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A Brief Introduction to Natural Fibers and Preparation of Lignocelluloses for Different Applications

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Abstract

In this research we discussed the brief introduction of natural fibers and different plants were collected and by chemical method lignocelluloses sheet was fabricated which further can be used for many different applications such as in textile industry also it can be used with nanomaterials for flexible energy devices. Lignocellulosic fibers were attained by mechanical separation from monochoria vaginalis and Typha Angustifolia plants, and then after drying of fibers, fibers sheet fabricated by bleaching of fiber with different concentration, the lignocellulose fiber sheets were so flexible that can twist into any geometrical shape and can cut with the help of scissor. That can help to prepare many flexible devices such as wearable energy devices.

Introduction

"Fibers are the hair like materials, like the piece of thread. There are two kinds of fibers: Natural Fibers, which consists of plant and Self-made fibers: which consists of synthetic fibers and regenerated fibers [1, 2]. Plant fibers are light weight, flexible and having good mechanical properties [3]. Hence natural fibers are very useful in many applications. The type of fibers depends upon the sources. It has been noted that fibers having different origin had different mechanical, rigidity, flexibility and biodegradable properties [4-6]. The length of natural fiber is approximately 1μm -50μm and diameter of the fiber is the order of 10nm-50nm nanofibers exist in cell wall [7,8]. The natural fibers are made up of many cell walls. If we remove these cell walls one by one, we will see that it contains nano cellulose fibers in it. These nano fibers add up the strength of the fiber. The main part of natural fiber or plant fibers is cellulose wrapped around nano and micro cellulose which are stick together by lignin which totally made up lignocellulose" [9]. The pulp and paper industry processes large quantities of lignocelluloses biomass in every year [10-22]. Historically, plants have found some uses in pulp and paper industry, but these fibers have been confined to areas such as modifications of raw starch fibers [23-35]. Over the years, the number of possible applications of plant fibers in pulp and paper industry has increased steadily [36-39]. The pulp and paper industry processes large quantities of lignocelluloses biomass in every year. Historically, plants have found some uses in pulp and paper industry, but these fibers have been confined to areas such as modifications of raw starch fibers [35].

Over the years, the number of possible applications of plant fibers in pulp and paper industry has increased steadily [36-39]. Lignocellulose are widely being used in in pulp and paper industries [40,41]. Lignocelluloses biomass in the form of plant fuel, has a very long history as a source of energy [42]. Industrial biomass composed on lignocelluloses waste, which is renewable, inexpensive, abundant and provides a natural resource for large-scale and cost-effective bio-energy collection [43-45]. Lignocellulose also have application in Biofuels and Bioethanol [46-48] Vehicle industry around the world used the lignocellulose fiber-based composites parts in the vehicles e.g. foot mats interior, rugs etc. [49-51]. Many applications have been reported for use of Lignocellulose application in automobiles [52]. Now a day's natural/nano lignocellulose fiber composites are using in the construction of the buildings [53,54]. A large

quantity of lignocelluloses plant wastes is generated worldwide from different sources leading to environmental issues. By use of these lignocelluloses wastes in making cement-bonded construction materials, we can reduce the magnitude of different problems [55-57]. Lignocellulose fibers are used as a composite form to be mixed with rubber, fibers provide good strength to them [25,53,58-62]. It adds up strength and stiffness when mix with other materials [9,63-67]. Lignocellulose fibers are also used to avoid erosion of soil and for the protection of the seeds [68]. Lignocellulose fibers are also used to avoid erosion of soil and for the protection of the seeds" [68].

Lignocellulose application in soil conservation materials are also reported [68,69]."Bacterial lignocellulose fiber has found many applications in the biomedical field as tissue engineering materials due to their good biocompatibility, mechanical properties similar to those of hard and soft tissue and easy fabrication into a variety of shapes with adjustable interconnected porosity [70-72]. Lignocellulose Paper-based supercapacitors, a very interesting and novel group of flexible and environmentally friendly energy storage devices, are attracting a great attention from the industry. Lignocellulose fibers with a unique porous bulk structure and absorptive surface properties enable the paper-based energy storage devices with a reasonably good conductivity performance at a very low cost" [73].

Experimental

Collection of Typha Angustifolia

For the collection of Typha Angustifolia southern Punjab Pakistan District Muzaffargarh village was selected and as these are self-growing plants so was easily available in steady water (Figure 1).

Figure 1: Typha Angustifolia.

Material and Preparation Method

"In this regard the first plant Typha Angustifolia (cat-tail) was chosen as plant source for the preparation and analysis of lignocellulose nanofibers. Typha Angustifolia (cat-tail) was collected Southern Punjab District Muzaffargarh Pakistan. Only leaves cut into lengths were used. The outer skin of the bark was peeled from the leaves by hand and used for fiber extraction. Samples were air-dried and stored at room temperature. The second plant which we selected for our research work was monochoria vaginalis (water hyacinth) commonly known as singhara in native Lahore. The reason behind this selection was that it is a self-grown plant. There is no need to plant it and to spend money and our energy on it. It is easily available and grow in any water populated area for example a pound most of contaminated water. We select this plant for our research work because monochoria vaginalis (MV) is softer for sheet preparation than the first plant" (Figure 2). Then extract the fibers from its stems with scissor. The fibers are in wet form. Then these fibers were dried for 3 days for further processes (Figure 3).

Figure 2: Prepared LC sheet and Fibers.

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Figure 3: Monochoriavaginalis.

Preparation of Lignocelluloses Sheet

"1.0 g of Raw Monochoria Vaginalis (MV)lignocellulose fibers were cut into small pieces. Fibers were first dispersed in 40% NaOCl solution (150 mL). Then bleached fibers were treated at room temperature for 2 hours under constant stirring (500rpm). After that, we grind the solution in mortar and pestle for 30minutes (Figure 4). We again do the stirring process for 30minutes. Again, grind the solution for 20minutes in mortar and pestle. Now the slurry solution was filtered on filter paper (90mm-d) in a Buchner funnel connected to a suction flask and vacuum as shown in diagram" (Figure 5).

Figure 4: Preparation of lignocellulose sheet.

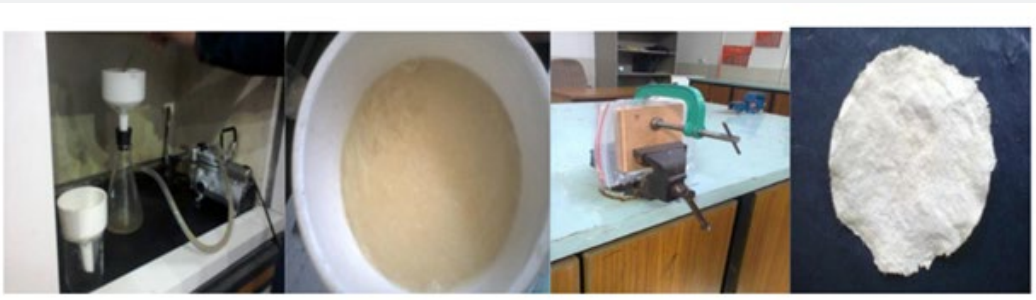

Figure 5: Preparation of lignocellulose sheet.

Conclusion

The lignocelluloses are extracted from natural occurring plants which is most important for the cost factor. It can be used in different applications at lowest cost. The extracted fibers can be used in energy sectors, textile, and paper industry etc. Moreover, the preparation method is also easy, and no special labs are required via simple chemical process lignocelluloses can be prepared having less investment on preparation, so these are interesting fibers for further research.

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