

## APPROACH TOWARDS GREEN FIBER: HEMP FIBER

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### ABSTRACT

Hemp is genetically different and distinguished by its use and chemical makeup. Hemp has long been cultivated for non-drug use in the production of industrial and other goods. Some estimate that the global market for hemp consists of more than 25,000 products. It can be grown as a fiber, seed, or other dual-purpose crop. Hemp fibre is obtained from the bast of the plant, *Cannabis Sativa L.* It grows easily to a height of 4 meters without agrochemicals. Hemp is used to make rope, canvas and paper; it can also be woven to make linen-like fabric used in clothing, home furnishing textiles and floor coverings. It is also used to reinforce molded thermoplastics in the automobile industry.

**Key words:** Hemp, fiber, eco-friendly, clothing, fabric

Hemp fibre is cultivated from the plants belonging to the *Cannabis* genus. *Cannabis sativa L.* has two varieties named Industrial hemp and marijuana. Classification of *Cannabis* as either marijuana or industrial hemp is typically based on a threshold concentration of delta-9-tetrahydrocannabinol (THC). Marijuana typically contains 3-15% of the psychoactive ingredient called delta-9-tetrahydrocannabinol (THC) on a dry-weight basis, while industrial hemp generally have less than 1% of THC. Although a level of 1% THC is considered a minimum value to elicit an intoxicating effect but as per current several other jurisdictions use of 0.3% THC is the arbitrary threshold point at which THC content is used to distinguish strains of hemp from marijuana. Industrial hemp is sometimes referred to as "true hemp" to distinguish it from numerous other unrelated plant species that include "hemp" in their common names.

Hemp is an annual plant and can grow on a wide spectrum of soils. It needs well drained, nitrogen rich and non-acidic soil. Hemp favours a mild climate, humid atmosphere and a rainfall of at least 25-

30 inches (64-76 cm) per year. Soil temperatures must reach a minimum of 42-46°F (5.5-7.7°C) before seeds can be planted.

The following are the various types of hemp fibres.

- Primary bast fibre - Long and low in lignin
- Secondary bast fibre - Intermediate and high in lignin
- Libriform - Short and high in lignin

### Green and dry plant components of hemp plant grown for fibre

Indian hemp is a full-bodied, tall, erect, annual herb, 1-5 meters in height, normally with male and female plants in approximately equal numbers. It has angular stems having palm-shaped or hand-shaped divided leaves with greenish flowers. Different products can be obtained from different parts of the plant - fibre from the stems, oil from the seeds and narcotic from the leaves and flowers.

### The Manufacturing Process

#### *Cultivation and harvesting*

Hemp is an annual plant that grows from seed. It grows in a range of soils, but tends to grow best on land that produces high yields of corn. Once the crop is cut, the stalks are allowed for retting (removal

of the pectin [binder] by natural exposure to the environment) in the field for four to six weeks depending on the weather to loosen the fibers. While the stalks lay in the field, most of the nutrients extracted by the plant are returned to the soil as the leaves decompose. The stalks are turned several times using a special machine for even retting and then baled with existing hay harvesting equipment. Bales are stored in dry places, including sheds, barns, or other covered storage. The moisture content of hemp stalks should not exceed 15 percent.

### **Fiber processing**

To separate the woody core from the bast fiber, a sequence of rollers (breakers) or a hammer mill are used. The bast fiber is then cleaned and carded to the desired core content and fineness, sometimes followed by cutting to size and baling. After cleaning and carding, secondary steps are often required.

### **Retting**

- Retting is process to separate fibres from bark tissue. It can be done through various methods.
- Dew/Snow retting- Hemp stems are left in open, where rain, dew, irrigation or snow (prevalent in Uttarakhand in India) can keep the stems moist. This process may take up to 5 weeks and gives a coarse fibre which is light brown in color.
- Water retting- Stem bundles are submerged in water for bacterial break down of pectin. It takes 7-10 days and produces better quality fibre.
- Warm water retting- Stem bundles are soaked for 24 hours then these bundles are treated with heat for 2-3 days. This process gives very clear and uniform hemp fibres.
- Chemical retting- In this process, chemicals are used to dissolve the pectin. This process takes approximately 48 hours and produces a very high quality product.

### **Industrial processing**

After retting, the fibre is degummed, dried, decorticated, scutched, hackled and combed processes that separate and clean the component parts so each part can be used for various purposes. Tows' are derived from the scutching and hackling process. The scotched and hackled tow is spun into coarse yarn or cord in a dry or wet spinning process subject to various levels of purity, including refining and parallelizing, by means of different carding machines (carding of different intensities). In India, carding is mostly done by hands. Traditionally, hemp processing plants are very small and labor intensive.

### **Present status in India**

Hemp is primarily cultivated in the districts of Almora, Chamoli, Garhwal and Nainital (excluding the Terai and Bhabar) in Uttarakhand in the country. It is also produced in Kashmir and Travancore to a small extent. The limited cultivation in selected parts of the country is mainly due to requirement of low soil temperature at the time of planting. Currently, India is not strongly present in the map of hemp producing countries. To improve this situation, many efforts need to be undertaken in a consistent manner.

### **Market potential**

- There is an increasing awareness of hemp fibre and a wide spectrum of hemp products are now available in the market, made of different parts of the plant – long bast fibre, medium fibre, short core fibre and seed oil.
- Long fibre has long, strong strands (superior to cotton) suitable for textiles; has anti-mildew and anti-microbial properties that are particularly useful for sails, tarp, awnings and carpets. Moreover, it is biodegradable and serves as an environment-friendly substitute for fibre glass. Hemp fibre is used for a variety of textile products, such as bedspreads, blankets, backpacks, carpets,

clothing, draperies, hats, luggage, mattresses, sails, sheets, shoes, shirts, tents, towels and upholstery. Hemp textiles have a number of distinct advantages over other fabrics like hemp textiles are longer, stronger, more lustrous and absorbent and more mildew resistant than cotton textiles.

- Medium fibre has low lignin levels that make it ideal for paper and non-woven applications. The German Aerospace Institute and many German and American automobile companies are using hemp extensively for making auto components such as gaskets, seat covers, floor mats, and interior paneling. Fibre composites are among the fastest growing segment of the wood-products industry, thus showcasing the huge potential market for industrial hemp.

#### **Uses of hemp**

- Hemp has been used for centuries to make rope, canvas and paper. Long hemp fibres can be spun and woven to make crisp, linen-like fabric used in clothing, home furnishing textiles and floor coverings.

- Hemp fibres are also used to reinforce moulded thermoplastics in the automobile industry. The short core fibres go into insulation products, fibreboard and erosion control mats, while the fibrous core can be blended with lime to make strong, lightweight concrete.

- **Building Materials**

Hemp bast or long fibre and hurds or inner short fibre can be processed and used with existing technology in construction. The hemp stalk can be incorporated into building materials straight from the field. Hemp fibre added to concrete increases tensile and compressive strengths, reduces shrinkage and cracking.

Hemp fibres have excellent potential – they can reinforce plastics, substitute mineral fibres, be recycled, can be grown

ecologically, and have no waste disposal problems. A range of products can be derived from non-woven mats for a range of uses: insulation, filters, geotextile, growth media, reinforced plastics and composites.

- **Hemp Concrete & Insulation**

Hemp hurds are not only very absorbent, but are also uncommonly rich in silica. When mixed with lime, hemp hurds change from a vegetable product to a mineral. In this mineral state it is often referred to as hemp stone, and it weighs between 1/5 and 1/7 that of cement based concrete. Several hundred houses have been built in Europe using this material. Sometimes the hemp hurds are mixed with lime, water and either gypsum or river sand. When it is poured it hardens, and becomes mould and insect resistant. One advantage of hemp concrete is that it makes it unnecessary to have several layers of conventional building materials – it is outer and inner wall, and insulation all in one – it can replace bricks or cement-concrete, a vapour barrier, insulation, and plaster board or panelling. All that is needed as a finish is an exterior coat of whitewash to which pigments can be added if desired. The interior surface is an attractive cork-like texture that can be waxed or varnished (using a hemp based varnish).

#### **Environmental Advantages**

Hemp is an extremely fast growing crop, producing more fiber yield per acre than any other source. Hemp can produce 250% more fiber than cotton and 600% more fiber than flax using the same amount of land. The amount of land needed for obtaining equal yields of fiber place hemp at an advantage over other fibers.

Hemp grows best in warm tropical zones or in moderately cool, temperate climates, such as the United States. Hemp leaves the soil in excellent condition for any succeeding crop, especially when

weeds may otherwise be troublesome. Where the ground permits, hemp's strong roots descend for three feet or more. The roots anchor and protect the soil from runoff, building and preserving topsoil and subsoil structures similar to those of forests. Moreover, hemp does not exhaust the soil. Hemp plants shed their leaves all through the growing season, adding rich organic matter to the topsoil and helping it retain moisture. Farmers have reported excellent hemp growth on land that had been cultivated steadily for nearly 100 years.

### CONCLUSION

As a fabric, hemp provides all the warmth and softness of a natural textile but with a superior durability seldom found in other materials. Hemp is

extremely versatile and can be used for countless products such as apparel, accessories, shoes, furniture, and home furnishings. Apparel made from hemp incorporates all the beneficial qualities and will likely last longer and withstand harsh conditions. Hemp blended with other fibers easily incorporates the desirable qualities of both textiles. The soft elasticity of cotton or the smooth texture of silk combined with the natural strength of hemp creates a whole new genre of fashion design. The possibilities for hemp fabrics are immense. It is likely that they will eventually supersede cotton, linen, and polyester in numerous areas. With so many uses and the potential to be produced cheaply, hemp textiles are the wave.

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