

## **7. Different Applications and Developments in Sports Textiles**

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### **7.1 Introduction:**

Technical textiles, such as those used in spacesuits, bulletproof vests and medical implants, as well as automotive applications, geotextiles for embankment reinforcement, agricultural textiles for crop protection and apparel for heat and radiation protection. The industry serves a wide range of other businesses and is quite large and developing. Technical textiles have a 4 percent annual growth rate on a worldwide scale. Currently, construction materials, furniture, hygienic medical devices, and filter clothes are the most common uses for technical textile materials. Depending on their intended function, these technical textiles can be categorized into a wide range of groups. Agrotech, Buildtech, Clothtech, Geotech, Homotech, Indutech, Medtech, Mobiltech, Oekotech, Packtech, Protech, and Sporttech are some of these.

One of the many subcategories of technical textiles is sports textiles. Sportswear, sporting goods, and sporting accessories are the three main divisions of the sports textile industry. Sports shoes, sports composites, sailing and flying activities, parachute materials, artificial grass, ballooning materials, and other technical textile items are also included in Sporttech. In order to manufacture active sportswear, various academics and companies are collaborating to improve the qualities of sports materials. Sportswear materials should have the following qualities: low weight, quick drying, and flexibility. Optimal heat and moisture management, good air and water permeability, prevention of a long-lasting feeling of dampness, low water absorption of the layer of clothing facing the skin, quick drying fabric to prevent catching cold, pleasant to skin, soft, non-abrasive, and non-chafing, durable, lightweight, soft and pleasant touch, and ease of washing are some functional, aesthetic, and comfort requirements for making active sportswear. The type of activity, the surrounding climate, and the degree of physical exertion required all affect how well sportswear performs functionally. Wear performance of highly active sportswear may have an impact on the player's degree of comfort, making it one of the most crucial quality criteria.

Clothing and footwear worn for sports and physical activity is referred to as sportswear or active wear. Modern sportswear is made using advanced materials using modern

technology. Sports textile refers to the clothing used by athletes in a variety of sports, including jerseys or T-shirts, pants, shorts, hats, shoes, and other accessories. Due to the employment of sophisticated and intelligent textile technology, this style of clothing offers several unique qualities.

The need for textile materials in the production of sportswear, under armor, leisure wear, and associated items & equipment has significantly increased as a result of rising interest in active sports and outdoor leisure activities including flying, sailing, climbing, and cycling.

## **7.2 Features of Sports Textiles:**

- Sports textiles must have properties like adaptability, comfort when worn, ease of handling, etc.
- Must be capable of quickly drying and chilling, as well as the capacity to convey heat and moisture.
- Due to the high electrical conductivity of sports apparel, both anti-static and anti-microbial efficacy is required.
- Must have the capacity to offer UV radiation defense.
- This sports textile is known as thermal conductivity, which allows one to feel cool in summer and warmer in winter.
- It should be sturdy and durable while still being as light as feasible.
- Compared to natural and synthetic fibers, sports textiles promise a higher level of protection.
- Easy care, smart and useful design. They also prevent UV-A and UV-B rays, which are harmful to the skin.
- Water and air should pass through the material easily. Moreover, the layer of clothes next to the skin absorbs less water.
- Must be able to quickly absorb moisture. So that the body can quickly absorb perspiration from the skin and aid in keeping it dry.

### **7.2.1 Functional Requirements for Sportswear:**

- **Functional:** Sportswear that is useful must be extremely light, have little fluid resistance, and have a high degree of persistence and flexibility. Important qualities for people looking for comfort and healthy activities include heat regulation, UV resistance, sweat absorption and rapid drying, and vapor permeability.
- **Aesthetics:** Important aspects from an aesthetics or sensitivity standpoint include softness, surface texture, handling, shine, color, and comfort.

### **7.2.2 Primary Components of Sports Textiles':**

Sportswear is made from a variety of knitted, woven and non-woven materials and fibers. However, sportswear frequently uses polyester as a sort of material. Since it is essentially fabric comprised of plastic fibers, it is lightweight, wrinkle-free, durable, breathable and comfy.

### 7.2.3 Fibres Used for Sportswear Are Classified Below:

- **Natural fiber:** Cotton, wool, silk etc.
- **Synthetic fiber:** Polyester, polyamide, polypropylene, acrylic, Nylon, spandex etc.
- **Special synthetic fiber:** Micro fiber, **carbon fiber**, Dacron, lycra roica, Leofeel etc.
- **Modified synthetic fiber:** The fiber which is produced by gel spinning, bicomponent spinning and micro fiber spinning.
- **High performance fiber:** **Aramid fiber**, Novoloid fiber, PPS fiber, PCM fiber, Kevlar etc.

The fabric used to make sportswear can be made using both natural and synthetic fibers. The list of those fibers is mentioned below-

Natural Fibers	Synthetic Fibers	Special Synthetic Fibers
1. Cotton	1. Polyester	1. Micro fiber
2. Wool	2. Nylon	2. Carbon fiber
3. Silk	3. Spandex	3. Dacron
	4. Polypropylene	4. Lycra
	5. Aramids	5. Roica
	6. Acrylic	6. Leofeel

### 7.3 Fabrics for Athletic Wear:

- **Fabrics for Tricot and Quilting:**

Flatbed knitting machines are used to create tricot textiles. They drape smoothly and have outstanding run and wrinkle resistance. Tricot cloth features a distinctive zigzag weave with a smooth side and textured side. As a result, the cloth may be both soft and extremely durable. Layered materials known as quilted textiles are made of two fabrics that are sewn together to create a puffy unit and contain a filling. For extra protection, wind-resistant quilted textiles are ideal for outdoor use. Sportswear is also made using this cloth.

- **Mesh and Fleece Fabric:**

Mesh is useful in athletics because it provides high comfort and stretch as well as allowing air to flow and reach the skin, making it great for ventilation portions of a garment, particularly for locations where heat builds extremely rapidly, like on the back. Often used in sportswear for tracksuits, hoodies, and zip-up shirts, fleece textiles are soft and cozy. Unless it is exceedingly thick, the fabric does not tear, making sewing much easier and the grain line is parallel to the selvage.

- **Microfiber Textiles:**

Microfiber fabrics are often constructed from materials that are very fine, such as polyester, polyamide, or polypropylene. Since natural fibers cannot be as tiny as they are, they are produced from synthetic materials. Due to its fantastic qualities, such as being lightweight, having a silky drape, and being breathable while yet being resistant to rain and wind, microfiber textiles are useful luxury sport materials.

#### **7.4 Other Unique Fibers and Textiles Used in Athletic Apparel:**

It is impossible to provide all necessary sportswear qualities in a straightforward construction made of a single fiber. The appropriate fiber should be used in the appropriate area. The characteristics of the base fiber largely determine how the fabric behaves. The kind of fiber, weave, weight or thickness of the material and the presence of chemical treatments are the most crucial characteristics.

- **Polyester:**

Polyester has exceptional dimensional stability and offers superb resistance to dust, alkalis, rot, mold, and the majority of common organic solvents. Polyester also has excellent thermal stability or heat resistance.

- **Polypropylene:**

Due to its hydrophobic nature and excellent thermal properties, polypropylene is said to be a proven performer in moisture management, keeping the user warm in cold weather and chilly in warm weather.

- **Nylon:**

The characteristics of nylon fiber include being lightweight, having a high strength, being soft, having good durability, and having improved wicking behavior. Because of its poor air permeability, it is most frequently employed in densely woven clothing, which can retain heat.

- **Cotton:**

Clothes made of cotton offer a nice balance of softness and comfort. However, due to its propensity to absorb and retain moisture, cotton is not advised for use in base layer apparel.

- **Roica:**

Leo feel is a soft nylon-66 yarn created by Asahi Chemical, and Roica is a polyether-type spandex generated by dry spinning. In a blended knitted tricot fabric, the Roica and Leo feel give it a soft feel and outstanding stretch. Swimwear is where it is primarily utilized.

- **Bamboo:**

Pure bamboo fiber yarns are used to create bamboo textiles, which have beautiful colors, great wet permeability, moisture vapour transport properties, a soft hand, and improved drape. It is a young company with huge potential for green cloth. Bamboo fiber has a special anti-bacterial property that makes it perfect for making socks, tight-fitting t-shirts, and undergarments. Due to its anti-ultraviolet properties, it may be used to produce summer apparel.

- **Soybean:**

Soy protein present in fibers creates an excellent, soft hand that is endowed with both moisture permeability and absorption, which finds its optimum use in knits and innerwear. Finishes with an antibacterial agent and has health-care features. Its usage in premium knits and innerwear holds a lot of promise.

- **Dermizax EV:**

a competitor, is a thin fabric with a feather-like texture, outstanding waterproof and moisture permeability, and long-lasting water repellency, including 20,000 mm of water pressure resistance and 30,000 g/m<sup>2</sup>/24-hour moisture permeability. It is a great and unique fabric for active sportswear that is waterproof, moisture breathable, and has exceptional durability against the elements.

- **Entrant HB:**

This next generation fabric has a hybrid structure that harmoniously combines the benefits that a coating and lamination have to provide. Excellent durability against repeated washings and high resilience to water pressure characterize it. Outdoor clothing is the primary usage for this fabric.

- **Toray:**

Toray created "H2OFF," a polyester microfiber fabric with a special high-density weave made up of millions of tiny, crimped fiber loops. Additionally, it has excellent and long-lasting wind-chill resistance, outstanding breathability, excellent water repellency, and beauty with a soft hand.

- **Naiva30:**

The high thermal shrinkage feature of Naiva yarn is used to create the many nylon micro-loops that are found on the surface of Naiva textiles. In addition to having superior moisture permeability, Naiva fabric also has certain other advantageous qualities including lightness, softness, and the capacity for secondary finishing. The material is utilized quite effectively in active sportswear and climbing gear.

### **7.5 Alteration (According to Need) To the Fabric's Structure:**

- **Breathable Waterproof Textiles:**

Recent years have seen an increase in the need for materials that are soft yet more resistant, waterproof but breathable, and lightweight but strong. This gave the impression that "smart textiles" satisfied some of these demands. These materials were created and developed to enhance the advantages of exercise and reduce any potential downsides. Elastic fibers are utilized in the creation of more casual clothing to enable unrestricted range of motion and to transfer body fluids to the next fibrous layers. It is feasible to create the optimal structures for practical sportswear with the correct fibers, yarns, and technologies.

- **Layered Textiles:**

Layered fabrics are increasingly popular for athletic clothing. Layered fabrics perform better in terms of thermo physiological control than single layer textile structures. Each layer has a specific purpose; the one adjacent to the skin quickly moves sweat to the outer layer, which quickly absorbs it and evaporates it into the atmosphere.

By doing this, it helps to keep the body cold and remove part of the body heat. The inside is made of a synthetic material with good moisture-transfer capabilities e.g. polyester, nylon, acrylic or polypropylene is used whereas on the outside, a material which is good absorber of moisture, e.g. cotton, wool, viscose rayon or their blends can be placed.

- **Finishing Process:**

Graft polymerization, which produced fabrics with hydrophobic inner and hydrophilic outer surfaces by polymerizing acrylic acid on polyester fiber, was used to manufacture functional sportswear. Due to slower drying times, this style of sportswear is reported to be more comfortable during light exercise but not during vigorous exercise.

By quickly wicking and evaporating moisture, moisture management coatings raise the comfort level in athletic gear. Antimicrobial finishes like beta cyclo dextrin are said to destroy germs, whereas fragrance finishes like microencapsulated peppermint are said to offer characteristics that ease muscular tension. By choosing the right sportswear, heat stress can be decreased.

### **7.6 Factors to Take into Account While Designing Sportswear Include:**

Comfort, Safety, Cost and Availability of Materials, healthy and clean, No negative effects on human health

- **Sportswear Has the Following Qualities:**

Resilience, Absorption, Air permeability, Lightness, Stress and Strain Resistance, Easy to care, Strength, Durability, Tailor ability and Formability.

## **7.7 Applications of Sports Textiles:**

Sports textile usage is now rising steadily. Sports textiles include garments and mats used for yoga activities as well as clothing and sports equipment used in a variety of sports.

**Utilization of Smart and High-Tech Technology in Sportswear:** In sports, high-tech textile materials are nothing new. In recent years, certain materials and patterns have been seen that may swiftly wick away moisture from the body, absorbing perspiration more quickly and drying the skin. All-black jersey patches aid athletes in drying their hands more quickly for improved grip.

- **Sports Fabrics That Breathe:**

For a variety of reasons, certain employees are required to wear specialized protective clothes at work. To improve the capacity to keep sweat away from the body, certain finishing techniques can be employed to increase the difference in surface strength between the front and back of cloth.

- **Artificial Turf:**

Artificial turf is constructed of synthetic fibers and is designed to resemble real grass. It is frequently utilized on a variety of outdoor lawn games like football, cricket, tennis, golf, and ice hockey. It is presently utilized for numerous home lawns, airports, and commercial reasons in addition to the playground. These synthetic fields are utilized in stadiums that are completely or partially covered, away from direct sunlight.

## **7.8 Different Sportswear:**

Sports come in a variety of forms all throughout the world. Below are some examples of popular sportswear categories:

- **Auto Racing Clothing:**

In order to compete in motor racing, a helmet must be comfortable. In order to prevent excessive perspiration when participating in sports, helmets should also have aeration capabilities.

- **Football Wear:**

Football is the most widely played sport in the entire globe. Football apparel should be comfortable, breathable, and flexible. The players ought to feel free and adaptable.

- **Cycling Clothing:**

Cycling clothing is straightforward and really should not be baggy. It ought to be flexible because moving will be very difficult. Clothing should fit properly and not press on the skin at all.

- **Baseball Gear:**

Baseball gear includes cleats, gloves, and professional combat attire. For the athlete to be able to move quickly, the cleats must be baseball-issued. Although professional combat is appropriate, it must be pleasant and not adhere to the similarly.

- **Basketball Gear:**

Basketball players travel a great deal around the floor. Because of this, the court's surface can be slick, making wearing the incorrect shoes deadly. Basketball shoes should be worn with adequate grip, and the accepted footwear is court footwear.

- **Yoga Clothing:**

Yoga is an adaptable sport. Enthusiasts pick clothing that won't restrict their ability to move freely. Stretching is necessary because of the frequent posture changes involved in the activity.

- **Ice Hockey:**

Ice hockey is a fascinating sport, which is why people wear it. Wearing safety gear is crucial for this reason. The equipment should be able to protect the player's neck, chin, and shoulder region.

- **Martial Art Clothing:**

Karate, judo, kickboxing, and kung fu all have clothing options available in the market for practitioners of these arts. Therefore, it is wise to be aware of the particular martial arts sport while purchasing apparel.

- **Swimming Suit:**

Swimwear is a sort of clothing worn by men and women while engaging in water-based activities including swimming, diving, and surfing. It is sometimes referred to as a bathing suit.

## **7.9 Different Trades of Sportswear:**

Coolmax, Lumiance, Dryarn, Killat N, Dri-release, Field sensor, Water magic, Triactor, Sportwool, Entrant, SYPMPATEX, Gore-tex, Naiva, Hygra.

## **World's Top Brands involved in Sports Textile:**

Nike, Adidas, Sky Sports, ESPN, Under Armour, Puma, ASICS, UFC, Brand, MLB, Advanced Media, Reebok.



### **7.10 Conclusion:**

Numerous diverse concerns, like respiratory water resistance, colorlessness, etc. of the clothes are being related with sports textiles and are seeing some significant technical advancement. The degree of comfort in sportswear will surely rise as more breathable clothing is produced in a variety of combinations. To keep players calm and assured, they must possess these attributes. The development of breathable sportswear technology aims to improve athletic performance by combining breathable materials with attributes like UV protection, skins and compression apparel. Additionally, sports textiles are now simply & intelligently fulfilling additional functional tasks through the use of smart textiles & wearable technology. Sports textiles are technological materials that make the wearer comfortable while engaging in physical activity. Variety of sportswear is used in field of sports. However, for greater performance, sportswear often requires specific unique qualities, functions and traits. Therefore, maintaining the right quality is crucial while producing sportswear. High-intensity sportswear is a very broad and difficult subject where the necessary functionality may be provided by appropriate choice of raw material, structure and geometry of fibers, yarns and fabrics, surface modification, and garment assembly technology.

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