HEMP FIBERS AND ITS PROCESSING TECHNOLOGIES

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Abstract

Renewability and durability of materials have become increasingly important concerns in the production of products and applications. Therefore lot of research is going on in the field of natural fibers. One such fiber is hemp fiber, which has become increasingly rational substitutes to glass and carbon fibres in some applications, and have the capacity to be used in less costly, more reliable and more environmentally sustainable composite materials. Its fibers were also known for their light weight and long fiber lengths, and were often commonly used in the manufacture of cables, boats, newspaper and fabrics. In this paper hemp fiber and its processing technologies are highlighted.

Keywords: Plant fibers, Green composites, Processing technologies, Hemp.

1. Introduction

The high consumption of products based on petroleum has a negative environmental impact. Whereas Natural fibers are classified as environmentally friendly materials with many favorable properties compared to synthetic fibers. These fibers are inexpensive, plentiful and sustainable, and are manufactured at low cost. They are solid and rigid and have the ability to create composites with similar unique properties to those of glass fibre, due to their low concentrations. All of the plant-derived fibers can produce methane when grown. While on the other hand the fossil fuel sweltering require synthetic fibers to supply the energy required for production, which releases CO2 into the environment[1]. Therefore plant fibers posses various advantages as these materials are manufactured by adding different epoxies and unsaturated polyester resins to these materials according to the requirements for different applications [2,3]. Plant filaments are discovered appropriate to strengthen polymers. Ultimately, these differences can lead to problems in predicting composite design and efficiency. Regular strands are likewise thermally flimsy contrasted with most engineered filaments what's more, are restricted to preparing and working temperatures underneath 200°C. But the problem of working with these fibers is there is low interfical bonding and they are hyperbolic in nature. which sometimes results in poor composite mechanical properties . Therefore changing the strands and the lattice, or both, is thus crucial in producing a composite with enhanced material properties. More work should be done right now, given all, to enable characteristic fibre-strengthened composite materials to compete with composite materials of glass and carbon fiber in terms of consistency and solidity.The most rooted cellulose strands are hemp, jute, and flax among many of the characteristic filaments with hemp and flax providing the highest properties for Young's modulus.Hemp, however, flax strands often have high viewpoint ratios (length / width), which is an enticing ascribe to be used as composite support for strands.In any case, Hemp, compared with other fibres also has the advantage of being very free from disease and can be grown at high densities to avoid the growth of weeds between plants. The signature fiber includes a large variety of vegetables and natural strands.classification of plant fibers is shown in Figure 1. Accessibility of characteristic strands and simplicity of assembling is enticing scientists to attempt nearby accessible cheap characteristic strands as fortification in polymer lattice and yearly production is shown in table 1[4] [5].In this paper hemp plant fibers and its processing technologies are discussed.

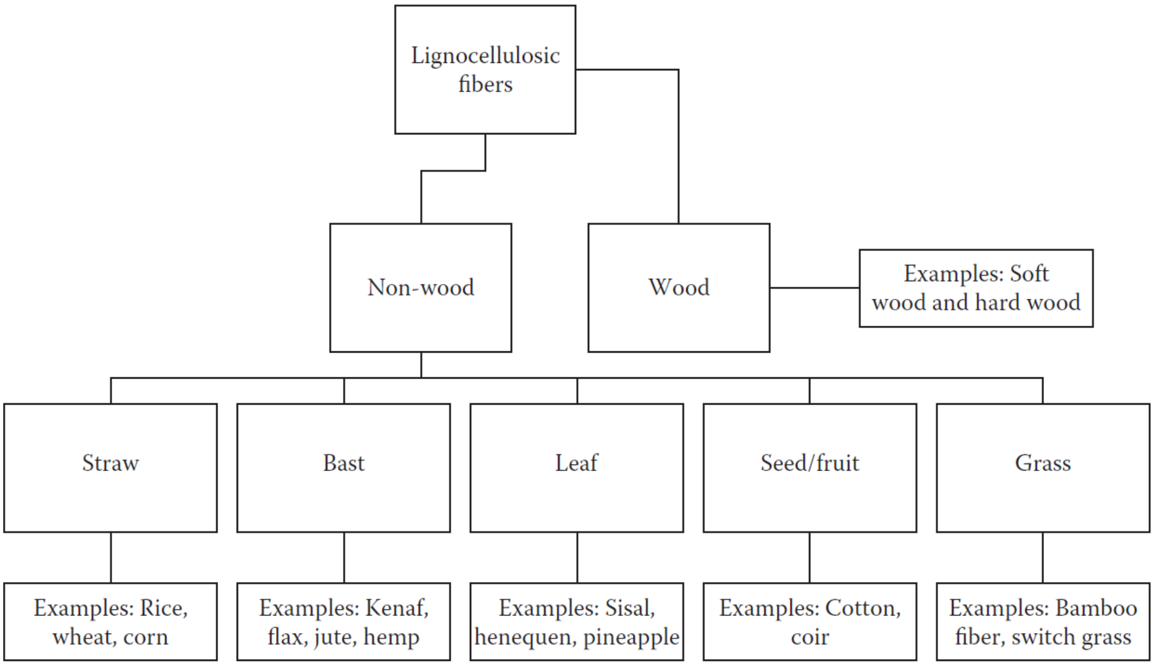

Figure 1. Classification of plant fibers[1]

Table 1. Classification of natural fibers, origin and yearly production around the world [6].

Fiber type (plant)	Botanical name	Origin	Production (10^3 tons)
Abaca	Musa textilis	Leaf	91
Bagasse	Saccharum officinarum L.	Stem	1,02,000
Banana	Musa uluguruensis Warb	Leaf	200
Bamboo	Gigantochloa scortechinii Dendrocalamus apus	Stem	10,000
Coir	Cocos nucifera L.	Fruit	650
Cotton	Gossypium spp.	Seed	19,010
Flax	Linum usitatissimum	Stem	830
Hemp	Cannabis sativa L.	Stem	214
Jute	Corchorus capsularis,Corchorus olitorius	Stem	2850
Kapok	Ceiba pentandra	Seed	123
Kenaf	Hibiscus cannabinus	Stem	970
Phormium	Phormium tenax	Leaf	-
Pineapple	Ananas comosus Merr.	Leaf	-
Ramie	Boehmeria nivea Gaud	Stem	100
Sisal	Agave sisalana	Leaf	318.8

2. Composition of Hemp Plant

The synthetic piece just as the arrangement of the plant strands is genuinely confused. Plant filaments are basically a bio composite with cellulose micro fibrils are implanted in a grid basically made out of lignin and hemicelluloses[7]. Moreover Gelatine, colors, and extractives are also present. They are essentially an unbending, crystalline cellulose micro fibril–fortified nebulous lignin with or deprived of hemicellulose network as shown in figure1.

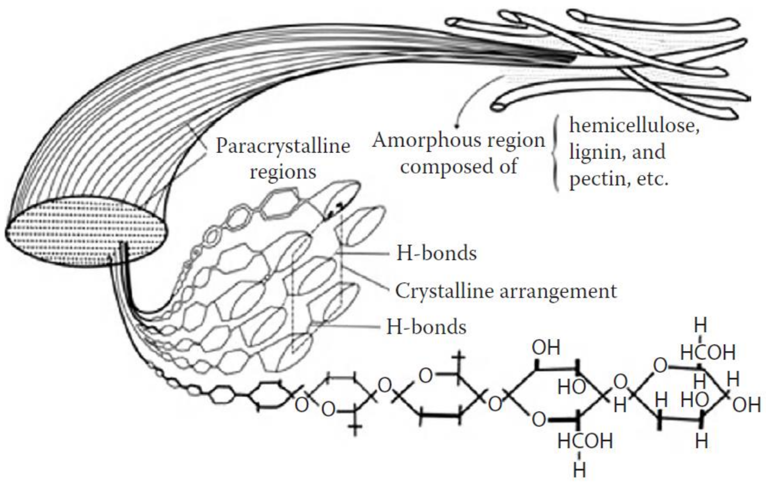

Figure 1. Structure of Hemp plant fiber [8]

3. Properties of Hemp based fibers

Plant strands, as support, have as of late pulled in the consideration of specialists as a result of their favourable circumstances over other set up materials. They are earth inviting, completely biodegradable, liberally accessible, sustainable and modest. The biodegradability of plant filaments can add to a sound biological system while their minimal effort and elite satisfies the financial enthusiasm of industry. At the point when characteristic fiber–strengthened plastics are oppressed, toward an amazing finish cycle, to ignition procedure or landfill, the discharged measure of CO_2 of the filaments is impartial regarding the acclimatized sum during their development [9]. The rough idea of regular fiber–fortified plastics is a lot of lower driving to points of interest with respect to the specialized and reusing handling of the composite materials when all is said in done. Normal fiber–strengthened plastics, by utilizing biodegradable polymers as frameworks, are the most ecological agreeable materials, which break down toward a mind-blowing finish cycle. Plant fiber composites are utilized instead of glass for the most part in non structural applications. Various car segments recently made with glass composites are currently being produced utilizing ecologically well-disposed composites.

4. Processing technologies for Hemp fiber.

The creation of normal composites is a difficult undertaking as the inborn properties of these filaments are very unique in relation to inorganic filaments. The significant contemplations for preparing of these strands are their hygroscopic nature and low protection from high temperature because of which just constrained saps could be utilized as lattice. The manufacturing methods used to create hemp fiber-reinforced thermoplastic composites are essentially the same as in used to manufacture synthetic fibre-containing related composites.Melt mixing, extrusion compounding, and solution mixing are the growing mixing methods used to blend fibre with thermoplastic polymer. Some of the basic processing technologies for these fibres are discussed in next section.

4.1 Melt Mixing

Melting that used a radial flow mixer (turbulent) is a common method of compounding thermoplastic polymers with short fibre-reinforcing. The thermoplastic polymer is heated slowly to its melting point, then added to the hemp fiber mixture. After mixing, the composite combination may be rolled into a sheet or molded in to another shape. A few blending settings, including blending length, rotor speed, and dissolve chamber temperature, can decide the blending results. Joseph et al.[10] investigated the sisal fiber with PP utilizing a Haake Rheocord blender. They appeared that insufficient blending and poor fiber scattering happened at short blending occasions and low blending speeds, while low blending temperatures brought about broad fiber breakages. Composite quality misfortune because of fiber breakage additionally happened at high blending occasions and high blending speeds. High blending temperature can bring about fiber corruption and poor fiber scattering

4.2 Extrusion Process

Expulsion is one of the best techniques for aggravating characteristic filaments and thermoplastic polymers. A thermoplastic polymer and short hemp strands are drawn and joined into a warmed expulsion barrel by methods for a solitary screw or two corotating screws, contingent upon the sort of extruder[11]. The polymer is softened and blended in with hemp fiber to frame a composite soften, which is then drawn forward through the extruder barrel furthermore, further blended and compacted to improve the liquefy homogeneity. The liquefy at that point exits the barrel through a formed bite the dust, which decides the state of the expelled composite.

4.3 Solution Mixing

Liquid mixing is an approach to physical mixing where rubber is melted during fiber compounding, such as melt mixing and extrusion[12]. This strategy includes dissolving the polymer in a suitable dissolvable, adding the fiber to the polymer/dissolvable blend, and fueling the polymer in a vacuum stove from the liquid.The polymer hastens are ineffectively bound to the filaments, and the fiber and polymer can be completely consolidated by expulsion or pressure shaping. Solvents don't convey enduring manufactured changes to thermoplastic polymer cross sections, anyway rather produce physical changes that incorporate the division of individual polymeric chains. For example, xylene can be used to separate PP.

4.4 Injection Molding

This method is among the most commonly used methods for making molded parts from thermoplastic and thermoplastic reinforced materials. The Utilizing of standard thermoplastic infusion shaping machines, short hemp fiber – fortified materials can be framed into complex shaped parts is done in this process. Imbuement crumble plays out the limit of relaxing the preformed (for the most part by removal exasperating) composite pellets in a warmed barrel, passing on a homogeneous mellow to the machine gush, and injecting the condense into a shut shape. Infusion forming process doesn't incite a similar degree of mechanical grinding on the composite liquefy as blending procedures, for example, expulsion and soften blending, simultaneously, it likewise doesn't prompt critical fiber harm. The shape unit, which includes a fixed area and a versatile segment, encases the formed depression into which the composite is infused and cooled, and is along these lines answerable for deciding the last shape of the shaped part.

5. **Conclusion**

With the rise in global energy crisis and environmental risk, the unique benefits of biological fibers . Hemp fibers have played an significant part in human scientific and cultural history. Hemp fibers plays an important role in the manufacture of advanced bio-based products . In light of their environmental and financial advantages, the utilization of common filaments in composites is expanding. Normal fiber composite materials of superior were made from many years of research. To request to improve the properties, broad work is at present being completed worldwide on common strands and their composites. The strands and composites are arranged regarding applications with various usages for various properties. Inexhaustible creature strands give an energizing chance to create bio-composite materials that are economical. In view of their simple accessibility, light weight, minimal effort and eco-accommodating nature, scientists ' center has now been expanded around these plant fiber strengthened composites. . The material will give enduring reaction to the issues of moistness maintenance (poor gum closeness), affectability in outside condition and weakness for withstanding long stretch introduction, influencing, and unforgiving road trail conditions; a portion of the major impediments to their completely created present day sales. Apparently the utilization of these kind of materials in vehicle body sheets is conceivable to the extent that green composites have comparable mechanical execution with fabricated ones.

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