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TEXTILE MATERIALS AN INVESTIGATION BY TECIDOTECA ABOUT FABRICS, KNITS AND NON-WOVENS IN TIMES OF A COVID-19 PANDEMIC

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Abstract: In everyday life we use clothes, fabrics that are flat and flexible; knits that fit better to our body and the well-known non-wovens (NT), but recently textiles have gone beyond clothing and have become essential in the fight against the global pandemic caused by COVID-19 as raw material for making masks, and in the production of equipment. protective equipment (PPE) resulting in a high demand for non-woven fabrics. In this scenario, many doubts arose in relation to textile products for protection against the virus, in view of that, the textile industry became the focus of research and comments about its needs, raising questions such as: Which textile material is ideal for protection against coronavirus? To answer these questions, it is necessary to understand how the textile chain takes place as a whole, from the formation of a thread, a fiber, a fabric, a mesh and the non-woven, as well as the processing. In order to identify the contributions of non-woven fabrics for use in the manufacture of PPE products, as protection against the virus, the non-woven flag, built in the Tecidoteca project, is presented. It brings an image of the right side / reverse side and non-woven roll, the technical sheet, as well as the application of use and market segment.
Keywords: Fabric library, non-woven, COVID-19.

INTRODUCTION

The raw materials used in the textile industry are varied, and the objective is to adapt the most different fiber solutions to the market. For this reason, it is essential that manufacturers in the textile and related sector know the types of fabric and the purpose of each material used and how they behave in the face of new needs.

Then,

> Textiles have always been considered one of the oldest manufactures of man, because since always, man intertwined palm leaves, tanned and sewed the skins to use on his body with time and the transformation of the raw material, he learned to handling the fiber and transforming it into yarns, fabrics, knits and, finally, finishing' (VASQUES, 2018).

However, "[...] to measure not only the spontaneous associations that most people have when 'seeing' a fabric, non-woven or knitted, but its particularities such as: composition, nomenclature, manufacturer/ supplier, protection capacity, analysis the surface of textile design, its aesthetic message, wear segment and conservation" (VASQUES; GOMES; FORTUNATO; PAIVA; BARCELOS; MENEGUCCI, 2013, p.109).

The relevance of the textile area is articulated from the course of society and humanity. According to Silva (2012, p. 11).

> The history of the relationship between human beings and tissue is intertwined with the humanization process itself. From the dawn of civilization, when man settled in groups, he began to spin and produce fabrics. Initially, natural fibers such as cotton, linen, wool, silk and, more recently, artificial fibers were used.

We believe that, as important as food production and livestock production, textile production has been fundamental to our humanization, which radically differentiates us from other animals (SILVA, 2012).

In this sense, fibers are very thin and elongated materials, like filaments that can be continuous or cut. The fibers serve as raw material for manufacturing, and can be spun, for the formation of threads, lines or ropes or arranged in blankets, for the production of paper, felt or other products. (DICTIONARY..., 2014). Textile fiber is initially classified as natural fiber (vegetable, animal and mineral) and non-natural/ chemical fiber (artificial and synthetic).

Natural fiber - **Mineral fibers** have their origin in rocks with a fibrous structure and are essentially constituted by silicates. An example of a fiber of mineral origin is asbestos; **vegetable fibers** are elongated structures, with a rounded cross-section, which can be classified, according to their origin, into: seed fibers, stem fibers, leaf fibers and fruit fibers; **Fibers animals** they can come from the glandular secretion of some insects, as is the case of silk, or from hair bulbs of some animals and present a molecular structure composed of keratin, as is the case of wool. (FIBRENAMICS, 2022).

Non-natural/chemical fiber - **Artificial fibers** they are fibers produced by man, but using raw material from natural products, such as cellulose. Artificial fibers are obtained from the transformation of natural polymers, through the action of chemical agents, in extrusion processes. For the most part, the precursor polymer of artificial fibers is cellulose, extracted from cotton linters, leaves of trees, such as eucalyptus, bamboo, soy, corn, among others. Other precursors, such as casein from milk or alginate extracted from algae, can also be used. The most used are: viscose (CV), acetate (CA), Lyocel and modal; **Synthetic fibers** are fibers produced by man, using chemical products from the petrochemical industry as raw material. The best known are: polyester (PES), polyamide (PA), acrylic (PAC), polypropylene (PP), and polyurethane (PUR), elastane (PUE). (FIBRENAMICS, 2022).

To understand how the textile industry works, we have two basic flowcharts about textile fibers, in FIG. 1 the scheme is carried out by the Brazilian Association of Artificial and Synthetic Fiber Products (ABRAFAS) and FIG. 2 a Basic Configuration of the Textile Chain made by the Union of Weaving,

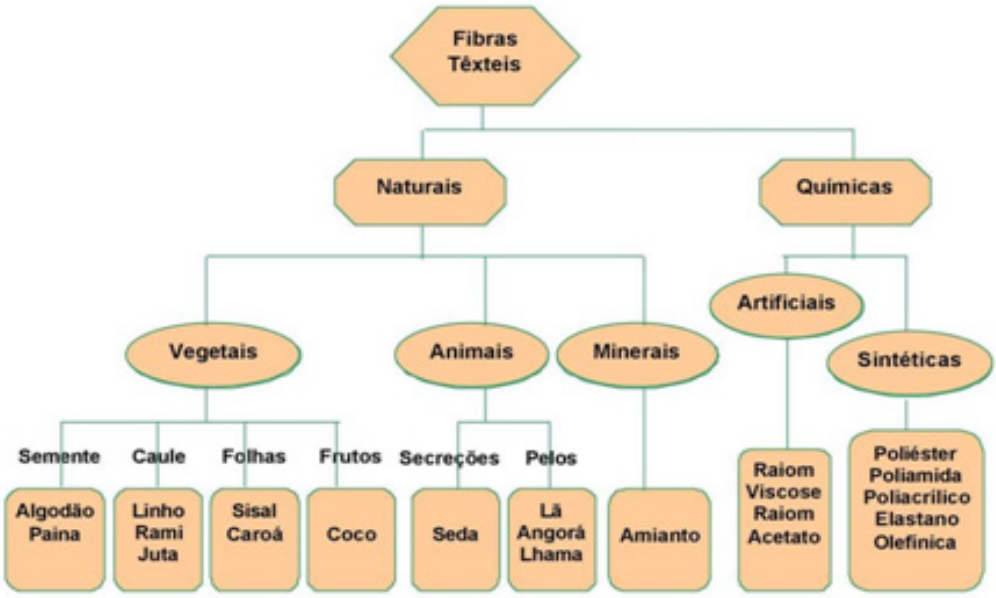

Figure 1 – Textile fiber classification flowchart.

Source: ABRAFAS (2020).

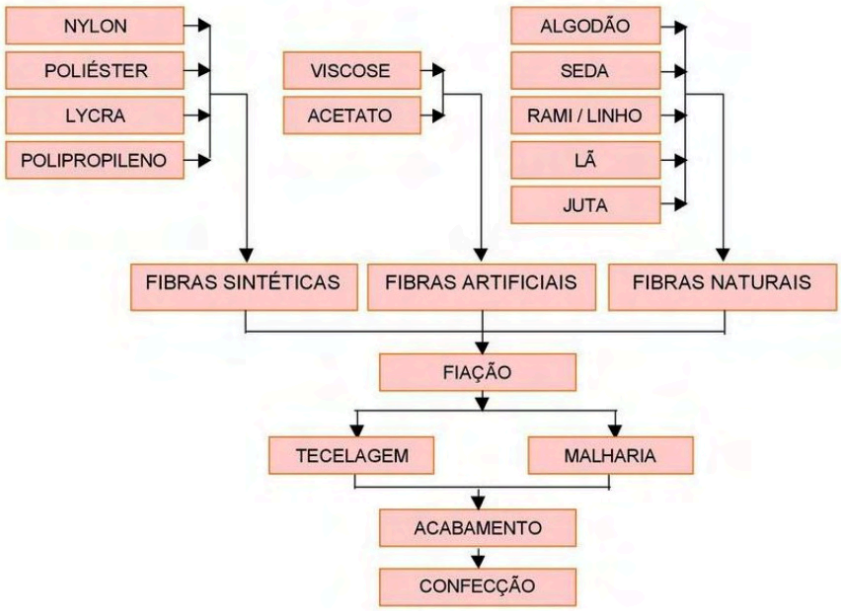

Figure 2 – Flowchart of the basic configuration of the textile chain.

Source: SINDITEC (2020).

Spinning, Threading, Dyeing, Printing and Yarn and Fabric Processing Industries of Americana, Nova Odessa, Santa Bárbara do D'oeste and Sumaré (SINDITEC).

Among the textile fibers there are two main natural and unnatural fibers. Among the natural ones, there is cotton fiber (CO), as shown in FIG. 3, considered the most important among the natural plants due to some of its characteristics, such as: touch, tangibility and softness.

The textile and fashion sectors place great value on natural cotton (CO) fiber, both 100% and in blends with other natural or non-natural fibers. Non-natural fibers have three divisions: artificial (cellulose), synthetic (polyester) and non-synthetic (metals).

Polyester (PES) is one of the most used non-natural fibers by the textile industry. Its raw material is mainly terephthalic acid and ethylene glycol, respectively, ethane diol. The transformation of this fiber takes place by filaments into threads and the process is done by melting this raw material, which is usually carried out at temperatures close to 90ºC. This occurs so that the fiber increases its consistency and reduces the elongation at break and the tendency to shrink (this fact is essential, as it always returns to the original stage, that is, it does not shrink).

WIRES AND THE WIRING PROCESS

The fibers are transformed into threads by physical processes, through the spinning machine and, thus, the threads are transformed into fabrics, comments the author Daniel (2011, p.22). And how are textile fibers processed, transformed?

After choosing the fibers, the process of transforming the fibers into yarns (spinning) takes place by means of machines that clean, twist and determine the thickness and length of the yarn, using either cotton (CO) or polyester fiber. (PES) among others. And so, the stacking and opening of the bales will take place, then the fiber is introduced in the spinning process; through a conveyor belt (pre-feeder), the product is inserted, which automatically eliminates fine and coarse impurities; after suction, the fiber comes out in flakes, which are transported to the next process (carding), this process is known as carding, which receives the fiber flakes (PES) or (CO) from the previous process and completes the cleaning process of the fibers, initiated by the beater (eliminates the husks, pieces of stems and earth). At that moment, separates the fibers themselves, the short and long fibers, and the parallelization of those that come out in the form of a wick (known as a bridal veil) occurs. Then, the card delivers several rovings to passers (it has the function of regularizing the rovings coming from the card and stretching). In the following process, the fiber passes through a machine known as a roving frame, which has the purpose of stretching and parallelizing it, giving it a small twist, as stipulated for consumption, it will be introduced to the yarn, fabric or knitwear segment. At that moment, the fiber is in the form of a wick directed to the spinning machine that has the performance of determining the twist of the textile material and placing the yarn in fixed positions to improve performance and productivity. The twist, which basically depends on the fineness of the yarn being produced, is obtained through the output speed of the product from the first pair of cylinders and rotation of the spindle. And, finally, we have the conical machine that transfers the bobbin threads from the spinning machines to the conical coils. Subsequently, after winding the yarn in the cones, the steaming process can be carried out (which is done to improve the strength of this yarn) and finally for dispatch, which

Figure 3 – ginned cotton fiber (CO).

Source: Collection of the UEM-Moda/Cianorte Fabric Library (2020).

Figure 4 - Polyester Fiber (PES).

Fonte: Acervo da Tecidoteca UEM-Moda/Cianorte (2022).

is directed to the segment of use (clothing, weaving and knitting).

FABRIC: WEAVING PROCESS

Weaving is one of the oldest arts. Like many other arts, centuries have passed being performed in the same way and their improvement has been very slow. So slow that the same generation could not notice any change. Rodrigues (1996, p.17). However, currently the innovations and technologies in the weaving area is one of the most advanced, or better, that has revolutions per minute (RPM). Fabrics can basically be classified into flat, dobby, looped, special and non-woven. Flat fabrics are characterized by the interlacing of the weft and warp yarns. Within this category (flat), there are smooth fabrics, which have a uniform appearance, dobby fabrics (whose appearance, has some decoration, can be obtained by the weave of the threads - for example, checkered, striped) and jacquard, which has a decorative effect. produced by weaving (the weft threads follow a determined path to form the designs). Examples of jacquard are apricot and brocatel fabrics. In knitted fabrics, there is no interlacing of weft and warp, for this reason it has greater elasticity. In looped fabrics, the process consists of an association of interlacing the knit and the common weaving, lace is an example. That is, in many textiles, the decoration of the fabric comes from the construction of the material itself, which forms the pattern (EDWARDS, 2012, p. 12). After being spun, the fabric is constructed (weaving) on the loom, which has three fundamental connections: canvas, twill and satin.

KNITTING: WEFT AND WARP

Diana Von Furstemberg, a knitwear enthusiast, created her first piece, a lace-up blouse, in the same way as her ballet creations, and then evolved into the crochet dress, or coeur, which became a classic for the fact. to be knitted. The mesh is capable of embracing the most complex forms of the human being (DANIEL, 2011, p.135).

> The machine knitting industry dates back to the early 16th century, but it couldn't be more alive and interesting than it is today. Knitwear offers infinite creative results, enabling an independent and experimental approach to design. Recent advances in technology and manufacturing, together with contemporary yarn treatments and technology, have given the industry a renaissance and today, knitwear can be found at all levels of the fashion market, from mass production of socks, underwear and sports to the use of its sculptural qualities in high fashion and accessories such as bags, shoes and jewelry. The technique also offers an incredible range of possibilities for art, interior design and architecture (SISSONS, 2012, p. 7).

The technology of knitting fabric that is obtained by loops, forming a mesh in the tubular format. They consist of fabrics with needles intertwining the threads in several series of loops (knits) that are interconnected with each other. There are two distinct forms of loops, weft knitting and warp knitting.

And, finally, the processing (finishing), which are printing, dyeing, laundry and embroidery, among others. Therefore, they are constituted by several processes, aiming to improve the physicochemical characteristics of fibers, yarns, knits, fabrics and non-wovens. After knowing the entire textile trajectory of the textile chain process, we have the most used textile product to protect against COVID 19, the well-known non-woven fabrics (TNT), currently scientifically known as non-wovens (NT).

THE NONWOVENS (NT)

According to the Brazilian Association of Nonwovens and Technical Fabrics Industries (ABINT, 2022),

> According to the NBR-13370 standard, Nonwoven is a flat, flexible and porous structure, consisting of a veil or blanket of fibers or filaments, oriented directionally or at random, consolidated by a mechanical (friction) and/or chemical (adhesion) process) and/or thermal (cohesion) and combinations thereof. Nonwoven is also known as nonwoven (English), notejido (Spanish), tessuto nontessuto (Italian), nontissé (French) and vliesstoffe (German). Some stricter definitions, which are beyond the scope of this document, to differentiate Nonwovens from some types of paper, establish percentages of very short vegetable fibers in relation to the total mass.

To better illustrate and understand the process of fabrics, knits and non-wovens, FIG. 5 clearly shows the structure of a fabric (interlacing of a set of warp threads and another set of weft threads, forming an angle of (or close to) 90°). Knits can be weft or warp. And finally, nonwovens, a tangle of compacted or needled yarns.

CLASSIFICATION OF NONWOVENS

There are several technologies to manufacture a non-woven fabric. In general, the paper, textile (spinning and finishing) and plastic industries have greatly influenced the technologies that exist today. In the practice world, nonwovens can basically be classified by the manufacturing process, raw material, fiber/filament characteristics, consolidation process, weight, transformation and/or conversion process, or association of these elements. As for the weight (Weight per Area Unit):• Leve: menor que 25 g/m2;

- Medium: between 26 and 70 g/m2;
- Heavy: between 71 and 150 g/m2;
- Very heavy: above 150 g/m2.

To explain the use and application of a non-woven we have the Extension Project Tecidoteca da UEM – Campus Regional de Cianorte aligned to the fashion course, where it highlights the non-woven by images, technical sheet and application of use in the market segments and highlights the importance of protecting and using nonwovens to combat the COVID-19 pandemic.

FABRIC - FASHION EMU

The Telateca extension project (textile flag collections), from the State University of Maringá (UEM), Cianorte Regional Campus (CRC) FASHION course, aims to study the concepts of structure and composition of textile materials used in the manufacture of clothing (woven, knitted and non-woven),

Figure 5 – Structure of a fabric.

Source: Fabric Library Collection:UEM-Moda/Cianorte (2022).

as well as their particularities and finally catalog them. The extension project aims to make available a collection of textile flags for consultation and research by the university community and professionals in the clothing and fashion area of Cianorte and region. Thus, it allows access to raw material in loco and digitally on the blog (http://tecidotecauem.blogspot.com/). Well, it has the function of understanding, conserving, knowing and organizing textiles as documents for research in the fashion area and the like. Below is the banner with the specific information of the non-woven (NT) cataloged in the Tecidoteca project, as well as the application of use and market segment.

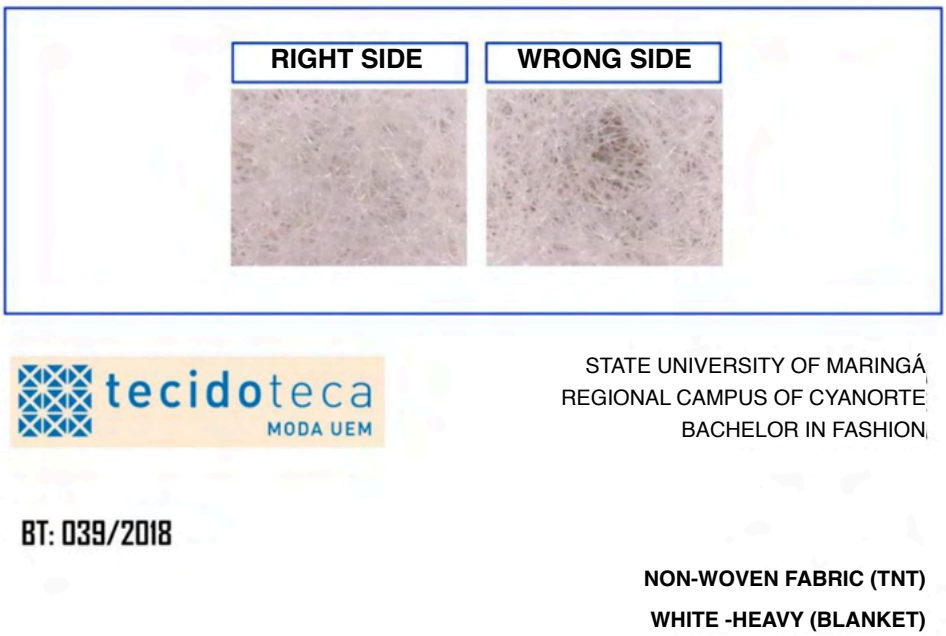

Figure 6 – Non-woven flag header.

Source: Collection of the UEM-Moda/Cianorte Fabric Library (2022).

Figure 7 – Right and wrong side image and non-woven roll.

Source: Collection of the UEM-Moda/Cianorte Fabric Library (2022).

Fabric library

Datasheet **BT: 039**

Article: Calendered Nonwoven Blanket (NBR 13370)
Color. White (consultation made in the Pantone catalog[R])
Composition / Fiber Composition: 100% polypropylene (PP)
Gramage / Weight: 180,65 g/m ^{2} - Heavy (NB — 12984 of ABNT)
Largura/ Widht: 1,40 m
Kind of fabric / Fabric Types:
( ) natural ( ) synthetic ( ) artificial
Sensory touch: Rough and warm
Method of construction: Cast way
In the Via Fundida process, we include nonwovens produced Via Extresão, which are continuous spinning (Spunweb/Spunbonded) and Via Sopro (Meltblown). These processes work with raw material in the form of polymers (plastic materials).
In the Spunweb/Spunbonded process, a thermoplastic polymer is melted through a "spindle", cooled and stretched, and then deposited on a mat in the form of a veil or blanket.
In the Meltblown process, a thermoplastic polymer is melted through a "spinneret" with very small holes, and immediately a flow of hot air quickly solidifies the mass into very fine fibers, which are blown at high speed to a collecting screen forming the blanket.
After the formation of the veil or blanket, it is necessary to carry out the consolidation (union of the fibers or filaments), which in most nonwovens also provide the necessary finishing for the final product.
Thermal — Thermobonded
The connections of the fibers or filaments of the nonwoven are carried out by the action of heat, through the fusion of the fibers or filaments themselves. (ABINT)
Analysis method: 55x approximations (electronic wire count)

Saving Cares.

SÍMBOLO/ *Symbol*	DESCRIÇÃO/ *Description*
	Lavagem a mão *Handwash*
	Não alvejar *Do not bleach*
	Não secar em tambor *Do not dry in drum*
	Não passar a ferro, danos irreversíveis nas fibras *Do not iron, irreversible damage to fibers*

Note: The tests of the textile flags were carried out by the TECIDOTECA 2297/2009-DEX extension project for the use of the academic community, without any commercial purpose. The results are our responsibility and may differ from the supplier's data. If you have any questions, contact: (44) 3619-4028.

Figure 8 – Non-woven technical sheet.

Source: Fabric Library Collection:UEM-Moda/Cianorte (2022).

APPLICATION AND USES IN MARKET SEGMENTS

Segment:

1- Personal Hygiene
Disposable diapers; Pads, cloth diaper protector.

2 - Medicine
caps; masks; bandages; hospital clothing; strip for hair removal.

3 - Clothing and Footwear
protective clothing; aprons; Interlinings; caps; jackets; Reinforcement for shoes.

4 - Home Applications
Ecobags, Bed and tableware; Bathroom set; American game; Cover for sofa; pillow covers; etc.

5 - Upholstery
Upholstery coating and lining; Office chairs and armchairs; Car upholstery covers.

6 - Automotive Industry
Internal coating of ceilings; Sunscreens (sunshade); Car cover.

7 - Agriculture and Horticulture
capillary mats; Greenhouse protection; Plantations and seedlings.

8 - Packaging and Protective Substances
gift packaging; bags; travel bags; Bag lining; bags; folders; Machine covers; Fax and computers; Soap and shoe wrappers; Clothing protectors.

9 - Miscellaneous
Canvases for artists; Advertising articles; tracks; Panels and flags; tents; CD case; sachets; Ballroom decoration; Bags for supermarkets.

Figure 9 – Nonwoven use application and market segment.
Source: Fabric Library Collection: UEM-Moda/Cianorte (2022).

FINAL CONSIDERATIONS

The textile industry is increasingly articulated with the technologies inserted from yarns to the final product (benefits), it is known that in order to have a textile product with antivirus properties, especially the coronavirus, it is essential to apply several tests in laboratories and especially at the research in textile chemical laboratories. Considering that the fabrics have weft and warp in their formation and that the knits have their loops and in this way there is an escape of air in their textile constructions. It can be said that the most suitable non-woven fabric for protection from the COVID-19 virus, as the fibers and threads in their tangles are compacted and do not let air or air microparticles pass through the material, obtaining effective protection against the virus.

It is necessary to evaluate the appearance of production in the development of PPE, especially masks, an item that has become imperative for the population today, considering that in addition to production in weaving, knitting and non-woven factories, masks in particular began to be produced. domestically. The spread of the virus affects quickly, so it is extremely necessary to use a mask, alcohol gel, among other care against COVID-19. Brazilian researchers have developed antiviral textile materials generally used for the manufacture of PPE and the materials tested so far are shown to be effective against the virus, however some of these have a limited duration, the behavior of these materials is still hypothetical. Considering the number of washes, use, twists, friction, and of course contact with other chemicals.

Also according to Vasques, Leme, Pinheiro, Fortunato and Paiva-de-Brito (2022), the production of Brazilian antiviral textile materials has been developed by researchers at Universities such as the Federal University of São Carlos (UFSCar) and the University of São Paulo. (USP) in partnership with technological fabrics and textile products companies such as Nanox and Rhodia. Antiviral textiles are being commercialized and the progress in the development of these materials is considerable for the premise of being prepared for the future, so mapping products in order to analyze them in terms of development and performance is essential for their proper use. it's safe. Therefore, we can see that the correct use of textile material can save lives. Although there is a forecast of a second economic crisis in the global textile industry and the current scenario increasing the value of raw materials, the industry is innovating and creating new high technology products, which allows greater competition in the area. This movement is strong in the universities of technology and in the production plants we see the movement to meet with introductions of these innovations, whether in the field of equipment, or in the area of chemicals and fibers, bringing this future market to an increasingly concrete present (ZOMIGNAM , 2002).

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