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An Overview on the Influence of Fabric Structural Parameters in Sports Intimate Apparels

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Abstract: Sports intimate apparels are worn next to the skin, which are the key aspect to physiological comfort of sports persons and help to increase their performances. Natural and synthetic fibers are mostly used in sports apparels. Natural fibers have excellent comfort, except wicking, which can be overcome by modifying the fiber profile of synthetic materials, and also imparting finishes in the fabric. It is evident that type of fibre, properties of yarn, structure of fabric, finishing treatment and features of clothing were the factors affecting clothing comfort of sports intimate apparels. Among these the economical way of fetching comfort in the sports intimate apparels can be done through the selection of right raw material, and fabric structure with right structural parameters.

Keywords: Comfort properties, Knitted fabrics, Plaiting, Loop length, GSM.

INTRODUCTION

Sportswear should perform or function for some purpose, by means of moisture management and other techniques sportswear can be made to help people to be active, cool, comfortable and dry. Ref.[6]. In a normal situation, human beings restore a correct balance of heat exchange, modifying the environment. However, outdoor activities are more demanding in terms of thermal balance, the ability of recovering the thermal balance and moisture management is more challenging to achieve. For that reason, Ref.[2]. Active sportswear should provide sufficient heat; air and moisture transfer there by the skin temperature remains within comfortable range and wearer doesn't feel dampness.

Thermal and moisture management properties of fabric are essential factors for deciding not only the comfort but also the performance of wearer. Ref.[8]. Most important purpose of clothing is to provide a stable micro climate next to the skin by maximizing the rate of heat and moisture loss from the body.

Sportswear is typically designed to be light weight so as not to encumber the wearer. On the other hand, sportswear should be loose enough so as not to restrict movement and should possess good sew ability; retain its appearance during wear. It should be durable and have easy-care properties. The sportswear has specific style requirements;

Ref.[3]. Functional requirements of sportswear:-



Fig.1. Sports intimate apparels

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- Optimum heat and moisture regulation
- Good water vapour and air permeability
- Rapid moisture absorption and wicking capacity
- Rapid dryness
- Dampness should be avoided
- Dimensional stability even in wet condition
- Durable
- Breathability and Comfort
- Easy-care properties
- Light weight
- Soft and pleasant touch
- Smart and Functional design
- UV resistance

Textile structures can be engineered to deliver desired properties with respect to heat and moisture transport from the body by manipulating the fibre, yarn and fabric structural features.

Ref [6]. Textile fibres in sports intimate apparel:-

The latest sports textile materials are well-designed in fulfilling specific needs in different sports activities. Sportswear fabrics and apparel that are made for high performance have become an inevitable. Ref.[6]. Advances in fibre science, yarn, fabric production technologies, and finishing techniques are the contributing factors for developing active sportswear fabrics and successful marketing of functional sportswear. Due to the recent inventions in the design and production, today's sports textiles use both manmade and natural fibres.

Cotton is Comfortable Soft Hand, Good Absorbency

The slow drying rate and cold-when-wet, these characteristics of cotton make this material unsuitable fibre for use alongside the skin during strenuous activity.

Wool has good wicking property, highest moisture regain and is a good insulator even when wet. On the other hand, wool is slow to dry.

Regenerated Fibers, are derived from natural sources, and be likely to be absorbent. Tencel is the registered trade name for a type of lyocell by Lenzing, made from wood pulp cellulose. It has a good absorption capability. Usually blend well with other fibers, both natural and synthetic. They are very soft and comfortable making them a good choice for base layers in active wear.

Ref. [4]. Bamboo has excellent UV protection, anti-bacterial and bio degradable characteristics. High moisture absorption capacity, breathability and fast drying behaviour ensure excellent comfort.

Ref.6. *Viloft* is an engineered viscose thermal fibre by Acordis. There is Viloft active, Viloft thermal, Viloft micro and Viloft spirit; the fabrics made from them have a natural look and soft feel and they manage moisture and temperature well.

Synthetic fibers are frequently chosen for sportswear. Polyester has outstanding dimensional stability and offer excellent resistance to dirt, alkalis, and has a comfortable smooth feel. Ref.[6]. It is the fibre used most commonly in base fabrics for active wear because of its low moisture absorption, easy care properties and low cost. Polyester is essentially hydrophobic and does not absorb moisture. However, most polyester yarns used in base layer clothing are chemically treated so that they can able to wick moisture.

Field sensor by Toray Industries Inc. is made from a polyester filament yarn which has the grooves that help the fabric to absorb sweat quickly and disperse perspiration throughout the outer surface for rapid evaporation.

Coolmax by DuPont is manufactured in either tetra-channel or hex channel polyester, which "wicks" moisture away from the skin to the outer layer of the fabric. This fibre grooved sections allow moisture to escape by capillary action and it dries fast, these properties helps the wearer to feel comfort.

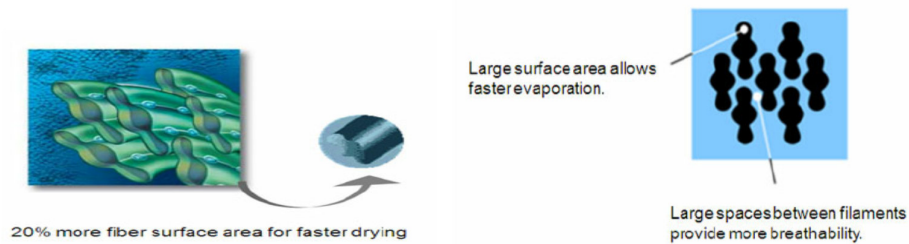


Fig.2. Coolmax fibre cross section

Cool Pass® by Hengligroup is an eternal high functional polyester fibre designed with slots conduct to siphon effect. Ref.[7]. It pulls moisture away from the skin, transfers it to the outer layers. It helps to regulate body temperature and keeps the wearer dry and comfortable.

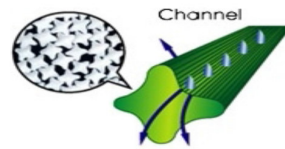


Fig.3. Cool Pass fibre cross section

Thermolite by DuPont is a very fine hollow core fibre for use in the cold weather. The presence of air in the fibre core significantly improves the thermal resistance of the fabric and also convoluted surface of the fibers and the increase in surface air generated by using a fine fibre improve the wicking capacity

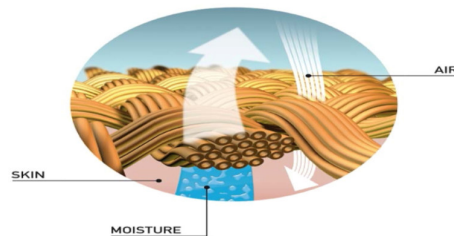


Fig.4. Thermolite fibre cross section

Polypropylene fibers are increasingly being used in sportswear market although its market share is still small. The fibers have very low moisture absorbency but excellent moisture vapor permeability and wicking capabilities. Polypropylene has the advantage of providing insulation when wet. Insensible and liquid perspiration are transported away from the skin without being absorbed making it an ideal fibre for sportswear. Polypropylene is claimed to be a proved performer in moisture management due to its hydrophobic nature and has very good thermal characteristics, keeping the wearer warm in cold weather and cold in warm weather.

Yarn used in Sports Intimate Apparel

Fabrics made from staple-fibre yarns are more absorbent than the fabrics made from filament yarns of the same content and yarn size, due to the looser packing of the yarn. A looser packing in the yarn increases the fibre surface area for absorption and by increasing the gaps between the yarns, increases moisture vapor permeability. Ref.[6]. Staple- fibre yarns also provide better thermal insulation due to the increased volume of air contained in the yarn. They may also improve the sensorial comfort through a warmer feeling to the touch; the yarns have slightly lower areas of contact to the skin.

Fabric Structure used in Sports Intimate Apparel

Over the last few years, there has been growing interest in knitted fabrics due to its simple production technique, low cost, high levels of clothing comfort and wide product range. Knitting technology meets the rapidly-changing demands of fashion and usage. Knitted

fabrics don't encumber there by it provide freedom of movement, but they also have good handle and easily transmit vapor from the body. That's the reason knitted fabrics are commonly preferred for sportswear, casual wear and underwear.

Single jersey fabric has remarkably lower thermal resistance and thermal conductivity and higher water vapor permeability and air permeability. It gives warmer feeling at first touch due to their lower thermal absorptivity values. Ref.[5]. This structure is suitable for active sportswear summer garments for better moisture management properties.

Interlock structure have higher thermal conductivity and less water vapor permeability values due its heavier fabric thickness Thermal conductivity values will be higher. Ref.[5]. Air permeability is lower for fabric with larger specific surface area. Ref.[5]. This garment is suitable for winter garments.

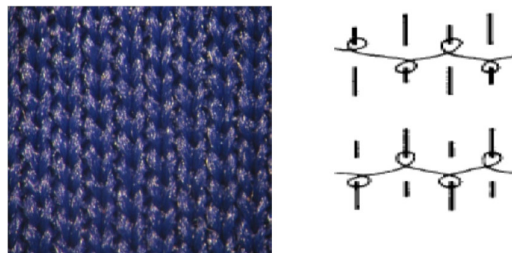


Fig. 5. Interlock fabric structure

Rib fabric absorbs more water but the longest time to drying. Slow release of moisture gives buffering effect.

Ref. [5]. This fabric has higher thermal insulation and higher thermal resistivity due to its thickness.

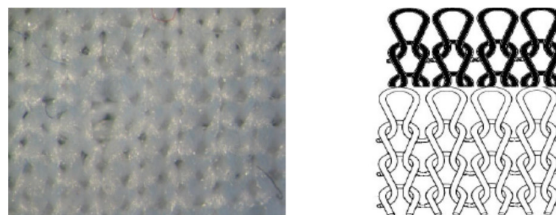


Fig.6. 2 layer fabric structure

Plated fabric have distinct face and back side which may be made from two different yarns. Thus allowing the possibilities to have different properties such as hydrophilic/hydrophobic, finer/coarser on the two faces. These plated fabrics allow rapid transport of sweat, more permeable to air compare to the interlock and double jersey. Air permeability is higher than the interlock fabric. Water absorbcency is relatively higher than the interlock structure.

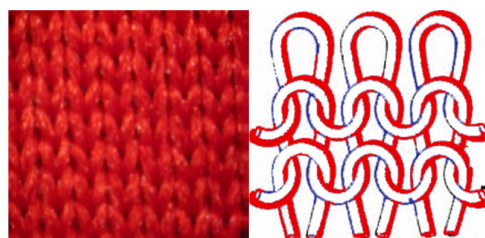


Fig.7.plated fabric structure

Conclusion

This review concludes that, superior comfort can be achieved by plated knitted fabric structure, with the inner layer - hydrophilic material and the outer layer - hydrophobic material with high wicking rate, helps to increase in moisture management properties. Air permeability can be achieved by reducing the fabric thickness and increase in loop length of the fabric. Thermal properties can be achieved by providing sufficient heat transfer through coarser and finer yarn linear density in the inner and outer layer of fabric so the

wearer feels comfortable. Comfort properties in active sportswear can be achieved by selection of right raw material, yarn linear density and fabric parameters (fabric thickness, tightness factor, and weight and fabric structure).

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