

## Innovations in Textile Manufacture

Myrtle Usen IBOKETTE, *Ph.D*,

Dorothy Thompson, *Ph.D*  
Department of Home Economics  
University of Uyo, Uyo

And

Roseline Williams AKPAN, *Ph.D*  
Department of Fine and Industrial Arts  
University of Uyo

### ABSTARCT

*The study assessed innovations in textile manufacture. Manufactured fibers are made in factories from material that are not in fiber form. For example, Nylon fibers are made using petroleum (oil) or natural gas air and water. Manufactured fibers are widely used in clothing. They are found in every other aspect of modern life, for example tires for all kinds of vehicles are made from manufactured fibers. Nylon polyester, are aramid account for two thirds of the tire market. Micro fibres are made of threads that are spun new very tightly and are therefore extremely fine. Such fabrics are usually always light – weight, durable and water repellent. Micro fibre can be used alone to produce 100 percent manufactured fabrics or woven in blends with cotton, linen and other natural fibres.*

**KEYWORDS: Innovation, Textile and Manufacture**

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### Introduction

Fibers are divided into two basic groups: Natural and Manufactured fiber. Natural fiber grown in plants or on animal cotton and wool are examples of natural fibers. Manufactured fibers are made in factories from material that are not in fiber form. For example, Nylon fibers are made using petroleum (oil) or natural gas air and water. Within each group there are families of fibers. All the fibers within a family are similar. They are called by a generic name. A generic name is a name given to a whole class of similar items example “wool” is a generic name. Manufactured fibers are widely used in clothing. They are found in every other aspect of modern life, for example tires for all kinds of vehicles are made from manufactured fibers. Nylon polyester, are aramid account for two thirds of the tire market, (Igbo, 2013). The tires last longer than tuber ones and given better gas mileage. Soft body armor, disposable surgical products, bubble shaped done are all made from manufactured fibers. At the end of this chapter the reader will be able to

1. Mention the first, second and third generation fibres.
2. Describe new developments in fibre and fabric production.
3. Describe some of the environmentally friendly process involved in fibre and fabric manufacture.



## Generations of the Fibre Family

According to Gupta, (2016), a modification of each fibre family is termed the generation of the fibre family. Fibres which were originally classified as manufactured fibres are rayon, nylon, acrylic and polyesters. These have however been modified according to their families, depending on the desired end uses three generations of some families of fibres have been developed and these are:

**First Generation Fibres:** These are the original man-made or manufactured fibres that are still in use till date or presently. These were produced to supplement the natural fibres, they are various forms of rayon, acetate and nylon.

**Second Generation Fibres:** These were developed from the first-generation fibres. They are actually produced to improve upon the performance and appearance of the first-generation fibres. They were made for specific uses, these include fibres for making carpets, tires and artificial furs used as apparel fabrics. They are made to offer specific set of properties to specific consumers.

**Third Generation Fibres:** These are textured filament fibres with specific characteristics designed for specialized textile markets.

These are classified as follows:

- a) bi – component fibre
- b) bi – constituent fibre
- c) blended filaments

**Bi-component fibres:** These are made by combining two modifications of the same generic family. The combination occurs as the solution of fibres is being extruded from the spinneret. For example, the two nylon fibres of different kinds are combined to form one fibre. The different fibres which formed the component have different qualities that complement each other.

**Bi-constituent fibres:** These are produced by combining two fibers from two different generic families. This type of fibres is formed when the two synthetic fibres solutions are extruded through spinneret at the same time. For example, the source fibre, source is a combination of 70 percent polyamide and 30 percent polyester fibre. This type of fibre is produced to replace the use of silk in oriental carpet making.

**Blended filament:** This type is made by twisting or interlacing two different filaments of different generic families together. The combination is carried out after each fibre has passed through the spinneret and allowed to cool. For instance, triacetate and nylon are blended to produce Arnel. They are used in making house coats and Lingeries.

## Specialty Fabrics Fibres and Yarns New Development in Fibres and Yarns Manufacture

In recent years or times, specialty fabrics have been developed. Some of these fibres respond to the sense of touch, hearing, sight and smell some of them have been



produced to behave like natural fibres. Technology has made morphology possible to be used to copy and create new surfaces. Bio-engineering technology is creating fibres that contain natural minerals like silver, jade and mica. Fibres that catch light have been designed by the study of the planes of butterfly wings. The fibres include the following:

**1. Water – repellent fabrics**

Fabric and fabric finishers that repel water are not new but they have been greatly improved (Britannica, 2023). Many of such new fabrics are made from micro fibers. Micro fibres are made of threads that are spun new very tightly and are therefore extremely fine. Such fabrics are usually always light – weight, durable and water repellent. Micro fibre can be used alone to produce 100 percent manufactured fabrics or woven in blends with cotton, linen and other natural fibres.

**2. Insulating fabrics**

As the name denote, insulating fabrics protect the wearer from wind while still letting body moisture escape. Insulating fabrics are lightweight, Flexible and breathable.

**3. Sun-protection fabrics**

Since sunrays can pass through the holes in many loosely woven fabrics, recent discoveries have made it possible to produce fabric that can offer total protection from ultraviolet rays. Such fabrics are said to possess ultraviolet protection factors (UPF) or Sun Protection Factors (SPF). (ARPANSA, 2018), The Ultraviolet rays penetrate deep into the skin and cause aging. Sun protection or the ultraviolet protection fabrics can protect the wearer from ultraviolet rays about the equivalent of a Sun Protection Factors (SPF) of 5 to 15 sun protection fabric are produced by batting such fabrics in a special chemical solution. This produces fabrics with SPs of 50 or more. Such sun protection is supposed to last through numerous washings before they can wear away. An example of fabrics with this property includes coldblack which guarantees a minimum of UPF 30.

**4. Antibacterial fabrics**

Textile manufactures have developed fabrics that can resist bacteria. In sport clothing, these treated fabrics can act as a built-in deodorant since the chemical treatment destroys these bacteria that cause perspiration odors. Antibacterial fabrics have also found significant use in hospitals and where sheets with built in resistance to bacteria can reduce the spread of diseases.



**5. Sorona Fabric**

This is a new form of nylon with a very 20ft feel and a fantastic wear resistance. It has a good dye ability and stretch recovery. Sorona fibre is a corn-based polymer produced by the process of bio technology.

**6. Fabric from slugs**

With mounting concern for the preservation of the eco-system, sludges produced by bacteria in a vat of fermenting wine has been used to produce a foul smelling fabric which could be refined to be a fabric for the future.

**7. New treatment of Leather**

Leather fabrics of the early 80s and 90s were stiff and thick skinned with boxy sunouettes. However, technological innovations in leather fabrics production have brought leather fabric treated and made thin, super supple and as light – weight as woven fabric. This has changed the looks of coats, Jackets, Skirts and dresses. Leather fabrics are also given different types of finishers are distress, patent or glazed in different shades beyond black and brown.

**8. Development of sport wear fibre**

Some fabrics like fleece and sympatex have been developed for fluctuation in weather conditions. Moisture management fabrics have also been developed to accommodate the desire for more comfortable sport wear. The coolmax is an example of such sport wear fabric. The coolmax family of fibres with effective moisture management properties are now produced for individually demanded requirement and guarantees that the consumer stay cool and dry in every situation.

**9. Tactel fabric**

This is another form of sport wear fabric. Tactel creates either shiny, bi-multicolored or iridescent effect in stylish exercise and leisure clothing. Family of there include the following.

- a. Tactel fresh fx: This is from the polyamide family. It combines the anti-microbial properties of silver-a natural innocuous and dermatologically tested active ingredient with the typical characteristics of tactel family.
- b. Tactel super micro: This is an extremely light-weight super fine yarn that is perfect for sheer light weight fabrics. It is used for producing intimate apparels.
- c. Tactel Diabola: This particular fabric has an unmatched draping quality and is brightly coloured. It is favorite with intimate apparel manufacturers and brands.
- d. Interactive Textile Fabrics: These fabrics are with technology literally woven in them. They can do things like changing its colour, broadcast and receive radio signals and act as keyboard under one's fingertips. Emergency innovations



have projected that extensible and interactive fabrics can be used to produce dress beyond the function of dress. They can be used as washable interface screen which is voice activated. The voice activated interface screen would be used to control the outer appearance of the garment (Weber, 2009). The wearer could programme an infinite number of looks or combination into the computer by accessing the interface memory bank just like MP Players. This image projected would extend beyond their body's mass but would be slightly transparent on close inspection. Expansible dress would be based on technologies similar to OLEDs and PLEDs where the image appears over the wearer entire body.

## 10. XD Spacer Fabrics

These are fabrics with extra dimension they are a range of three-dimensional knitted spacer fabrics mainly produced on double needle bar warp knitting machine. Their thickness varies from 3mm to 20mm, (innovationintextiles, 2009). Spacer fabric are widely used in place of foam and neoprene products.

### Advantages of XD Spacer Fabrics

They have the following advantages

- |                                     |  |
|-------------------------------------|--|
| i. Good breathability               | ii. Good insulation property               |
| iii. Excellent compression strength | iv. Good durability                        |
| v. Can be recycled                  | vi. Good pressure re-distribution property |

### Uses of Spacer Fabrics

XD Spacer fabrics are used in the manufacture of the following key application

- |                       |                          |
|-----------------------|--------------------------|
| - Cycle helmet        | - Boot soles             |
| - Medical products    | - Neoprene replacement   |
| - Compression product | - Firemen's clothing and |
| - Body armour         |                          |

Fibres employed in the production of XD Spacer fabrics. The following fabrics are used in the production of XD Spacer fabrics

- |             |                               |          |
|-------------|-------------------------------|----------|
| - Polyester | - Coolmax                     | - Neomax |
| - Kerlar    | - Polyamides and Micro fibres |          |

## 11. Easy Care Wool

These are used in the production of easy care sleeper wears that have the following properties.

- Light weight
- Does not need chemical treatment



- It helps to induce sleep
- Maintains and regulate temperature
- Looks and feels fantastics
- It has a combination of merino looks and other natural fibres such as bamboo and silk yarn structure fabric weaves, knits and finishing procedures.

## 12. Latest Fibres and Yarns

Tokyo institute in Japan has developed a highly crytaline carbon nanofiber (CNF) which has 30% greater conductivity than conventional products. All the same, (Technical Textile, 2011). Fibres with an extra conducive VNF of 100-300 nanometers have long been developed with a melt-spinning process.

## 13. Automative Fabrics

Presently in Brunswick, Australia some researchers are using a natural bio polymer found in crustaceans (Crabs) to produce odourless fabrics used in the Automative industry.

## 14. Nano-Structure Fibre

This fibre is developed for the production of advanced fire fighting suits. It is produced by new Energy and industrial technology development organization (NEDO). Nano fibres are produced by electro-spinning. Fabrics produced by Nano technology have large surface areas. They are light weight and breathable. They are impermeable to chemical and biological agents. Nano composite fibres can incorporate particles of metals that create a shield from UV rays and other harmful agents. They can incorporate capsules that react to body temperature to release drugs and perfume.

## 15. Tencate Inkjet Nanoprinting Technology

This is based on inkjet technology ink or coating particles are applied with great production precision and high speed. It reduces production coats and develops unique new materials which strengthens its leading position in its core market. This inkjet technology not only leads to an innovative printing technology but also to a new nano-process technology which can apply high speed and added value functionality to textile substrates. It helps to realize large environmental benefit and save energy.

## 16. Skin Friendly Polyester

This has stable pH level and was developed by a company called Tejin Ltd. According to their company, it has developed a new polyester fabric that is gentle to the human skin by stably maintaining its mildy acidic pH level similar to healthy skin. It is produced by modifying polyester rather than adhering agents to fibres to enable it to maintain its pH level stably after repeated washing and wear while also maintaining polyester's supreme characteristic such as water absorption and quick drying properties. This fabric has odour prevention properties, anti-bacterial finish and its stain resistant, (Technical Textile, 2011).



## Properties

This fabric has the following properties

- Low functionality
- Limited durability
- Loss of original texture over time
- Limited to water absorbing (hydrophilic fibres) and
- Capacity to dry preparation quality.

## 17. PLA

These are new synthetic generic fibre from sugars found in crops such as corn and sugar best. This fibre shares many characteristics with polyester. They are UV and chlorine resistant. Its producers claim they are superior in softness, stretch recovery and have more vibrant colours than polyester.

## 18. Production of Cashgora

This fibre is a new natural fibre produced by crossing feral goats with angora bucks. It has a soft and natural feel, but not as bustrous as cashmore. It can be blended with wool to produce light- weight fabrics. Cashgora can also be blended with lycra to give extra stretch and stability.

## 19. LUNAFIFA

This is a new cotton fibre with wool core. This fabric is washable soft, smooth and warm, but has highly affinity for moisture.

## 20. Compression

This is produced by the Nalini compression technology. It is the new cycling clothing line that feature the benefit of graduated muscles compression. This technical innovation takes sport performances to the highest level through the process of enhanced muscular vascularisation some of the benefits of this fabrics are:

- Reduced muscles pain after physical activity
- Increased venous return
- Enhanced faster lactic acid elimination
- Increased physical power and strength
- It has higher endurance level.

## 21. Process 2000

This is a finishing process that applied the process of curning to keep garment wrinkle free. The process of curning involves treating the fabric in a heated chamber to set crease in the fabric permanently.

## 22. Dryarn

This is a microfibre that is of well-being and performance while respecting the health of individuals and their environment. It is an innovative polypropylene microfibre with high performance level. It is light weight insulating and transparent as well as hygiene, comfortable and environmentally friendly. It is a very stable fabric which does loose its shape unlike unconventional fabrics. It is very durable and always in



form. It does not absorb humidity and dries very quickly when washed. It gives the skin a pleasant fresh and dry sensation.

### 23. Field Sensor

This fabric is designed to keep the wearer always dry and comfortable. It is a high-performance fabric, it achieves this by adopting nature's techniques, such as the capillary action by which trees ensure that even the smallest branch and leaf stay in the field sensor multilayer structure. The wearer's perspiration is quickly by its inner layer and transported to the layer through capillary action. It allows perspiration to evaporate rapidly leaving the weaver comfortable.

### 24. Man to Dry

This fabric is highly absorbent. It absorbs moisture and quickly disperses it. It allows for effective heat exchange its properties include:

- Transpiring
- Easy care
- Resists delicate washing and
- No ironing
- Size stability
- Good soil release capacity

## Environmental Concerns in Textile Fibres and Fabric Production

The growing demand worldwide environmentally friendly products has generated a new awareness and ingenuity at each level of textile production in the industry. Many countries like USA have established an environmentally excellent programme to make textile producers take action to protect the environment through their American textile manufacturers institute. In these countries encourage recycling environmentally efficient manufacturing and finishing processes are encouraged (Dilley, 2011). This has led to many textile firms now budgeting and planning for environmental improvement. Environmental protection can be carried out through the following:

- i. **Alternatives in Cotton growing:** This involves new standards being set for the growing, processing printing and dyeing of natural cotton fabrics. Some firms in the USA have developed naturally coloured brown, green and blue cotton that eliminate the need for dyes. New species of cotton that are insect and water resistant are being developed. These cotton species require little or no chemical insecticides or fertilizers. The Utilization of organic farming techniques has led to the production of chemical-free cotton fibres.
- ii. **Recycling Polyester:** These are made of empty soft drink, soda bottles and polyester manufacturing wastes, they are cleaned, chopped, melted and spun into fibre and used monthly as fleece for the production of outer wears.
- iii. **Alternatives in fibre and fabric Production and finishing:** Recently, many companies are working to develop non-toxic pesticides, environmentally friendly alternatives to PVA and finishing detergents. Citric-acid cleaners have been produced to replace phosphate and chlorine. Natural oils have been used to produce petroleum lubricants. Bi-functional fibre-reactive dyes have been





- developed to decrease the use of water and the production of waste (effluents). Resins are now used to replace acid washes in textile production.
- iv. **“GREEN” jeans:** Formerly, the textile industry in USA was dumping approximately 70 million pounds of scrap denim into American landfills yearly, but now some universities in conjunction with some industries have developed a method to reclaim the cotton waste from denim and convert it into yarn for re-weaving. The new fabric is called REUSED DENIM. It is made of 50 percent reclaimed denim yarn and 50 percent virgin cotton yarn. Companies are also making efforts to reclaim scraps from other fabrics.
  - v. **Green cycling jerseys:** These are produced from advance biophyl and thermocool technical yarns used in the manufacture of mens summer wears. They keep the body cool and are still environmentally friendly.
  - vi. **Eco-friendly silk:** Tango bio-fabric industry in Osaka Japan has developed eco-friendly silk fabrics for Bio-front, a type of bio-plastic polyester polymer rather than adhering agents to fibres to enable it to maintain its pH level stability after repeated washing and wear while also maintaining polyester.
  - vii. **Sun-protection factor:** Fabrics are now given sun protection factor (SPF) of 5-15 in order to make them environmentally friendly. This makes the fabric to offer total protection from the total protection from the ultraviolet rays occasioned by global warming which has led to the depletion of the ozone layer. Such fabric is bathed in a special chemical solution which gives the sun protection factor of up to 50m. Also, special type coldblack technology has been developed and used in the manufacture of posh design sportswear for men (ARPANSA, 2018). Coldblack is a type of finish which can be applied to fabrics to actively reduce the absorption of the sun rays and offer reliable protection from the damaging ultra-violet rays.
  - viii. **Use of dry printing methods:** Dry printing is a process of decorating fabrics. The wet methods produce much effluent while the dry methods do not. In the dry printing method, there is relatively little water waste or harmful effluents (like the liquid residue after dyeing fabrics) that need to be disposed of. Hence, since it is more environmentally friendly.
  - ix. **Re-cycled bottle-pet fabric:** RE-PET as it is fondly called is a new eco-friendly fabric developed by textile company known as MOA SPORT and is got from the recycling of PET bottles which have the same characteristics as polyester yarns but have lower or less adverse effect on the environment. This fabric helps to conserve energy and preserve natural resources.
  - x. **Thermocool:** The need for environmental sustainability has led to the replacement of traditional petrochemicals with renewable resources. Thermocool is therefore one of such fabrics being produced in order to sustain the environment
  - xi. **BIA-loves green:** This is a warp knitted bi-elastic fabric. It has low environmental impact' it has a low CO2 emission property. It does not consume a lot of energy and water during the processes of production. It has very good colour fastness.



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