**NATURAL ECO-FRIENDLY FIBRES: A STEP TOWARDS SUSTAINABLE DEVELOPMENT**

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**ABSTRACT**

Global trends towards sustainable development have brought to light the eco -friendly textiles. Eco-friendly textiles include manufacturing of eco-friendly fibres, eco-friendly textile processing, healthy production environment, use of non- toxic chemicals by textile industry, etc. Many textile production processes lead to land, water and air pollution. These processes are harmful not only to the environment but to the human health also. This means that right from the cultivation or manufacture of raw fibers to their disposal after the use in textiles should meet various eco- standards to keep human beings healthy and our planet earth clean and safe. This paper deals with natural eco–friendly fibres**.**

**Keywords:** Sustainable Development, Eco-Friendly Textiles, Eco- Friendly Fibres

**Introduction**

Natural fibres 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. Nowadays some natural fibres form an interesting alternative for the most widely applied fibres in the composite technology. Worldwide movements towards sustainable development have brought to light the natural, renewable, and biodegradable fibres which are gaining popularity among the people due to their eco-friendliness and positive effects on agriculture, environment and economy. Presently major emphasis is given to eco- friendly production technologies where the concept of cradle to grave or womb to tomb is followed. This means that right from the cultivation or manufacture of raw fibers to their disposal after the use in textiles should meet various eco standards to enable them to be labeled as “Eco- friendly textiles”.

In recent years ecological issues have loomed large especially in textile industry, an industry not noted for eco friendliness. The eco- problems in textile industry occur during many production processes and are carried forward right to the finished products. Some of the environmental harmful stages of textile industry are fibre growth with herbicides or pesticides, dyeing with toxic chemicals, emissions to air and water, toxicity potential of processing wastes and area usage of the textile drains. These textile production processes leads to land, water, air and noise pollution and are harmful not only to the environment but to the human health also. There are increasing number of cases experiencing health problems such as rashes, allergies, respiratory and concentration problems due to chemical sensitivities. Therefore, there is an urgent need of eco –friendly way of manufacturing textiles.

Moreover, India is a potential exporter of readymade garments, home textiles and handicrafts. As the foreign buyers are much concerned about the safety of the textiles and the hazards caused by the textile products, it is necessary to produce eco-textile products that are safe to the wearer and the environment.

**Eco- Textiles for Sustainable Development:**

 “The principles of sustainable development say that we should live within environmental limits and that we should enjoy and aspire to a healthy, just and fair society. That’s not an either/ or, it’s both/and”.

*Will Day, SDC Chair*

In 1987 the United Nations World Commission on Environment and Development released the report *Our Common Future*, commonly called the Brundtland Report. The report included what is now one of the most widely recognised definitions of sustainable development.

Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs. It contains within it two key concepts:

* The concept of 'needs', in particular, the essential needs of the world's poor, to which overriding priority should be given; and
* The idea of limitations imposed by the state of technology and social organization on the environment's ability to meet present and future needs.

*World Commission on Environment and Development,*[*Our Common Future*](https://en.wikipedia.org/wiki/Our_Common_Future)*(1987)*

Manufacturing eco-friendly textiles is a major contribution in the area of textiles towards sustainable development .The word “eco” is used as a short form for ecology. Ecology is the study of the interactions between organisms and their environment. Therefore “eco-friendly” (or “ecology friendly”) is a term to refer to goods and services considered to inflict minimal or no harm on the environment. There are a variety of materials considered "eco-friendly" for a variety of reasons: First and foremost, the renewability of the product. Renewable resources are items that can be replenished in a relatively short amount of time; the second factor is the ecological footprint of the resource - how much land (usually measured in acres) it takes to bring one of the individuals (plants or animals) to full growth and support it; and the third thing to consider in determining the eco-friendliness of a particular product is how many chemicals it requires to grow/process it to make it ready for market.

 The term “eco-friendly textiles” refers to a selected group of textiles that have a reduced carbon, energy and pollution impact when compared to the standard methods used to produce textiles and manufacture clothing. Eco-friendly textiles include eco-friendly fibers, eco-friendly textile processing, healthy production environment, use of non- toxic chemicals by textile industry, etc.Natural eco-friendly fibres are obtained from the nature in fibrous form. Generally eco-friendly fabrics are produced from crops that do not require pesticides or chemicals to be grown, use less water and energy to be produced and processed and create less waste during production , processing and at the end of their useful lives.

The criteria for eco -friendly textile products are built around three key areas:

1. Environmental requirements concerning the fibre types used;
2. Environmental requirements concerning the processes and chemicals used in the production of textiles; and
3. Requirements concerning the usability of the final textile products.

In India, Textile and Apparel industry is the second largest industry after agriculture. At present, it is amongst the fastest growing industry segment and is also the second largest foreign exchange earner for the country.India is one of the largest producers of fibres in the world. The main fibres produced in India include cotton, silk, jute, wool, and man-made fibres. India is the third largest producer of cotton, the second largest producer of silk and the fifth largest producer of man-made fibres. India has strong domestic as well as international demand which led to huge growth of textile and apparel industry in India. It provides direct employment to over 35 million persons. As per the latest report by Technopak, Indian Textile & Apparel Compendium 2010, the Indian domestic textile and apparel market size in 2009 was Rs. 218570 crore (US $ 47bn) and is expected to grow at the rate of 11% Compound Annual Growth Rate (CAGR) to reach Rs. 656000 crore (US $ 140 bn) by 2020. This huge sized and fastest growing textile and apparel industry occupies a vital space in the Indian economy and contributes substantially to its exports earnings. The industry can play a major role to lead the world towards sustainable development through manufacturing eco-friendly textiles which include eco-friendly fibers, eco-friendly textile processing, healthy production environment, use of non- toxic chemicals by textile industry, etc

**Natural Eco-Friendly Fibres**

**Organic Cotton Fibre**

Organic cotton is more environment friendly than the traditional variety as it uses no pesticides, herbicides, or insecticides during the growing cycle. There are many growers of this crop, and the number is steadily increasing.

Cotton is a wonderful fibre for making clothes, but it is now recognized that conventionally grown cotton causes great harm both to the environment and to the health of cotton industry workers. Its extensive use of pesticides and insecticides can cause ill-health to people that come into contact with the chemicals and widespread pollution by soaking into water tables. Organic cotton is grown without chemicals and therefore does no harm to either environment or workers, but it is more labour intensive and furthermore fields must be free of chemicals for three years before the crop can be certified organic. There have been huge global increase in the demand for organic cotton and now the problem facing by farmers is producing enough to meet the demand.

**Hemp Fibre**

Hemp has naturally long fibres which makes it suitable for spinning with a minimum of processing. The [ecological footprint](http://naturalhealthcare.ca/medical_terms.phtml?term=ecological%20footprint) of [hemp](http://naturalhealthcare.ca/herbology_101.phtml?d=y&herb=hemp) is considerably smaller than that of the other plants considered for their fibres. Hemp plants grow very quickly and densely which makes it difficult for weeds to take hold, eliminating the need for herbicides and artificial fertilizers. It has many excellent properties, being environmentally positive with no need of pesticides and insecticides; it actually improves the soil where it is grown. Hemp is drought resistant and can be grown in most of the climates. Textiles can also be processed from the fibrous stalks without the use of toxic chemicals. As it does not require high technology to process, it is ideal to be processed locally increasing local employment and saving transport costs.

 **Bamboo fibre**

Bamboo is a material whose luxurious softness has been compared to cashmere. As a plant it is fast growing and highly sustainable and is mainly naturally organic, requiring few farming inputs and no pesticides. It does not require replanting after harvest but will regenerate from its vast root structure. Bamboo helps to improve soil quality and helps rebuild eroded soil. There are two ways of manufacturing bamboo, either mechanically or chemically. The mechanical way involves crushing the woody parts of the plant and then using natural enzymes to break it down into a mush so that the natural fibres can be mechanically combed out and spun into yarn. Bamboo produced by this method is sometimes called ‘bamboo linen’. However, very little bamboo linen is manufactured for clothing because this method is labour intensive and costly. Bamboo fabric for clothing is mainly produced by chemical manufacturing which involves ‘cooking’ the leaves and shoots in the strong chemical solvents sodium hydroxide and carbon disulphide in a process called hydrolysis alkalization combined with bleaching. Both these chemicals have been linked to health problems. Low levels can cause tiredness, headaches and nerve damage. Carbon disulphide has been blamed for neural disorders in workers of manufacturing units. Because of health problems associated with this manufacturing method and damage to the environment it is not considered eco-friendly but good news is that the newer manufacturing methods have been developed which are more benign and environment friendly. Nowadays lot of bamboo fabrics is produced without any chemical additives.

More importantly, bamboo fibre is a unique biodegradable textile material. As a natural cellulose fibre, bamboo fabric can be 100% biodegraded in soil by micro organisms and sunlight. The decomposition process does not cause any pollution in the environment. Long time exposure to ultraviolet radiation may cause skin cancer but the apparels made from bamboo fibre can absorb ultraviolet radiation in various wavelengths, thus lessening the harm to human body to the maximum extent. It has good quality of moisture absorption and ventilation. With this unique microstructure, bamboo fibre apparel can absorb and evaporate human sweat very quickly. Bamboo fabric garments make people feel extremely cool and comfortable in hot conditions. “Bamboo fibre comes from nature and completely returns to nature in the end”. Bamboo fibre is praised as “the natural, green and eco-friendly new type textile material of the 21st century.

**Ramie Fibre**

Ramie is a highly sustainable eco- friendly fibre. It is very strong and durable and is 8 times stronger than cotton and even stronger when wet. Ramie is a flowering plant, and when the fibers are extracted from the plant for spinning, it can be harvested up to 6 times in a successful year. Ramie is naturally resistant to bacteria, mould and mildew rot or insect attack. It does not require pesticides. Ramie fabrics are good choice for warmer climates. It has good stain resistance and it does not shrink.

 **Soy Protein Fibre**

Soy Protein Fibre (SPF) is the only protein fibre has a luster of silk which makes the fabric elegant. Soya bean protein fibre has not only excellent optic effect but also has outstanding features in wearing. Knitting fabric of soybean protein has soft and smooth which is same as that of fabrics made from silk blended with cashmere. Soya fabric is renowned for its softness, comfort, luster and drape combined with washability and durability. It is more expensive than organic cotton or hemp at this time and is seen as a new luxury product. One of the positives being talked about is the fact that the cloth is produced from a by-product of food manufacturing of soya bean.

The original colour of soybean protein fibre is light yellow just like that of tussah silk. Breaking strength of the single soybean protein fibre is over 3.0c Ndtex, which is higher than that of wool, cotton & silk and only lower than that of polyester fibre of high intension. Soybean Fibre has outstanding antibacterial, biodegradable, anti-crease, easy- wash & fast- dry property.

**Pineapple Leaf Fibre**

Pineapple leaves are used to obtain Pina, a textile fibre that is used to make fabrics. The pina fibers are extracted from the pineapple leaves by hand scraping, decortications or retting. Pineapple leaf fibre is very common in tropical regions and it’s very simple to extract fibres from its leaves. The utilization of pineapple leaf fibre in composite material is a new source of materials which can be economic, eco- friendly, and recyclable. Commercially pineapple fruits are very important and leaves are considered as waste material of fruit which is being used for producing natural fibres.

It is white in colour, smooth and glossy as silk, medium length fibre with high tensile strength. It has a softer surface than other natural fibres and it absorbs and maintains a good colour. Nowadays bio-composite reinforced materials are widely accepted in place of traditional materials in high strength and several light weight applications. Such composite materials exhibit good strength by weight ratio, high tensile and flexural strength, high creep resistance, and high compactness.

 **Stinging Nettle Fibre**

This fibre is obtained from the Brennessel plant which is naturally resistant to vermin and parasites. It can be grown without pesticides and herbicides. These fibres can be mixed with organic cotton and spun into yarn. Nettle fibre is stronger than cotton and finer than linen fibre. They can be made into a wide range of woven as well as knitted fabrics. Due to its glossy look, nettle fabric is becoming popular as sustainable alternative to cotton.

**Banana Fibre**

Banana fibres are extracted from the barks of the banana tree and are biodegradable. These fibres are bonded by natural gums and made of thick walled cell tissues. Normally two to three outer sheaths are removed, and the intermediate layers are used. The outer layer of the plant gives coarse fibres that are very brittle and the innermost sheaths are also rejected as they contain pulpy matter. It can be easily blended with cotton or other synthetic fibers. It is popularly known as Manila hemp since decades in Philippines. This fibre looks like bamboo fibre and ramie fibre. It is strong, shiny and lightweight. Banana fibers were used for making ropes and mats till recent past. With its many qualities getting popular, the textile industry is also fast adopting this fibre for making various fashion clothing and home furnishings.

**Corn Fibre**

Corn fibres are bio-degradable. It posses good dye ability in comparison to some natural fibres such as cotton and milkweed fibres, and good fastness with all classes of dyes. The energy required for production of corn fibres was low. Corn-based polylactic acid (PLA) is used for wide range of applications similar to polyethylene terephthalate (PET) based on renewable resources. Corn is a clean product; i.e., on reaching the end of its lifetime, it is completely biodegradable, compostable, burnable (without producing dangerous fumes) and recyclable. Corn fibre has already threaded its way into some winning outfits produced by designers from across the globe. Corn fibre manufacturers have claimed that these fibres can be used for sportswear, jacket, outer coat, apparels etc.

**Sisal Fibre**

Sisal fibre is a kind of natural fibre, which possesses high specific strength and modulus, low price, recyclability, easy availability. Using sisal fibre as reinforcement to make sisal fibre reinforced polymer composites has aroused great interest of materials scientists and engineers all over the world. Sisal or sisal hemp is an agave.

 Agave sisalana that yields a stiff fibre is used in making rope. It is not really a variety of hemp, but named so because hemp was for centuries a major source for fibre. The Sisal plant has a 7-10 year life-span and typically produces 200-250 commercially usable leaves. Each leaf contains an average of around 1000 fibres. The fibre element, which accounts for only about 4% of the plant by weight, is extracted by a process known as decortications. Among flax, hemp, abaca, sun hemp and other agro-based fibre species, annual sisal production is the second largest worldwide after cotton.

**Calotropis Fibre**

Calotropis fibre is a new type natural cellulose fibre and is obtained from Calotropis procera and Calotropis gigantea, belonging to the Apocynaceae family. This natural cellulose fibre has good touch to skin like cotton and beautiful luster like silk. It has a large hollow structure with a thin wall that looks like an air-filled pipe. It is about 2 to 4cm long and 12 to 42 microns in diameter. Because of its excellent properties, the fibre has become one of the new ecological materials which have huge development potential.

 With enhancement of environment protection consciousness of people, today natural fibres have shown great promise in a variety of applications that were previously dominated by synthetic fibres due to their important aspects of biocompatibility, possible biodegradation, non-toxicity and abundance.

**Jute Fibre**

Jute fibre is obtained from skin or bast of plant's stem. It is the second most important vegetable fibre after cotton, in terms of usage, global consumption, production and availability. It is 100% bio-degradable and thus, environment-friendly. It is used extensively in manufacturing different types of packaging material for agricultural and industrial products. Jute is now not just a major textile fibre, but also a raw material for non-textile products. Jute characterized by its silky texture, high tensile strength and resistance to heat and fire is considered fit for use in industries as varied as fashion, travel and luggage, furnishings, carpets and floor coverings, decorative textiles and made-ups*.* Non-woven jute fabrics carry applications in meditech, agrotech, protech, geo-textiles, etc.

**Coir Fibre**

Coconut tree is popularly known as tree of life is useful to humans from its head to toe. These fibres have high lignin and low cellulosic content. Extracted fibres are spun into durable yarn, mostly with a brownish hue. They are light weight, resilient and durable. Fibres extracted from activated carbon of coconut shells are known as cocona fibres. These fibres are used in mats, and rugs. They are also made into apparels. These fibres are fused into polyester fibres to improve its wicking and absorbing properties. Coconut fibres have the ability to protect the wearer against UV rays and have the ability to absorb and hold body odor till the fabric is washed.

The emergence of environmental awareness among consumers has led the world to demand for goods and services that are eco-friendly. Eco –friendly textiles are gaining importance in the consumer market. Consumers who initially considered only the aesthetic value are now looking at the harmful effects on health and environment created by various chemicals during production and processing of textiles. It is better for the society to prevent harmful effects than to cure it after its creation. A step ahead in this direction is the cultivation or manufacture of eco-friendly fibres.

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