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Natural Fibers as Sustainable Textiles: A Review

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ABSTRACT

Natural fibres are environment-friendly, biodegradable and less costly. The applications of natural fiber have grown rapidly and conquering new markets relentlessly. A new approach to produce new materials is by sustainable textiles, which offers a wide variety of possibilities for development of new materials with improved properties. In addition to, uses of natural fibre materials are now considered more critically because of increasing environmental consciousness and the demands of legislative authorities. Natural fibres have successfully proven their qualities when also taking into account an ecological view of fibre materials. This review paper discuss about review report on natural fibers and its applications.

Key words: *Natural fibers; Sustainable textiles, Applications.*

INTRODUCTION

The textile fibers are an integral part of human civilization. These textile fibers and their uses predate the recorded history of textiles. Textiles especially for the clothing are known, ever since the mankind learnt how to protect themselves by using animal skin, tree leaves etc. The civilization taught us to make clothing's by using conventional natural fibers like cotton, wool, silk and linen. The historic development of fibre is considered to a strange trial and error process ever since this utilized for making apparel. The present day fiber making process such as twisting of fibres to chords and other practices are said to be practiced from Paleolithic age. In the early part of the 19th century and the beginning of the 20th century, men started producing fibres other than natural sources, which have been called as man-made fibers. Later on, these man-made fibres grow up drastically in textile industries for producing clothing and other important materials. However, some of the synthetic fibers use for producing clothing materials for day to day use poses hazardous effect to human health.

The natural fibers are renewable resource, thus providing a better solution of sustainable supply, like it has low cost, low density, least processing expenditure, no health hazards, and better mechanical and physical properties[13,14]. The most important property of natural fiber is biodegradability and non carcinogenic which bring it back into fashion, with an advantage of being cost-effective.

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The versatile nature of it also makes it suitable for automobiles, railway coach, building construction, partition wall cabinets, or furniture for machinery uses and packaging. Natural fibers are at the heart of an eco-fashion movement that seeks to create garments that are sustainable at every stage of their life cycle, from production to disposal. Natural fibers have intrinsic properties such as mechanical strength, low weight and healthier to the wearer that has made them particularly attractive. Progressively, eco-textiles are being used for industrial purposes as well as in components of composite materials, in medical implants, and geo and agro-textiles[12].

Some of the environment friendly textiles:

Pineapple: The pineapple, *Ananas comosus* belonged to the family Bromeliaceae is a short tropical herbaceous perennial plant with a height of 1.0–2.0 m. Pineapple leaf fibres (PALF) are the products from waste of pineapple plant cultivation. The pineapple leaf fibre is more compatible natural fibre resource and constitutes a good chemical composition. It is multicellular lignocellulosic fibre containing polysaccharides, lignin in major amount, and some minor chemicals like fat, wax, pectin, uronic acid, anhydride, pentosan, colour pigment, inorganic substance etc.. Pineapple leaf fibre is one of the natural fibres having highest cellulosic content nearly 80%.

Fibres can be extracted from the waste of pineapple leaves. These fibres are called 'pina', in Spanish which gives the meaning pineapple. These fibres are likely to be very soft, and are easily broken. So the process is usually becomes slow and time consuming. Extracted fibres are handspun into ivory shaded, which gives natural glossy fabric. To make pina fabric strong, they are also blended with other fibres. If it is blended with silk, they are known as pina-seda. It is very soft and lustrous. These fabrics are light weight, and easy to maintain. Pineapple fibres are blend well with other fibres. Moreover fabrics made from pineapple fibres have an elegant appearance. After many inventions, pina fabrics can rightly be commended as heirloom textiles used for hometech, auto mobitech and geotech.

Blended yarns from natural and man-made fibres have the particular advantage of successfully combining the good properties of both fibre components, such as comfort of wear with easy care properties. These advantages also permit an increased variety of products to be made, and yield a stronger marketing advantage. Jurisdiction selection of fibres for blending can open up possibilities of newer application of these fibres along with different kinds of end products. Fiber blending can achieve quality products that cannot be realized using one fiber type alone, and it can also reduce the cost by substituting a less expensive fiber for a more costly one.

BAMBOO -- as a plant, bamboo is very fast growing, helps to improve the quality of the soil, the characteristics of each vary in size, growth habit, sun tolerance, soil moisture needs and heat/ cold temperature tolerance.. It is very sustainable. A bamboo fiber resembles cotton in unspun form which has a puffball of light, airy fibers. Several investigators have examined bamboo as a source of bast fiber and as a source of cellulose from pulping the bamboo[1,9,3]. One of benefits using bamboo fibers is that the bamboo is an abundant natural resource in Asia and Middle & South America. Bamboo fibers are often known as natural glass fiber due to its high strength with respect to its weight derives from fibers longitudinally aligned in its body[8]. The tensile strength of bamboo is relatively high and can reach 370 MPa[11]. This makes bamboo an attractive alternative to steel in tensile loading application.

Bamboo fabric possesses excellent natural functions of anti-bacteria, bacteria-stasis and deodorization. It has its unusual breathability and coolness, due to its cross-sections filled with various micro gaps and micro holes and it has better ventilation and absorption. Bamboo has a wider application due to its comfort, soft, lustre and absorbency. Example Nonwovens, baby wears, home textiles, decorative series, etc. Bamboo apparel is crowned as "Air Conditioning Dress". Bamboo fiber is praised as "the natural, green and eco-friendly new type textile material of 21st century".

BANANA:

Banana fiber, a ligno-cellulosic fiber, obtained from the pseudo-stem of banana plant (Musa sepientum), is a bast fiber with relatively good mechanical properties. The pseudo-stem is a clustered, cylindrical aggregation of leaf stalk bases. Banana fiber at present is a waste product of banana cultivation and either not properly utilized or partially done so. The extraction of fiber from the pseudo stem is not a common practice and much of the stem is not used for production of fibers. The buyers for banana fibers are erratic and there is no systematic way to extract the fibres regularly. Useful applications of such fibres would regularize the demand which would be reflected in a fall of the prices. According to Chandramohan &Marimuthu[2] banana fibers have highly strength, light weight, smaller elongation, fire resistance quality, strong moisture absorption quality, great potentialities and biodegradability. Banana fiber has recognized for apparels and home furnishings Banana fiber has great potentialities for paper making special demand of handmade paper[10].

JUTE:

Jute is one of the most affordable natural fibers in existence and it is second only to cotton in amount produced and variety of uses. Jute is a long, soft and shiny fibre that can be spun into coarse, strong threads and is one of the cheapest natural fibres. It is also the most versatile, eco-friendly, natural, durable and antistatic fibre. The plants are retted by the same method used for flax. The resulted jute strand, which are up to 3 m long, are composed of many very short fibres, elementary fibres (length between 0.5-6.0 mm, diameter 26-30 μm) held together by lignocelluloses. The fibres contain between 61-71% cellulose, large amount of hemicelluloses (14-20%) and lignin (12-13%) and pectin (0.2%)[6]. Jute has the ability to be blended with other fibers, both synthetic and natural, and accepts cellulosic dye classes such as natural, basic, vat, sulfur, reactive and pigment dyes. (https://en.wikipedia. org/wiki/Jute)

Kenaf: Kenaf fibres are obtained from Hibiscus cannabinus. Kenaf contains two fibre types: long fibre bundles situated in the cortical layer and short fibres located in the ligneous zone. Elementary fibres are short; their fibre length ranges from 3 to 7 mm, with average diameter of 21 μm. The cross-sections are polygonal with rounded edges and the lumens are predominantly large and oval to round in shape[4]. The lumen varies greatly in thickness along the cell length and it is several times interrupted. Kenaf fibres contain about 45-57% of cellulose, 21.5% hemicelluloses, 8-13% lignin and 3-5% pectin. Kenaf fibres are coarse, brittle and difficult to process. Their breaking strength is similar to that of low-grade jute and is weakened only slightly when wet. There are many potential specific utilization possibilities for kenaf whole stalk and outer bast fibres, including paper products, textiles, composites, building materials, absorbents, etc.[7].

ALOE VERA: To create a textile that is soothing to the skin, fabric can now be infused with aloe vera "capsules." Aloe Vera content is embedded into airtight and waterproof micro capsules. They open to release the gel only when the fabric is touched or rubbed. In addition to the skin benefits, aloe also adds a few interesting features to the fabric itself. It is naturally anti-bacterial; and so not only does it keep clothing cleaner, it also combats body odor. It is proving to be an exciting and beneficiary fiber for the wearer.[12]

CONCLUSIONS

Natural fibres are considered as potential replacement for man-made fibres. Natural fibres have a very strong benefit from both the side one from agricultural waste, used natural fiber for reinforced polymer composite and also these fibers are important for technical textiles production. Another one is plant wastes which additionally containing fibres. Natural fibres from annual plants have advantages of being low cost and low density and therefore they are light. They are a renewable material. In addition to, an

important advantage of these materials is their biodegradability and low toxicity.

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