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Class of Mineral Textile Fibres Review

Nsangou Abdouramane[1], Amba Cécile[1],Nkemaja Dydimus Efeze[1,4] , Pierre Marcel Anicet Noah [1,3] , Fabien Ebanda Betene[1,3], Hambaté Gomdjé Valery[2],Mewoli Armel[1], Ngum Lesley Ngum[5], Fouyou Anne Valée[1], Mbengono Nambele Cecile Constance[1]

[1]*Department of Mechanical Engineering, ENSET, University of Douala, BP 1872, Douala, Cameroon*
[2] *Departments of Textile and Leather Engineering, ENSPM, University of Maroua, Cameroon*
[3]*Laboratory of Mechanics, University of Douala, Cameroon, BP 2701 Douala, Cameroon*
[4]*HTTTC Bambili-University of Bamenda, Cameroon*
[5] *Institute of medical research and medical plant Studies*

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Abstract: *The aim of this work is to correct the secondary school curriculum of the Clothing and Textile Industry in Cameroon, which places mineral textiles only as of natural origin. In order to find the real class of mineral textile fibers, this reflection started from the definition of textile classes according to the ISO 2076.2013 standard and the French decree 631073 of 25 October 1963. Two main classes of mineral fibers emerge. Natural mineral fiber is that which comes directly from rocks in the form of fiber, such as asbestos, and those which are artificially produced from minerals (chemical mineral fiber). Chemical mineral fibers can be synthetic or man-made.*

Keywords: *mineral textile fiber, mineral fiber class*

I. Introduction

Although mineral textiles are considered potentially hazardous to health [1][2][4], since most fibers, even other than asbestos, can penetrate the body and cause serious health damage [2][13]. That is why the producing countries have banned it in their territory [2][3]. Iceland was the first to ban in 1983, followed by France in 1997, England in 1999, and the European Union in 2005 [3]. The class of mineral textile fibers is a quid pro quo that still plagues the minds of many teachers in the clothing and textile industry in Cameroon. This work is based on the observation that the secondary school curriculum for the Clothing and Textile Industry and certain tests in the certification examinations mention that mineral textile fibers are of natural origin. And the debate was held with about thirty teachers on this subject. This led to the question of the mineral textile fiber class. In order to better understand these questions and to give as complete an overview as possible of the mineral textile fiber class, we will first present the two classes of textile fibers (natural and chemical) according to the ISO 2076 standard. 2013, the French decree 631073 of 25 October 1963 and also the literature and then place the mineral textile fiber in this classification.

II. General classification of textile fibers

Two main sources of fibers have been identified [4][5][6][12]:

- **Natural fibers** derived directly from nature;
- **Chemical fibers**, which may be derived from the chemical transformation of natural base materials before being produced as filaments and fibres (man-made textile fiber) or from simple components extracted and then assembled and rearranged by polymerization (by addition or condensation) before being spun (synthetic fibre) [6][7].

A. Chemical textile fibre

According to the ISO 2076.2013 standard and the French decree 631073 of 25 October 1963, "chemical textiles are yarns and textile fibers obtained by spinning". The spinning is done by man, which makes it possible to define chemical textiles as textiles whose fibers are made by man. It is the man who decides the structure of the fiber according to what he wants to obtain. There are many textile structures (hollow, multilobedtrilobal, orange wedge, bean, dog bone, etc.):

Artificial fiber: Artificial fiber is obtained by taking the raw material, which is already a macromolecule, such as cellulose, proteins, or minerals, and modifying their physical structure or chemical composition [5][6][8]. They are formed from natural molecules that have undergone a chemical or physical transformation. The first artificial yarn was made of cellulose nitrate and appeared in 1884, with the filing of a patent by Frenchman Hilairede Chardonnet. This patent, gave rise to innovations that made it possible to use cellulose to manufacture products that replaced wool and cotton in some of their uses and in industrial manufacturing [6].

Synthetic fiber: It is obtained by synthesizing macromolecules, necessary from simple elements, such as carbon, oxygen, hydrogen, nitrogen, etc., from coal, oil, coal, etc., and then polymerizing (by addition, i.e., by linking a large number of monomer units in which the constituent carbon atoms are linked together or by polycondensation, i.e., the reactive elements link up, leaving behind a residue such as water, ammonia or carbon dioxide [7]. An American scientist, W.H. Carothers, in charge of the study of polymers, in order to find a substitute for silk, of which the Japanese were producers, discovered the polymer (Nylon), the first synthetic textile

in 1935. The name Nylon is said to be composed of the first letters of W.H. Carothers' exclamation at the time of his discovery: "New You Lausy Olds Niponeses" [6].

Manufacture of chemical fibers: Spinning is used for the manufacture of chemical fibers (artificial or synthetic). The principle is to take a material in a molten state or solution and extrude it through a spinneret with a number of orifices [5][6][8].

Melt process: The melting process is the most widely used. It applies to polymers with a well-defined melting point. This is the case for the most common synthetic materials such as polyamide, polyester, and polyolefin. With this technique, the polymer is melted and sent under pressure through the die. At the die exit, the filaments are cooled down, in and out [5][6][8].

Solution process: The principle of the solution process is to dissolve the polymer in a solvent, spin, and then regenerate the polymer by removing the solvent after spinning.Regeneration in a so-called wet coagulation bath.Case of polyacrylic, viscose. Regeneration by drying the solvent using a dry process: a case of polyvinyl chloride, acetate, polyacrylonitrile [5][6][8].

B. Natural Textile Fibre

Natural fibers are obtained directly from nature. They can be obtained either by ginning, retting, scutching, or shaving...[9][10]. In short, they are not obtained by spinning. In other words, it is not a man who moulds the fiber as he pleases. This is why the shapes of the different natural fibres are known. For example, cotton has a bean-like structure [8][10]. There are several natural fibres classified as such:

Animal fibres: Animal fibres are the hair of certain animals, for example, sheep's wool; besides sheep, cashmere hair comes from a species of goat, and the Angara comes from a breed of rabbit. Another very noble and appreciated animal fiber is silk, which comes from the silkworm, also known as the bombyx of the mulberry tree [4][5].

Plant fibers: Plant fibers are divided into 4 sub-categories [4]:

Fruits: Cotton is the most common plant fibre. Milkweed also comes from a fruit produced by a plant that was once considered a "weed".

Woody: These are fibres that are found between the bark of the plant and its wood. To extract them, they must be separated from the wood and bark. Flax and jute are the best known.

Leaves: Rarer and more exotic, fibres from leaves also exist. Abaca, a species of banana tree, produces a fibre called Manila hemp, which is used to produce twine and rope.

Secretions: As the sap of the rubber tree is extracted from the plant fibre to produce natural rubber (latex).

III. Place of mineral fibres in the classification of textiles

According to the International Mineralogical Association and the French Agency for Environmental and Occupational Health Safety (AFSSET), mineral fibre is obtained by melting and then fibrating various minerals [4]. Asbestos is a group of fire-resistant fibrous silicates [2][3]. There are two types of mineral fibre:

The ones that come directly from rocks in the form of fiber. In the theses of Mouhamed El HadiBoukari, MouhamedDallel, Hothi, and Thu Nga, asbestos is the only mineral fiber that is natural [9][10][11]. For Bernard Moreaux and Michel Grzeby, asbestos, wollastonite, and sepiolite are natural mineral fibers [2][12]. The term asbestos covers a variety of silicate hydrates formed naturally during the metamorphism of rocks and which are transformed into industrially usable mineral fibers by an appropriate mechanical operation [13]. These fibres are therefore called natural fibres.

Other ones are artificially produced from minerals [2]. These fibers are classified into three categories: vitreous fibers (glass fiber, glass wool, rock and basalt fiber, slag wool, refractory ceramic fibers), crystalline fibers (alumina fiber, potassium titanate fiber, and carbon fiber), and metallic fibers (steel wool, stainless wool, copper wool) [1][2]. Among these fibers, there are those that come from rocks (natural macromolecules) that will undergo a transformation into fibers (rock fiber, wool basalt, ceramic fiber). They are called man-made fibers [15]. Mineral fibers are resulting from the synthesis of molecules (glass fiber or glass wool produced from silica). They are synthetic chemical fibers [2][14].

Conclusion

At the end of this analysis, it should be recalled that the question was to place mineral textile fibers in the class of textile fibers of their origin according to the ISO 2076, 2013 standard and the French decree 631073 of 25 October 1963, which stipulates: "chemical textiles are yarns and textile fibers obtained by spinning". From this, it can be seen that mineral textile fibres are of two types: that which comes directly from rocks in the form of fiber. The term asbestos covers a variety of silicate hydrates formed naturally during the metamorphism of rocks and which are transformed into industrially usable mineral fibers by an appropriate mechanical operation. These fibres are therefore called natural. Another mineral fibre is artificially produced from minerals. These fibers are classified into three categories: vitreous fibers (glass fiber, glass wool, rock and basalt fiber, slag wool, refractory ceramic fibers), crystalline fibers (alumina fiber, potassium titanate fiber, and carbon fiber), and metallic fibers (steel wool, stainless wool, copper wool). Among these fibers, there are those that come from rocks (natural macromolecules) which are transformed into fibers (rock fiber, wool basalt, ceramic fiber). They are called artificial fibers. Mineral fibers are coming from the synthesis of molecules (glass fiber or glass wool produced from silica).

They are synthetic chemical fibers. In short, there are two main classes of mineral textile fibres: natural and chemical. Chemical mineral fibres can be artificial or synthetic.

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