Extraction of plant based natural fibers – A mini review

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Retraction

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Extraction of plant based natural fibers – A mini review

D Mohankumar[1], V Amarnath[2], V Bhuvaneswari[1], S P Saran[1], K Saravanaraj[1], M Srinivasa Gogul[1], S Sridhar[1], G Kathiresan[3] and L Rajeshkumar[2]

[1]Department of Mechanical Engineering, KPR Institute of Engineering and Technology, Coimbatore, Tamilnadu 641407, India

[2]Department of Mechanical Engineering, Sri Ramakrishna Engineering College, Coimbatore, Tamilnadu 641022, India

[3]Deputy General Manager, Shanthi Gears ltd., Coimbatore, Tamilnadu 641005, India
l.rajeshkumar@kpriet.ac.in[1]

Abstract. Natural fibers were given a lot of respect over synthetic ones in terms of sustainability. Application of natural fibers is superior to synthetics because they can be achieved cheaply and they have an environmental advantage. The usage time is usually shorter, often being fully or partially recyclable or biodegradable. There are wide varieties of natural fibers which can be reinforced to form composites and used for various applications. Combinatorial, or silicate, substances that can be made of a broad range of properties which is not derived a single resource. The reinforcement of fibers within the matrix becomes easy, only when the fibers are extracted from the plants, hence the extraction process is necessary in fiber reinforcement. There are various methods of fiber extraction, which include mechanical decortications, water retting process and manual extraction method. The extraction of fibers involves the retting process which is followed by the decortication process. From the above various methods, a suitable extraction method is selected based on the parts of the plant from which the fiber is to be extracted. Choice of extraction method governs the characteristics and properties of composites fabricated out of it. This review paper discusses the various methods of extraction and the feasibility of its application for various plants and fibers.

Keywords: *Plant fibers; Extraction; Decortification; retting; separation*

1. Introduction

1.1. Classification of Fibers

Natural fibers are the fibers that are available in nature and its available form may be from plants or animals. These fibers are considered to be renewable in nature and are characterized by advantages like easy availability, biodegradable and versatility in usage. Natural fibers are broadly classified as plant based, animal based and mineral based fibers [1-3]. Figure 1 shows the broad classification of natural fibers.

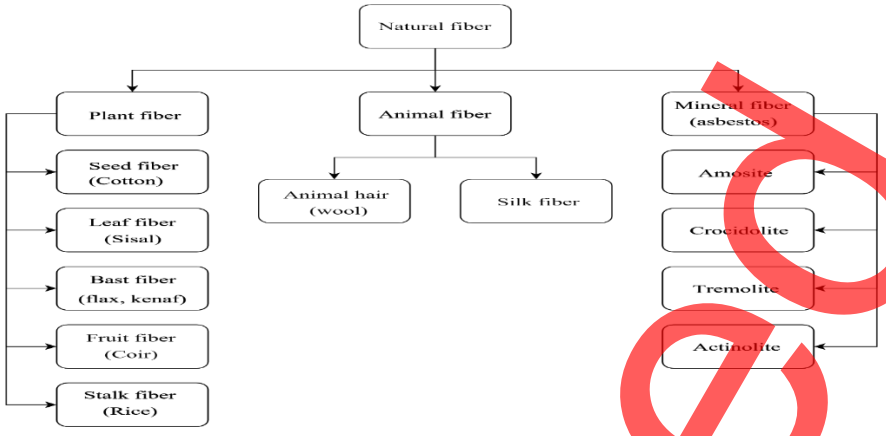

Figure 1. Classification of Natural Fibers [1]

1.1.1. Plant Fibers. The fibers that make up plants are made out of a variety of plastic known as cellulose. Those are spools of cotton, yarn, flax, ramie, kenaf, sisal, and hemp. The cellulose fibers used in the production of paper and cloth are a key part of that process. Things like this are something that can be divided into different categories [3, 4].

1.1.2. Seed Fiber. Fibers obtained from both the seed and seed case Cotton is a smooth, fluffy staple fiber that develops in a stem, or photo resistor, across the crops of the different crops. The cotton would be almost natural cellulose. From natural conditions, the cotton bolls can improve the dispersal of the seeds. Common examples of seed fiber could be cotton and kapok fibers [5, 6]. Figure 2 shows the cotton fibre before extraction.

Figure 2. Cotton Fiber

1.1.3. Leaf Fiber. In the plant kingdom, there are different types of soil fibers. Some of them are in the group of the most minerals. Agents to the use of the lingo cellulosic materials of both the cellulose fiber and the vitality of the material they are made of. The softer member of the synthetic fibres is made from is in the group of the most minerals. This is due to higher lingo cellulosic materials and the vitality of the material they are made of [7, 8]. These plants are like a rope and like paper in that they are very pliable. This is a bonus as the plant produces more luster as has been used in clothing and material like creating. The fibers used in the connective tissue of a plant leaf are made of both stems or phloem tissues, and every other layers of materials that keep the plant leaf together, such as sheathings of other types of cells [9]. Commonly known leaf fibers are sisal, pineapple, areca, abaca fibers and so on. Figure 3 shows the extracted pineapple fiber. Leaf fibers are very hard to harvest. The main leaf fibers that are processed and sold are the agave fibers and sisal fibers. Like the practice for producing rope in the past, but with improved technology that has allowed for a large amount of rope to be produced from one tree, more and more discarded fiber is being able to produce paper [10-13].

Figure 3. Pineapple leaf fiber

1.1.4. Skin Fiber. Cotton fibers are extracted from the skin of a cotton plant (also known as cotton) and are used to create additional substantial. Compared to other fabrics, these will have a higher tensile strength. As a result, these fibers are also used for durable yarn, cloth, packaging as well as paper [14, 15]. Jute is a long, smooth, light brown aeruginosa that must be spun into coarse cottony threads of a shiny brown. Jute is one of the most inexpensive natural fibers that are equal just to cotton in the amount of production and range of uses. Jute fibers are composed primarily of the plant materials cellulose and lignin. Commonly known skin fibers are flax, jute, hemp and soyabean [16-18]. Figure 4 shows the extracted form of jute fibers.

Figure 4. Jute Fiber

The jute plant requires a plain, well-drained soil and plenty of standing water. The appropriate environment for developing jute (warm and wet) is provided also by long rainy season, mostly during monsoon season. Temperatures above 20 degrees Celsius to 40 degrees Celsius and humidity between 70 and 80 percent are beneficial for cultivation of this plant. Jute needs 5–8 cm of rainfall to grow [19, 20].

1.1.5. Fruit Fibers. Membranes are accumulated from the fruit of the leaf, A chocolate bar is a herbaceous plant – botanically a berry produced by several tropical plant tropical tree Musa. In some countries, bananas may be called "plantains" for cooking, but in other parts, they may be called "bananas" for dessert. The fruit in question is a varied one, with its variations in color, shape, and firmness. It has a soft, fleshy rind, and the flesh has a scattering of starch within it, which varies from green and yellow, to deep red or purple in color. The fruit is grown on a vine above the plant, which grows in bunches. Almost every seedless or parthenocarp banana, which has been domesticated, comes from two wild species [21-23]. Figure 5 shows the extracted banana fiber.

Figure 5. Banana Fiber

1.1.6. Stalk Fiber. The fibrous material is discovered within the exact stems of its crop. Fruits, vegetables, and grains are categorized by having a large proportion of fiber, which is also how that affords us with endurance. The fibers may be chemically treated; in the way that viscose is handled (used to make rayon and cellophane). The scientists who study this material have begun exploring further the use of this material in composite materials [24,25, 26]. After the research on how strong cellulose fibers are, scientists are looking into using intensive levels of cellulose to create strong material that can be used in many applications. Least concern species (those that have adequate habitat that is not being destroyed, sufficient numbers present, and whose population is expected to recover without external intervention [11]) such as fiber crops, are those that should have only one crop growth until being cultivated for certain substances as vegetable oil fibers or lacebark fiber. When it comes to fiber crops, woodpeckers (short for wood pulp) can be better in unique situations than any cotton to make a product, particularly when it comes to technical efficiency, carbon footprint or cost. Normally, straws of wheat, rice, barley, and other crops including bamboo and grass falls under this category [27-29]. The figure 6 indicates the derived fiber from grass plant stalk.

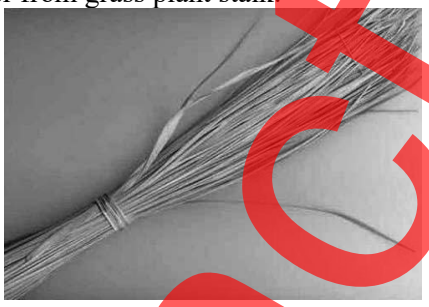

Figure 6. Grass Fiber

2. Extraction Of Natural Fiber

Fibres are natural or manmade substance that is significantly longer than its wide. The reinforcement of fibres within the matrix is easy only when the fibres are extracted from the plants.Fibres are extracted by the process of retting.Retting is to immerse then fibre bundles in clear slow flowing water in canals, rivuelts,ponds or ditches [29, 30]. Fibres come together to form stem and ribbon it has to be extracted to improve its physical properties and also to remove the cellulose, lignin and other micro level content from it. Extraction methods are suitably selected based on the parts of the plant from which the fibre is to be extracted. Choice of extraction methods govern the characteristics and properties of composites fabricated from it [31].

2.1. Mechanical Decortication

The shives, which need to be completely broken down during the based on the experiments process, are mechanically split up into smaller pieces of fibre bundles. Study is currently being carried out on the complex properties of fibre bundles to emphasise the complexities of fibre characteristics. An aspect of the business analysis approach will also result in the selection of enhanced progenies and the expansion of agricultural production techniques leading to the maximization of specific textures for specific uses [32, 33]. Much as in testing ware houses, made the effort of simple models containing only a few stem-free parts cannot be carried out on large scale production plants. Every selected stem went through all steps of the decortication process while assessing and registering all data [34]. At least 10 stems were selected to obtain the quantity of fiber bundles needed for subsequent characteristics, such as fineness, weight, dislocation or mechanical properties [35]. Figure 7 shows the Life cycle of natural fibre analysis
Earthen Method

As suggested by the SENCICO E.80 standard, fluid was personally mixing with clayey soil (oven-dry condition) until a monolithic mix was obtained, resulting in a water weight ratio to soil weight [36, 37]. The ingredients of the clay mixture were mixed together manually in the way that conventional clay-making techniques are used and then the mixture was formed into soil rock. The water content selection

was based on the cigar test, which is a simple field test designed to determine the moral effect of a pervious concrete. This test consists of molding the soil in the form of a 20 mm diameter cigar with a defined liquid limit, allowing on part of the cigar-shaped wooden mix knotted until it cracks, and measuring the length of three consecutive broken parts [38, 39]. For different water content the same technique is repeated until the specified break lengths are reached. Figure 8 shows the earthen process.

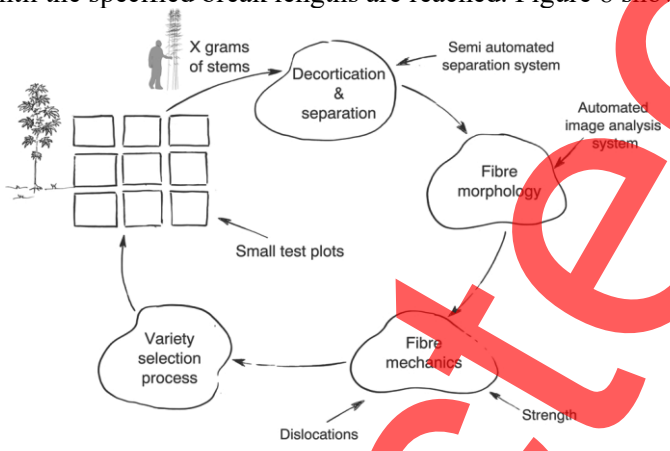

Figure 7. Life cycle of natural fiber analysis

Since manufactured polymers will be provided to sell these goods, it is essential that you realize that they will be incorporated with synthetic polymers which will affect the properties of the composites significantly, which will select for more robust products over long periods of time when this product is being used regularly. This is of major interest offered that ancient stone substances too are frequently included in the buildings and for the regeneration of older homes in the shape of adobe buildings or even mud bricks or even mortars of ancient stone material [34, 38, 39].

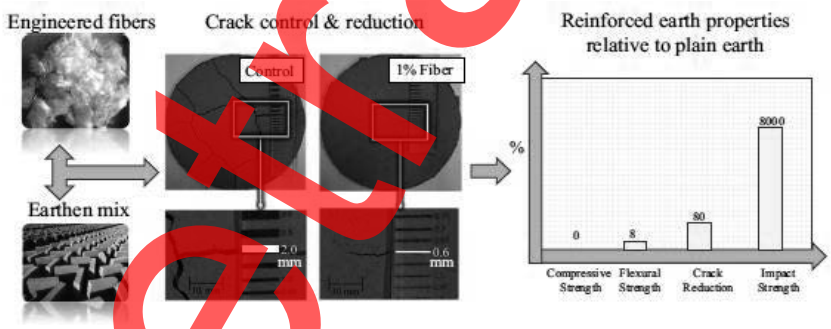

Figure 8. Steps involved in earthen method

2.2. Water Retting

The most widely accepted method of natural fiber production is through water retting, whereby bunches of stalks are immersed in water. Finally, the water moved in to the root making the water within the stem increased and making the top most skin burst. This increased absorption of humid air and rotting bacteria. The use of yeast when manufacturing cloth requires the selection of skilful harvest time when needed by the cloth maker. Covered in the previous slide, while the grain of the bark is gently submerged into water through a raking operation, the fiber is retting from many months in an anaerobic environment before being used. Natural water retting employee's stagnant or slow-moving water such as pond, slow stream, bogs, rivers [40-42]. Figure 9, shows the Water retting process.

Figure 9. Water retting process [39]

2.3. Manual method

In manual fabrication of fiber, the fiber gets collected from the river banks and the collected fiber is treated by water which is got stuck on the fiber for around 168 hours and then the fiber is dried in room temperature to minimize moisture in the fiber, thereby made into a fiber for textile use. The fiber is then removed from the plant tissues by manually peeling the fiber from the plant tissues. This allows the bundle of stems to be separated from the water that drains from it. The stems are then stripped separately. After the fibers are rendered into handfuls, the materials are then cleaned. The stems in the fiber are taken in hand and pounded on roads when the root ends are sufficiently crushed, they are broken off [43, 44]. The fibers that are loosely knotted are then able to be taken free from the rest of the stems. The fibers are then removed, sorted, and cleaned. Rub the skin of the plant gently until the outer skin is removed, which reveals the plant's fiber, which must be carefully dried [45, 46]. In Figure 10, extraction of fiber can been to be made by hand manually.

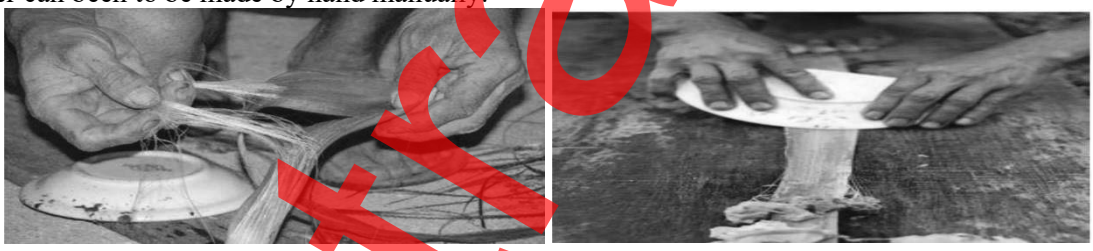

Figure 10. Extraction of fibers by manual method

3. Conclusion

Various researches have been constantly driven on natural fibers due to their potentiality to replace hazardous synthetic fibers and their remarkable characteristics individually and as composites. They give a tangible solution to the increasing concerns over the environment. In the current article, various forms of plant based natural fibers and their extraction methods were discussed in detail. Amongst all the extraction methods, it could be seen that mechanical decortication and water retting were the most productive methods and easy in terms of process. Though the other two methods, earthen and manual separation, renders precise fiber output, their process cycles were longer. Hence, as stated above the natural fibers extracted by any of the above methods may find suitable application as alternative for traditionally used synthetic fibers to form fiber reinforced composites. Usage of natural fibers not only substitutes the synthetic fibers in different applications but also promotes the green environment by nurturing the natural aspects in various day-to-day used engineering components.

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