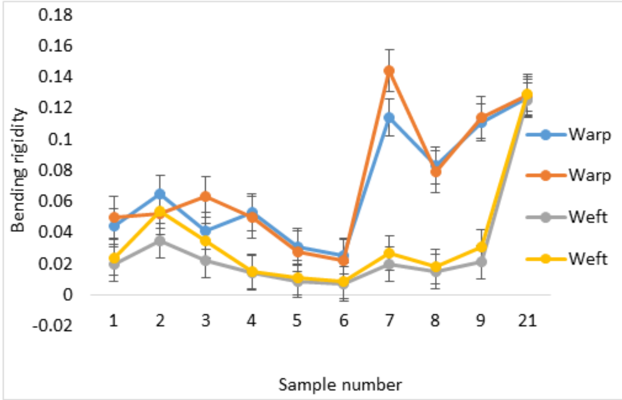

Figure 5. Bending rigidity of samples in warp and weft direction

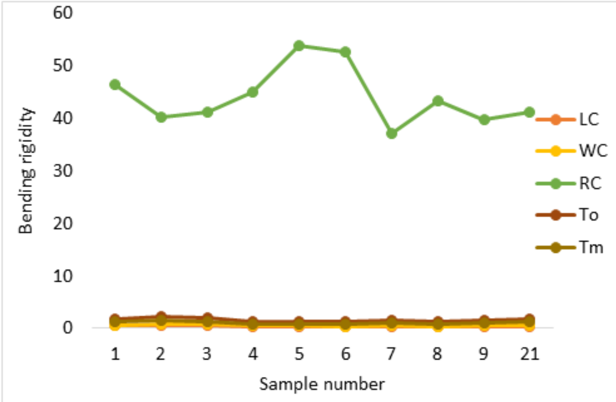

Figure 6. Compression property of different samples

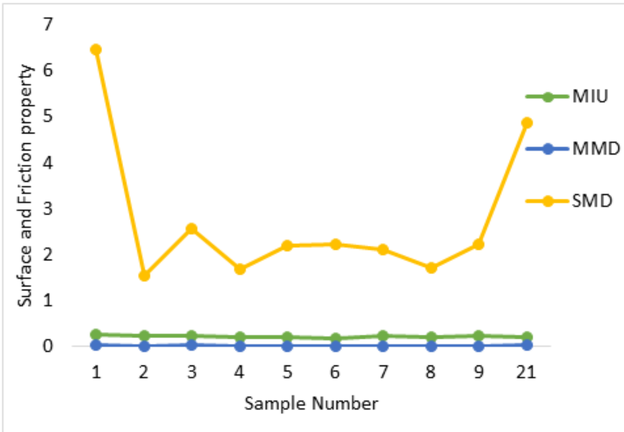

Figure 7. Surface and friction property in warp direction

The change in surface and frictional properties of functional fabrics under various finishing method in weft direction is shown in figure 8. As shown in the graph the change in mean deviation of surface roughness (SMD) in weft direction is significant however the change in fluctuation of frictional coefficient MIU and MMU are quite small. This means the change in smoothness of samples were significant. The weights of the different treated fabric sample were found to be higher in sample 21 and were lower on sample eight (Figure 9). Therefore the overall conclusion on the effect of various finishing methods on tactile properties of functional fabric were observable and detectable.

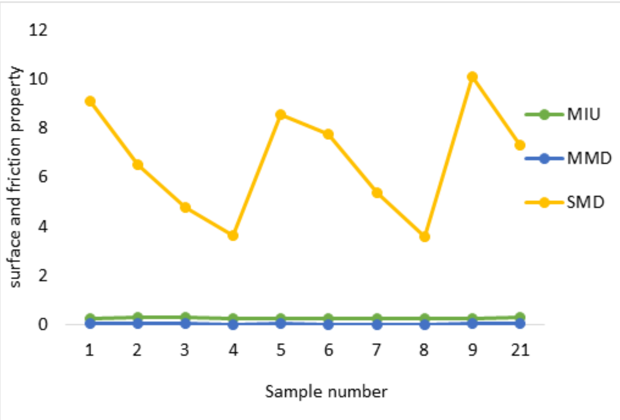

Figure 8. Surface and friction property in warp direction

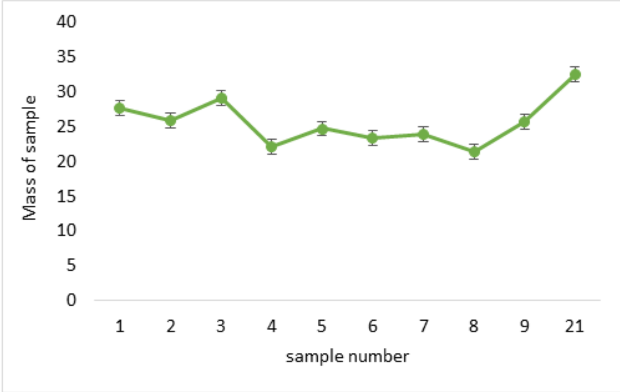

Figure 9. Weight of tested samples

The table 2 shows primary hand value and total hand value of ten different functional properties of fabric in terms of stiffness, Smoothness and Fullness and Softness. In this table the strongest property of fabric based on the primary hand value is found on stiffness on sample twenty one (S-25VP), smoothness on sample four (Prani) and fullness and softness is found also on sample four (Prani).

Table 2. Tabulated primary hand values for Lady Women's thin dress

Properties		01	02	03	04	05	06	07	08	09	21
H.V	Stiffness	5.09	5.31	4.90	5.25	4.75	4.68	5.80	5.71	5.75	6.76
KN-203	Smoothness	7.02	7.21	6.85	8.53	7.85	7.95	8.22	8.35	7.25	5.85
	Fullness and Softness	9.32	9.53	9.21	10.17	9.89	9.69	9.94	9.89	9.33	8.48
T.H.V(K.N-302,Winter)		4.60	4.80	4.42	5.72	5.04	5.01	5.52	5.59	4.82	3.75

The table 2 shows that the total hand value Judges which treated samples of functional property of fabric gives excellent property and poor or out use properties sample twenty one (S-25VP) which have high stiffness property and gives average total hand value property results of sample one(SIN 999), two(VUB45), three(VUB46) and nine (S-25VP) have good total hand values but sample four (Prani) , five (VUB43BP), six (VUB43BP), seven (VUB44BP) and eight (VUB47) have excellent total hand values however the highest total hand value is found on sample four (Prani) and also it have better fullness, softness and smoothness.

Conclusions

These objective test result analysis are established by Kawabata for functional fabrics of ladies winter dress. Ten low stress mechanical properties of fabric were obtained by KES-F. The results are displayed in graphical and statistical manner and the hand value and total hand value of the test results were on acceptable range the primary values of stiffness which was lies between 4.75 to 6.76, smoothness between 5.85 to 8.53 and softness and fullness also lies between 8.49 to 10.17 however we conclude that from the tested functional properties of different finished fabric type the highest total hand value is found on sample four (Prani) and also it have better fullness, softness and smoothness. For ladies winter clothe the best sample from different functional properties of fabric is prani or sample four.

Abbreviations

KES: Kawabata Evaluation System; IT: tensile linearity; WT: tensile energy; RT: tensile resilience properties; G: shear rigidity; 2HG: hysteresis of shear force at 0.5°; 2HG5: hysteresis of shear force at 5°; B: bending rigidity; 2HB: bending resilience behaviors; LC: linearity compression; WC: compression energy; RC: compression resilience; T: fabric thickness; μ: coefficient of friction; MMD: mean deviation of μ; SMD: geometrical roughness.

Conflict of interest

Authors have declared no conflict of interests.

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