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EXTRACTION AND CHARACTERIZATION OF NATURAL FIBER FROM *CURCUMA LONGA* PETIOLE

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ABSTRACT Researchers and scientists are looking forward to the new fiber sources for sustainable processing. The ultimate goal is to produce an organic fibrous material that can be utilized in the textile industry and to manufacture eco-friendly products. In this circumstance here emerges a fiber from *Curcuma longa* Petiole Fiber which has been attracted worldwide as a threat to biodiversity. Hence this paper highlights the physical, chemical and structural characterization of the fiber extracted from *Curcuma longa* Petiole Fiber. The fiber was examined for the physical properties such as fiber length, diameter, elongation, moisture absorbency, and fineness as well as mechanical properties by analyzing its tensile strength test.

KEYWORDS : Fiber properties, Length, Diameter, Elongation, etc.

1. INTRODUCTION

In recent years, lots of global environmental issues and inadequate raw fiber resources, so that the scientists worldwide have begun to show interest in exploiting the full potential of natural fibers and their diverse uses (Schuh 1997). Flax and hemp are an example, of most attractive natural cellulosic fibers in Europe (Peijs 2000). On the other influence, jute, sisal, and coir are more extensively reported in the literature (Chand 1998). There are many other less studied cellulosic fibers that are attractive in terms of their morphology, their intrinsic properties or their cost. *Curcuma longa L*. petiole fiber is one example of such fibers. The origin of *Curcuma longa* is from southern Asia, most probably from India. *Curcuma longa* does not occur in a truly wild state, although in some regions it looks to have become naturalized. It is a sterile triploid and is thought to have arisen by continued selection and vegetative propagation of a hybrid between the diploid wild turmeric (*Curcuma aromatic* Salish. native to India, Sri Lanka and the eastern Himalayas) and another closely related tetrapod *Curcuma* species. This fiber has relatively important textile potential(Msahli 2006) and it is a promising candidate as fiber reinforcement for resin matrix composites (Chaabouni 2005). It is worth noting that, although *Curcuma longa L*. petiole fibers have some characteristics in common with other lingo cellulosic fibers, their properties have not yet been fully described. Thus, to enable their use in technical textile application, the basic aspects of their structure and morphology, such as the chemical composition, the crystallinity, the density as well as the tensile mechanical properties must be analyzed. This work aims to characterize the physicochemical properties of *Curcuma longa L*. petiole fibers.

2. METHODOLOGY

2.1 MATERIALS

Curcuma longa L plants were collected from Tirupur, district, Tamil Nadu, India. The plant is one of the perennial herb and member of the *Zingiberaceae* family and is cultivated mostly in India and China (Lovyalabban 2014). The leafy plant with very large, lily-like leaves up to 1.2m long. The inflorescence is cone-like 10-15cm long and is attached to a stem enclosed in a sheath petide (Wasimahamad 2010). The native of a plant is cultivated in India, West Pakistan, China, Malaysia (Evans 2002) and other tropical regions of southeast Asia (Thomas 2000). They are light green in color, 30-40cm long and 8-12cm wide(Ross 2001).

Looking upon wide prospects and potential of turmeric used for various purposes, worthwhile to cultivate the plant at large scale. This will help in financial upliftment of poor and landless farmers.

Fig 1: *Curcuma longa.L* Plant

2. EXTRACTION OF *CURCUMA LONGA* PETIOLE FIBER

Strand fibers are extracted from the plant by various techniques like mechanical retting, chemical retting and water retting process (Kommula 2013). The *CLPF* are extracted by using mechanical retting process, where the *Curcuma longa* petiole plant was combed by using metallic brush traditional process. Then the stems were shadow dried in the open air to remove the moisture content(Binoj 2015).

METHODS

A. Physical Properties of *Curcuma longa* petiole Fiber

a) Fiber Length

The *Curcuma longa* petiole Fiber is analyzed for its length manually using a calibrated metal scale. The fiber was stretched on the flat table and straighten with care to avoid elongation while measuring. The results are expressed in centimeters.

b) Fiber Diameter

The *Curcuma longa* petiole Fiber diameter is analyzed using a Scanning Electron Microscope (SEM). The average value can be calculated by analyzing the ten different areas of an individual fiber.

c) Single Fiber Tensile Strength and Elongation

The tensile strength of the *Curcuma longa* petiole Fiber is tested according to ASTM D 3822 using eureka single yarn strength tester. The principle of the machine is a constant rate of traverse was the preconditioned fiber sample is mounted between the two jaws having the gauge length of 15 cm. The strength and elongation of the fiber are determined and noted at the point of rupture.

d) Moisture Regain and Moisture Content

The moisture regains and moisture content of the *Curcuma longa* petiole Fiber is analyzed manually using BIS and ASTM D 629 methods. The predetermined amount of fiber (A) is conditioned in the oven at 1050 C and the constant mass of the fiber is obtained (B). Thus moisture properties are calculated from the measured values using (1) for moisture regain and (2) for moisture content.

Moisture regain = A – B / B X 100…… (1)
Moisture content = A – B / A X 100…….. (2)

e) Fiber Fineness

The *Curcuma longa* petiole Fiber fineness is analyzed according to the ASTM D 1577 test method. The fibers of selected length (2 inches) were cut and bundled to the nearest weight of 0.001 mg and the number of fibers in the bundle were counted. Randomly twenty bundles are selected for testing and the average was calculated.

3. RESULT AND DISCUSSION

3.1. Physical Properties of *Curcuma longa* petiole Fiber

The length of the fiber depends upon the plant selected for extraction. *Curcuma longa* petiole Fiber has the length vary from 40 cm – 46 cm and diameter of 532.64 µm. The tensile strength of the *Curcuma longa* petiole Fiber was determined by randomly choosing the 20 samples from a lot and the accurate results are determined. The tensile strength of the *Curcuma longa* petiole Fiber range between 1060 ±7090Mpa. The mean elongation of the *Curcuma longa* petiole Fiber is found to be 1.6 % and the standard deviation of 1.4 %. The moisture regains and

moisture content of the *Curcuma longa* petiole Fiber is found to be 5.5 % and 5% respectively. *Curcuma longa* petiole Fiber has the fineness of 5.7 tex which shows the fiber is least bulk. (See Table I).

Table I Mechanical properties of *Curcuma longa* petiole Fiber

Single fiber length	40-46cm
Single fiber diameter	532.64µm
Tensile strength	4180 Mpa
Fiber elongation	1.6%
Moisture regain	5.5%
Moisture content	5%
Fiber fineness	5.7 tex

Fiber strength is generally considered to be next to fiber length and fineness in the order of importance amongst fiber properties [28]. The tensile strength of *Curcuma longa .L.* Petiole fibers is shown in fig 1. It can be clearly seen from figure 1 that *Curcuma longa .L.* Petiole fibers followed brittle fracture naturally.The average value of the ultimate tensile strength of the *Curcuma longa .L.* Petiole fibers was found to be 1060-7090 MPa. When compared with other natural fibers like Wild Date Palm, Veldt Grape, Tamarind, and Borassus. *Curcuma longa .L.* Petiole fibers had better tensile strength Moreover, the tensile young modulus of this fibers is also comparable with other natural fibers. The young modulus and the elongation at break of *Curcuma longa .L.* Petiole fibers were found to be 34.18 MPa and 7% respectively.

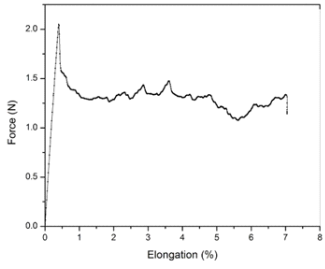

Fig 2: Single fiber strength of *Curcuma longa .L.* Petiole fibers

The *Curcuma longa* petiole Fiber has the water absorbency similar to that of cotton and other natural cellulosic fibers. Whereas the strength and elongation of *Curcuma longa* petiole Fiber are near to that of coir.

CONCLUSION

Curcuma fiber is a natural fiber that is derived from the sheath of Curcuma longa variety, which belongs to the family Zingiberaceae. The study of extraction conditions of fibers seems to have an important role in the properties. The characterization of Curcuma longa L. petiole fibers provide new scope for natural fiber research to complete with a hazardous man-made fibers with excellent properties. Tensile strength and young's modulus are 1060 ±7090Mpa and 1.6% of its elongation, which is significantly similar to other natural fiber. Thus this characterization results firmly confirms the possibility of using this fiber for the manufacture of eco-friendly material. Due to its good strength, cost-effective and renewable sources and the fiber can be used to make wider application of textiles.

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