Extraction Of Neem Twigs Fiber

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Abstract *: In this era of environmental consciousness, several research in natural fibres are in progress to increase the renewable fibers for different applications in the field of Technical textiles. In this study , Neem(Azadirachta indica) which is one of the most useful medicinal plant and widely grown in India has been selected and the fiber has been extracted from its twigs by the process of water retting. Retting is one of the traditional and reliable method in the process of fiber extraction that determines the fiber quality. The process was carried out for 20 days . The extracted fiber was then tested for antibacterial activity and FT-IR analysis.*

Keywords: *Neem twigs fiber, Water retting, Antibacterial, FT-IR*

I. INTRODUCTION

Growing environmental concerns, issues and challenges has led to the development of various natural resources product in several applications in our day today's life. One of the important application is the development of natural fibers in the field of advance technical textiles as the fibers shows specific properties, cost-effectiveness, biodegradability and recyclability. The use of traditional medicinal plants for fiber extraction has been observed for various textile applications. The neem tree, scientifically known as *Azadirachta indica*, which is widely grown in India, is one of the most important tree that constitutes several phytoconstituents and numerous pharmacological activities present in it. It is a fast growing tree which belong to the family of Mahogany. The branches are wide spread. The twigs of neem are used by the rural people and villagers for brushing their teeth as it has several beneficial properties . It is said that a large number of compounds have been separated and isolated from various part of the neem plant. The neem twigs have fibrous substances associated in it. The increasing demand in global textiles competition has led the researchers to face challenges and develop a wide range of commercial textile products.[1]

In the present study, the extracted neem twigs fibers were tested for its antimicrobial activity on human pathogenic bacteria such as *Escherichia coli* and *Staphylococcus aureus*.

II. MATERIALS AND METHODOLOGY

Selection of the plant source

A literature survey and pilot study was conducted before the selection of the plant source for the study. A medicinal plant, Neem (*Azadirachta indica*) which belongs to the Mahogany family, was selected for the research study. The neem twigs were collected from the surroundings of Saibaba Colony, Coimbatore.

Neem – A medicinal plant which is scientifically known as *Azadirachta indica*, a native to Indian subcontinent have several benefits. The plant has enormous applications as it has number of properties like anti-allergic, insecticidal, anti-inflammatory, anti-ulcer, anti-pyorrhoeic, antiscabic and other natural biological activities. As it possess many properties, it is often called as "Divine Tree" and "Heal All" in India. It has been used extensively in the treatment of a variety of diseases as well as in the ayurvedic applications.[5]

The neem twigs are often used by the villagers to brush their teeth and believed to be the most effective forms. A substance, called *Nimibidin* which is found in the neem bark is known for its anti-pyretic and non-irritant and found to be effective in several skin treatments like dermatitis, ulcers, scabies etc. It has strong diuretic and anti-inflammatory properties.

Methodology

Fiber Extraction Process : The neem twigs were identified and collected which is about 20-30 cm long and 1.5-3 cm in diameter. The fibers from neem twigs were extracted by the process of Retting which is one of the most important and traditional process of fiber extraction.[2]

The extraction of natural fibers by the process of retting from plants and their uses for production of fabrics and other woven or constructed textile materials has played major role in textile development. It is of different methods [3]. Here in this study, the neem twigs were retted by normal pool stagnant water retting process. Dew retting method were also tried but the neem twigs were not suitable for exposing in the sun and rain as the neem twigs became dried, hard and brittle which is unable to extract fiber.

In the process of stagnant pool water retting, the twigs were preferably cut into 20-30 cm long and the twigs are kept as nearly as possible as parallel to each other. Crossing of the neem twigs should be avoided so as to avoid entanglement. They are put into the water singly and make sure that the twigs are submerged in the water. One of the main cause of improper and difficult retting is the use of less and too little water for the amount of neem twigs to be retted. Sufficient amount of water is needed as it is used to dilute the acids and certain bacteria which are produced during the process of retting. The water which is used in the stagnant pool retting has to be changed in alternate days. The process was carried out for 17 days. During this, certain bacteria acts on the process by entering through the stomata to break the pectins present in the neem twigs. The twigs were beaten by wooden hammer to become loose for the fibers to separate easily. [6]

In the water retting process , it was observed that the fibers were separated from the inner layer of the twigs. The images of water retting process and retted fiber were shown in the figure 1a and 1b. After the water retting process, the proper separation of the fiber was done by manual process. Then, the separated fibers were dried in the shade for 24 hours at room temperature.

Figure 1a

Figure 1b

III. RESULTS AND DISCUSSION

Anti-bacterial activity: The extracted neem twigs fiber was then perform for the activity of antibacterial by using bacterial species. The selected bacteria were Staphylococcus aureus. and Escherichia coli, also known as E.coli.

Preparation of Media and culture : The antibacterial assay for the study was determined by using Luria Britani(LB), Nutrient Broth (NB) and Muller –Hinton Agar . The pH was adjusted for the media and the autoclaved was maintained at the temperature of 121 degree Celsius for 15 minutes.

Disc Diffusion : The method of Well diffusion was used for the determination of anti-bacterial activity for the study by using Escherichia coli (E.coli) and Staphylococcus aureus (S.aureus). This method shows the efficacy of antibiotics on a particular micro-organism. .

In this method, an agar plate was spread with the bacteria and antibiotics paper disks were added. Then the bacteria was allowed to growed on the agar media. It was then kept for observation. The amount of space around every antibiotic plate indicates the lethality of that antibiotic on the bacteria. The zone of inhibition can be measured after observation in the petriplates. Zone of inhibition was measured from the edge of the well to the zone in mm. Then the plates were incubated at 37°C for about 24 hours and control was also maintained. [7]

Samples	Zone of inhibition (mm)	
	Staphylococcus aureus	*Escherichia coli*
S - N	30mm	24mm

The sample-N indicates the neem twigs fiber which shows a good antibacterial activity against the two bacteria . The zone of inhibition was found to be 30 mm and 24 mm.

Fourier Transform Infrared Spectroscopy (FT-IR)

It is an analytical technique used for identifying organic, polymeric and several inorganic material. In the FT-IR analysis method, the functional groups of the sample are observe with the used of infrared lights for examining the chemical properties of the fiber. It is the first step in the analysis of materials. This method is helpful in analyzing the chemical composition of minute particles, upto the size of 10-50 microns.[4]

In the study for this extraction of neem twigs fiber, the pool retted fibers were analysed for observing the functional groups through the FT-IR – Shimadzu. The spectra of FT-IR analysis were represented in the figure 2. The peak levels shows the presence of certain functional groups.

In the figure.2. the images indicates and represent the frequency which ranges from 4000 to 500 cm-1 . Prominent peaks were observed in between 3000-2850 cm-1 indicating the presence of Alkanes (C-H group) with a few absorption bands in the infrared spectrum. Esters , Fluorides were present as frequency ranges from 1750-1730 cm-1 , 1400-1000

cm-1 . Several peaks were also noted which indicates the presence of Ester (C=O) between 1750-1730 cm-1, Alkene (C=C) between 1680-1600 cm-1. Peaks were noted from 1400-1000 cm-1,785-540 cm-1 and < 667 cm-1 indicating the presence of Fluoride, Chlorides and Bromides, iodides functional groups.

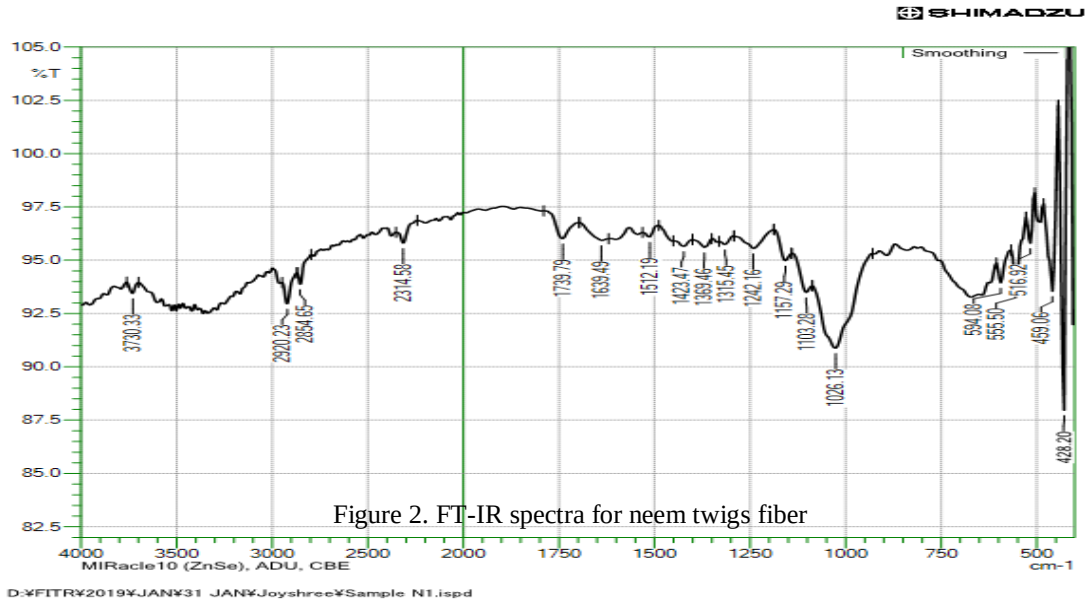

Figure 2. FT-IR spectra for neem twigs fiber

IV.CONCLUSION

Neem offers a wide advantages in today's mankind. It is harmless not only to humans but birds as well as insects. A large number of compounds and substances have been separated and isolated for the applications of pharmacauticals. In this study, fiber have been extracted from the neem twigs through the traditional and reliable process of stagnant pool water Retting . The pool retted fibers were then tested and analysed for the antibacterial activity and FT-IR . The result of FT-IR showed the presence of several functional groups like Alkanes (C-H groups), Esters, Fluorides functional groups.

REFERENCES

[1] Patel Margi H and Desai Pratibha B. 2014, Grafting of Medical Textile using Neem Leaf Extract for Production of Antimicrobial Textile. Research Journal of Recent Sciences. Vol.3.ISSN 2277-2502,pp;24-29

[2] Manimekalai. G and Kavitha . S. 2017, A Review on Application of Retting Techniques for Natural Fiber Extraction. International Journal of Creative Research Thoughts (IJCRT).Vol.5(4). ISSN: 2320-2882. pp; 372-377

[3] NIIR Board of Consultants & Engineers, 2005, Natural Fibers Handbook with Cultivation & Uses, National Institute of Industrial Research. Pp:31-34.

[4] Pavia, Lampman, Kriz and Vyvyan 2015, Introduction to Spectroscopy Fifth Edition, Cengage Learning India Private Limited. Pp: 27-31.

[5] Ruchi Tiwari, Amit K.V. , Sandip chakraborty and Kuldeep Dhalma, 2014, Neem (Azadirachta indica) and its Potential for Safeguarding Health of Animals and Humans: A Review. Journal of Biological Sciences. Vol.14 (2):110-123.

[6] Udeani and Nkemdilim Angela, 2011. Extraction and Textile Qualities of Fibers from Some Xerophytic Plants. Asian Journal of Textile. Vol.1: 34-41

[7] Zaidan, M.R.S., Noor Rain, A., Badrul, A.R., Adlin, A., Norazah, A. & Zakiah, I(2005). In vitro screening of five local medicinal plants for antibacterial activity using disc diffusion method. Tropical Biomedicine. Vol. 22(2): 165–170