

Cotton Clothing Comfort Compare to Polyester

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Abstract

In summer season polyester made garments are not comfortable to the wearer in absence of any softener in fabric, this happens only for the tropical countries like Bangladesh. We have seen that in hot weather polyester made garments wearer doesn't feel comfortable. Besides cotton made garments gives more comfort in the same aspect to the wearer in hot condition. Due to a novel comfort characteristics Cotton today is the most used textile fiber in the world. It has terrific soft hand feel, good moisture absorbency & good moisture vapor transmission. On the other hand polyester is used for different blended fabric & home furnishing materials for its hydrophobic nature and better durability. The main aim of this article is to find out the possible reason of variation of comfort between the cotton garments and polyester garments in the tropical countries. In this paper the comfort of cotton & polyester fibers are demonstrated with respect to their dominating properties, which are affected by some important factors. Some physiological interaction with skin and garments are also taken under consideration with a technical approach in this paper.

Keywords: Comfort, Moisture regain, Moisture vapor, hydrophilic, hydrophobic, Static electricity, Cross section, Hypothalamus.

1. Introduction

Clothing comfort is one of the most important attributes of textile materials. Comfort cannot be reliably predicted by any single lab test of a fabric or by any series of different fabric tests. This is because comfort is inherently subjective; it is entirely a perception in the mind of the individual wearer and thus defies objective, quantified analysis. This perception differs person to person, day to day, and sometimes even moment to moment. "Generally clothing comfort is defined as absence of perceived pain or discomfort." It is also defined as "Welfare, lack of pain and of nuisance." [1]

2. Cotton Fiber

Let's have an overview on Cotton. In the sub-continent cotton based garments are vastly used in clothing. Due to its rapid moisture vapor transmission it is getting popularity day by day. Cotton fiber is mainly cellulose based fiber which contains about 94% of cellulose. Cotton is composed of pure cellulose, a naturally occurring polymer [2]. Cellulose is a carbohydrate, and the molecule is a long chain of glucose (sugar) molecules [3]. It ranges in length of fiber is about 10mm to 65 mm and diameter from about 11 micron to 22 micron. DP of cotton is around 100014000. Cotton is basically a crystalline (about 70%) fiber but small portion of amorphous region also present in the fiber.

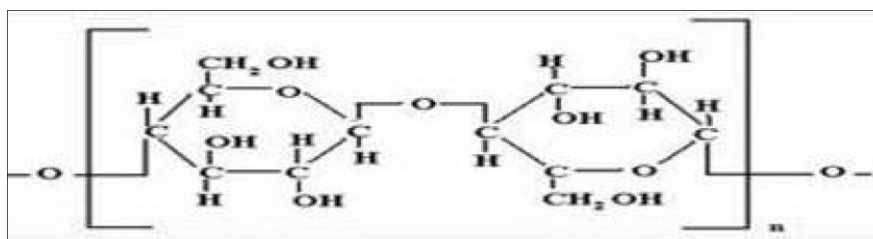


Figure 2.1: Structure of cellulose

3. Polyester Fiber

Polymers are made by a lot of little molecules together to make one long molecule, like a string of beads. The little molecules are called monomers and the long molecules are called polymers. According to the American Federal Trade Commission "polyester fibers are chemically composed of at least 85% by weight of an ester of a substituted aromatic carboxylic acid, including but not restricted to substituted terephthalate units and Para substituted hydroxyl benzoate units" [4 & 5]. Polyester is made by reacting ethylene glycol and terephthalic

acid. Polyester fabric is highly amorphous in the molecular structure, and hydrophobic in nature, which resist water on the surface of the fabric.

4. Variation of comforts depends on:

4.1 Moisture regains

Thermal comfort is depends upon the heat release from human body & moisture release is one of the way of heat loss, a man can release about 1200 ml perspiration/hr. in heavy activity with his Apocrine sweat glands & Eccrine sweat glands. We know that polyester fiber moisture regain is only about 0.4% whereas cotton fiber moisture regain is 7.0-8.5% at 65% RH. If we observe the cross section of the fiber of cotton we can see convolution form of fiber where more than 70% portions are crystalline and rest of it is amorphous portions. The cotton fiber is very absorbent, owing to the countless polar –OH groups in its polymers; these attracts water molecules, which are also polar can able to absorb water [6]. And the major portion of polyester is hydrophobic in nature which hardly allows moisture through the fabric. We feel discomfort whenever our perspirations are on in summer through the body & if the sweat drops are begins to deposit on our skin in order to failure of moisture regain of the garments. Cotton can absorb our perspiration & polyester hardly can do it, therefore polyester garments wearer perceives discomfort.

4.2 Moisture vapor transmission

The rate at which water vapor moves through a fabric plays an important role in determining the comfort as it influences the human perception and the cool/warmth feeling [9]. This process is called moisture vapor transmission. Cotton is a hygroscopic fiber that is it's a hydrophilic fiber whereas polyester is hydrophobic in nature which resists water in its surface. Moisture vapor transmission is relevant to the nature of the fiber. Due to the hydrophilic nature of cotton it attract moist vapor in its surface and then begins to transfer the vapor through the garments. Though it is possible to polyester is hydrophobic in nature which resists water in its surface. Moisture vapor transmission is relevant to the nature of the fiber. Due to the hydrophilic nature of cotton it attract moist vapor in its surface and then begins to transfer the vapor through the garments. Though it is possible to transfer vapor through the pore of fabric but polyester doesn't allow moisture on its surface because of its hydrophobic nature therefore it cannot pass vapor easily through the pore of the fabric. When a fabric allows the transport of water vapor at a faster rate, it is said to be a breathable fabric. In other words, the faster a fabric breath, the better is its comfort. So we can say that cotton is more breathable fabric than polyester.

4.3 Static electricity

The comfort is also depends upon fiber mechanical properties, since static electricity is the collection of electrically charged particles on the surface of a material, various materials have a tendency of either giving up electrons and becoming positive (+) in charge or attracting electrons and becoming negative (–) in charge, Where cotton is the neutral in static charge [7]. Neutral in static charge means it does not react with other matters when it is rubbed with other materials on the other hand polyester is negatively charged when it is rubbed with other surface [8]. It means polyester is highly sensitive to static electricity. Besides human dry skin & hair is charged positively whenever it rubbed with other materials like polyester. Due to this static electricity polyester clothes is remain cling next to skin, which is a great cause of discomfort. And there remain a small gap between garments and skin which trap hot air into it, as polyester is a less air permeable fiber, therefore discomfort is perceived by wearer. And when dry skin getting moist it begins to release charge then static electricity may decrease.

4.4 Microstructural Difference

Under microscope, the cotton looks like a twisted ribbon or a collapsed and twisted tube. This twisted property of cotton is called convolutions. The convolutions give cotton an uneven surface, which increase inter-fiber friction and enables fine cotton yarns of adequate strength to be spun. And the cross section shape is oval not circular like polyester fiber.

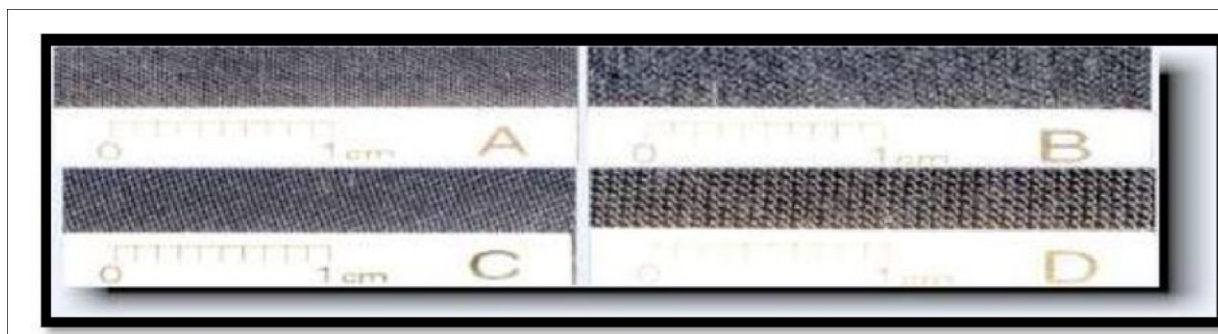


Figure 4.4.1: Microstructure with same specification A: woven cotton, B: knitted cotton, C: woven Polyester, D: knitted polyester.

For this reason the contact between cotton garments & skin is higher, therefore though a small amount of air is trapped in this gap but as the air permeability is possible through cotton, trapped air is capable to transmit through cotton [10]. On the other hand if we see the cross section of polyester fiber there we get very circular even shaped cross section so there should be more pores in the fabric structure of polyester & the pores retain air into them; therefore having more distance to the skin. Where also some air is trapped but not released easily to the environment, which air is getting body temperature and retain heat, as well as creates discomfort to the wearer.

4.5 Sensorial Comfort

Sensorial comfort means the effect of fabric properties on human sense. Our sense works by a nervous system based upon neurons. A neuroendocrine gland called hypothalamus is responsible for the heat mechanism of the body and can send any signal created on skin to the neuron. The contact between the skin and the inner clothing layer determines the subjective perception of clothing comfort, especially at high skin humidity. Strong friction between skin and clothing results in greater displacement of the skin during body movements, and thus leads to a higher degree of discomfort [11]. When polyester fabric gets friction with skin some sort of sound is produced which may be a cause of feeling discomfort to wear polyester garments, whereas cotton is smoothly gentle fabric regarding this aspect. Besides, polyester has a great disadvantage that has a chance of polyester allergy, where cotton is less hazardous from this point of view [12]. Apart from these polyester fabrics can make some discomfort on skin like itchy, tickling, and harsh feelings & causes polyester rash etc.

4.6 Aesthetics

Fabric aesthetics also gives a psychological comfort to the wearer. In case of cotton it is much softer than the polyester whereas polyester is harsh in hand feel. In hot weather cotton gives a rough touch whenever it comes in contact with skin, polyester is less compressible than cotton. In case of abrasion cotton does not introduce any charge where polyester introduces a negative charge, which makes some sort of discomfort to the wearer. Polyester fabric also gives a rough & tough noise if it has friction with different body parts.

5. Conclusion

Cotton is widely used fiber which has a terrific acceptance to the textile market & also to the customer, Cotton is obviously better in warm conditions in terms of comfort, but polyester is also a most popular fiber to produce better clothes for technical purposes, fancy fabric & furnishing purposes. Besides by applying softener and additives to polyester fabric it will become very popular for the casual clothing like cotton fabric.

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