Physico-Chemical characterization of Pineapple crown leaf fiber

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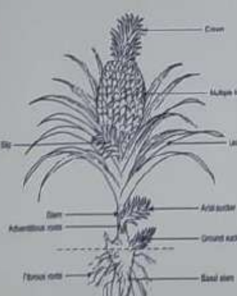
Introduction

For environmental and economic reasons, intensive research investigations have been conducted in order to produce new, lighter weight, greater strength, and more environmentally friendly materials without sacrificing safety but at a cheaper cost and with more regulated production procedures. Weight reduction increases fuel efficiency and the use of materials derived from renewable resources, resulting in lower emissions. Natural fibers will play a significant part in the coming "green economy," which will be based on the energy efficiency of utilizing polymer goods as renewable resources. These fibers are entirely renewable, environmentally benign, strong in specific strength, nonabrasive, inexpensive in cost, and biodegradable. Natural fibers are high in cellulose and are inexpensive and abundant for polymer reinforcement.

The pineapple is part of the bromeliad family, which has 50 genera and around 2,500 recognized species, all but one of which are native to Central and South America.

- The pineapple plant has a height of 1.5m and from 0.9 to 1.2m spread.
- Periods of interest are usually from May to August
- The plant prefers sunny sites.
- To maintain its shape and height is 2 months after harvest.
- The interest is on the pineapple crown leaf fiber (PCLF), as shown in the figure.



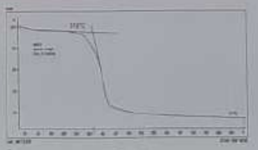
Methodology

Pineapple crown leaf fiber is obtained through the retting process, which involves peeling the crown leaves from the cluster and submerging them in a basin of fresh water, respectively. The basin, covered with a metal sheet, undergoes water changes every five days over a 20-day retting period, preventing direct sunlight and rain exposure. After this duration, the partially decayed leaves are removed from the basin, and the fiber is carefully extracted from these decayed leaves.

Results

Thermogravimetric analysis (TGA)

- The main degradation process of the hemicellulose and cellulose materials were observed to develop at approximately 235°C, after some limited loss of non-structural matter and moisture.
- As shown in the last slide, degradation mainly occurred between 319 °C and 375°C after which only some limited and gradual further decomposition took place.

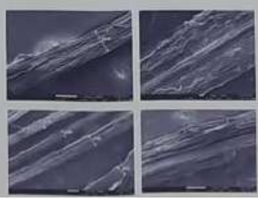


Fourier transform – infrared spectroscopy (FTIR) ANALYSIS

from which some indication of the similarities and differences with PCLF can be elicited, as from the spectrum in the last slide, there is absorption band related to the activity of hydroxyls between 3490 and 3150 cm-1, and C-H stretching between 2950 and 2850 cm-1. C=O stretching of hemicellulose; 1438 cm-1 possibly absorbed water; 1420 cm-1 ,O-H in plane bending of cellulose; 1318 cm-1 ,O-H bending and C-O stretching, which is unusually prolonged down to the peak at 1247 cm-1. The large peak at 1059 cm-1 was associated with C-O/C=C stretching vibration, and that at 617 cm-1 with the torsional vibration of pyranose ring.

Scanning electron microscopy (SEM) ANALYSIS

It is noteworthy that pineapple leaves develop a midrib only at the later stages of their growth. It would arise only once the crown is removed from the fully ripe fruit. On the other hand, retting did not allow complete degumming, as suggested by the figures shown, the images indicates of the rather repeatable and uniform diameter along the length of the fibrils.



Conclusion

In this study, the properties of natural fiber which is extracted from Pineapple crown leaf were examined, the physic-chemical properties of the PCLF has been done. The extraction method that was used is retting, untreated. The untreated natural fiber is mostly contained of cellulose, based on the results obtained from the table, the cellulose content causes the fiber to be moisture absorbent, this causes delamination between the matrix and fiber, lowering the mechanical characteristics of the composite significantly. Although the moisture content is considered a disadvantage of the untreated natural fiber, it has some advantages such as low energy consumption, low density, non-abrasive nature, low cost, renewability, biodegradability, easy availability, and worldwide abundance.

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