www.gsjpublications.com
Journal of Global Scientific Research (ISSN: 2523-9376)
2 (2020) 390-395

Journal of Global Scientific Research
www.gsjpublications.com/jgsr

Analysis of Cellulose extracted from Millet Husks with a Study of its Electrical Properties

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Received: 30 April 2020, Revised: 29 May 2020, Accepted: 21 June 2020, Online: 29 June 2020

Abstract

Research paper adopted to extract the cellulose from millet husk (MK), as cellulose extract was extracted through accurate and elaborate practical methods, as cellulose is one of the most important types of natural polymers. Several tests were carried out for the cellulose extracted from it, FT-IR (Fourier-Transform Infrared Spectroscopy), XRD (X-ray Diffract meter), and DSC (Differential Scanning Calorimeter). If FT-IR analyzes show several effective groups appear within the cellulose composition used, and XRD analysis showed random and only one peak in 22.2^0, and DSC It is noted that the lower temperature is a result of the lower degree of crystallization of the extracted cellulose, and then measured (I-V) at room temperature by Keithiey Series 2400 Source Meter, also, calculating the electrical conductivity $5.3x10^{-8}$ S/cm of this sample at the same temperature.

Keyword: Cellulose, millet husk, Extraction, FT-IR, DSC, Electrical conductivity

1. Introduction

Cellulose present in the cell wall, which can be reconstituted by photosynthesis, goes like agricultural losses, knowing that it has several applications, whether food or non-food Millet peel contains 15% of the protein and is rich in fiber, vitamins and amino acids such as lecithin, methionine and minerals such as iron, potassium, magnesium and phosphorous [1]. Cellulose fibers and their derivatives are one of the most abundant renewable polymer resources available, Cellulose is a high molecular weight linear polymer,. Cellulose is extracted from sliced wood pulp tablets and oxygen isotopes are also extracted [2].

Recently, natural materials have been relied upon to preserve the safety of researchers, as well as the use of recycling technology to preserve the environment and its integrity from pollution. Among the materials is the crop of millet, which is grown in several places, including Asia and Africa, and is used in several purposes, including food, including bird feed, And since the millet crop and millet waste (millet husk) have several

properties, among them, it has entered into many scientific fields[3,4,5]. It was found that millet husk contain a high density polyethylene, which has good mechanical properties, Ash scales of millet husks were also used in concrete industries, such as light concrete cubes in building walls and in walking methods. [6,7]. The use of guinea corn husk and millet husk (agricultural waste with no appreciable value to industries or competitive use as food) as alternative and cost-effective feed stock for the production of bioethanol was examine [8,9].

2. Materials and. Instruments

Millet husks were collected from the breeding cages of love birds, Basra, Iraq, The measurements were made by FT-IR Use a Japanese-made 4200, DSC and XRD Pert Pro MPD- Philips (Netherland) at the Polymer Research Center, College of Education for Pure Sciences, University of Basra, Iraq .In addition, using the digital device: Keithley Series 2400 Source Meter (England).

2.1 Extraction of Cellulose

After millet husk are collected, they are placed in plastic bags and transported to the laboratory, then well ground and then the suspended fat figure [1], is removed in it as follows;

Oil from the grinded husk was removed by solvent extraction with ethanol at 60 °C for six hours. The extractive-free sample was dried in an oven at 60 ^{o}C for 18 hours and stored in refrigerator before use. 3.3g of the sample was mixed with 100ml of 7.5% aqueous sodium hydroxide solution. The mixture was stirred for 1hour at room temperature. The pretreated husk was filtered at room temperature and then washed with 95% ethanol repeatedly to remove the base. The sample was then dried in the oven at 60^{o}C for 24 hours. 2.0g of the sample was further mixed with 100ml distilled water, 15ml glacial acetic acid and 2.0g of sodium chlorite. The mixture was stirred at 75 ℃ for 2 hours. The residue was washed with ethanol and distilled water. The sample was dried in the oven at 60oc for 24 hours. The yield obtained was 0.93g of cellulose (10). Then the extracted cellulose is dissolved with 1% acetic acid and electrical measurements are made, shown figure (1).

Figure: (1) (a): millethusks before extraction,(b): Cellulose, after extraction.

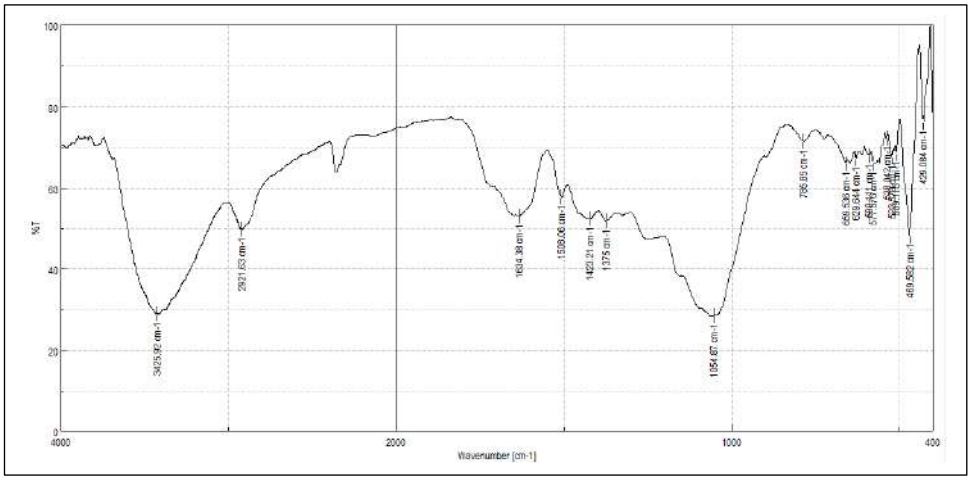
2.2 Electrical measurements Sample

Aluminum bases (TLC) of 2cm x 2cm, dimensions were used after being placed on a balanced base and the usual casting method was used using a single-use medical syringe and left for 24 hours to dry. (hot pleat) for a period of (10 minutes) and at a temperature of (70 ° C) to ensure the evaporation of the fluids and solvents used after which the model is ready for measurement [11].

3. Characterization and Measurements

3.1 FT-IR Measurements

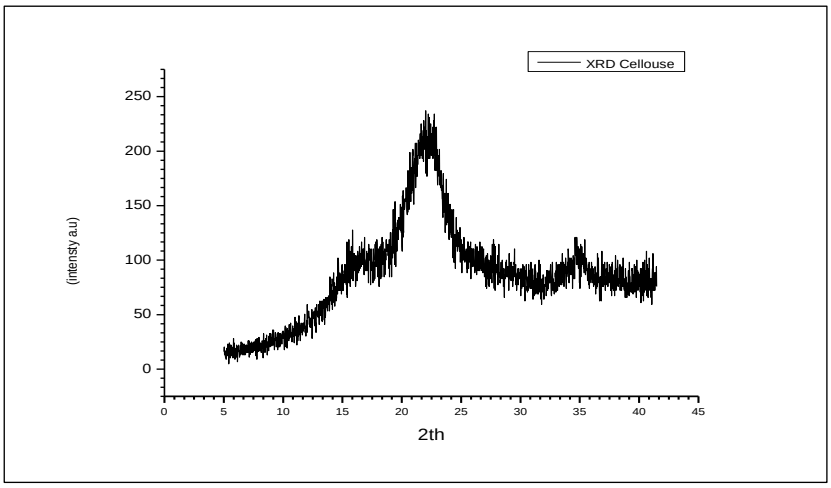
The infrared spectra for the Callouses millet husk (MH) powders were obtained and recorded as KBr disk using the Fourier Transform Infrared Technique (FTIR). The results of the IR spectroscopy in the mid IR range (4000-400) cm^{-1} are shown in Figure.2. The examination of the transmitted light reveals how much energy was absorbed in wavelength. This measurement is mainly used to find the effective group in the sample used, A strong peak at 3426.92$cm^{-1}$of vibration of O-H, and vibration 2821.83cm^{-1} of C-H bound , wavelength1634.8 ,1508 cm^{-1} stretching vibration C=O, rang wavelength in, The absorption bands at 1423, 1337, 1057 cm−1 and 896,7665 cm−1 belong to stretching and bending vibrations of -CH2 and -CH, -OH and C-O bonds in cellulose, Here, the behavior of cellulose extracted from wood is similar this result of FT-IR agreement with many researchers [12,13,14].



Fig(2): FTIR spectra of cellulose extraction

3.2 XRD measurements

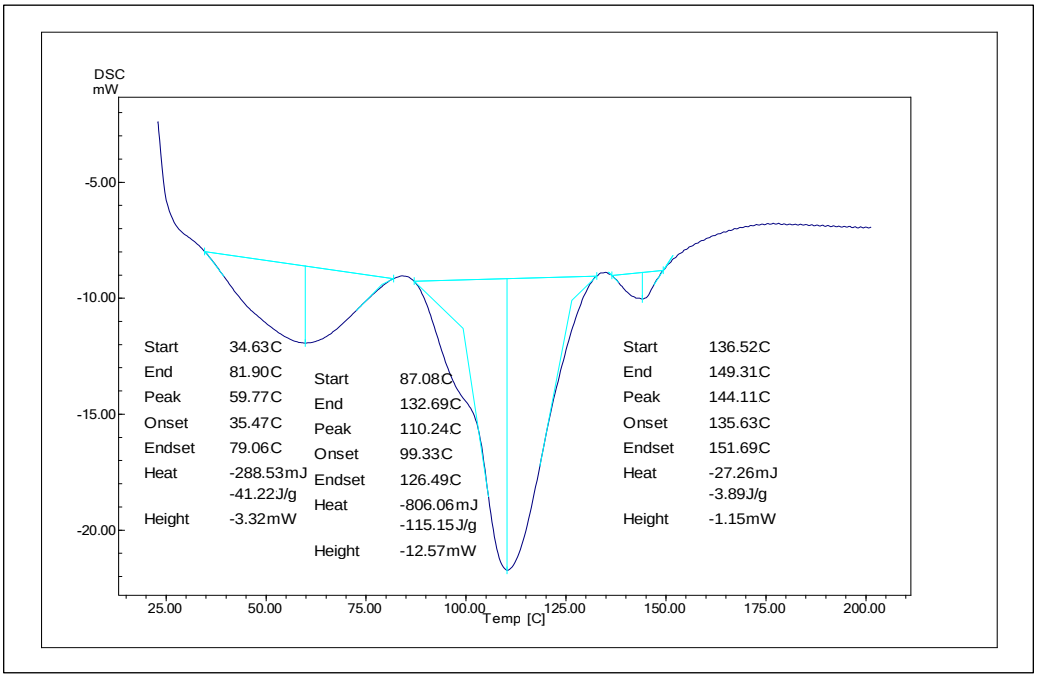
XRD of cellulose extracted from millet husk has been studied to know the crystallization of the material. The analysis within the range of angles(2^o- 40^o),in wavelength= 0.15406 nm, The X-ray diffract grams obtained for the initial samples are presented against the amorphous ones, and can you seen peak in 2θ =22.2^o,here, the degree of crystallization of the extracted cellulose shown in fig(2), and this degree may later be the degree of stability of the cellulose or degree of crystallization, and this agreement with Chioma Vivian Abiaziemand [15,16].



Fig(3): XRD spectra of cellulose extraction

3.3 Thermal Analysis DSC

Shows the thermal analysis (DSC) curve, the heat curves start at 34 °C and end at 81 ° C, in peak one at 59 ° C , curve two start at 87° C and end at 132° C, peak at 110° C , curve three start at 136° C and end at 149° C peak at 144° C, and end set in 151° C, the endothermic peaks characteristic of native cellulose, occurring in the 50-150 °C region of the DSC curves, It is noted that the lower temperature is a result of the lower degree of crystallization of the extracted cellulose [17].



Fig(4): DSC Curve of cellulose extraction.

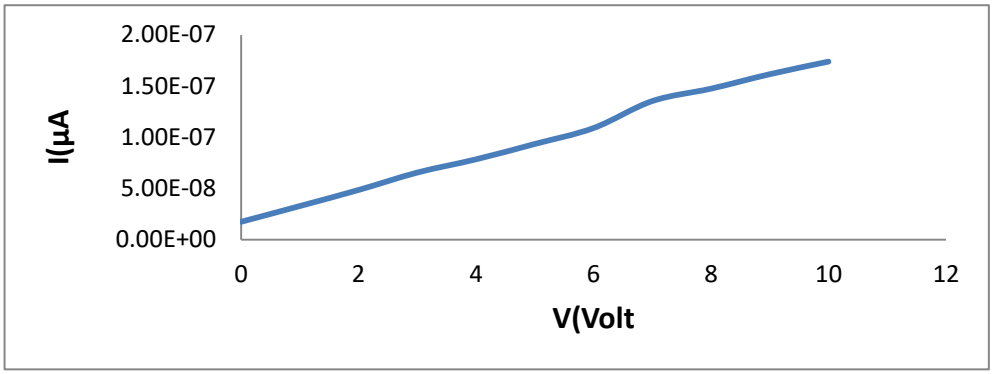
3.4 Electrical properties

Determine the mechanism of conductivity in Cellulose, the advantage of (current - voltages) should be studied. The current-voltage ratio of thin and thin film-encrusted polymers was calculated by callouses using the digital device: Keithley Series 2400 Source Meter and within the voltage range (0-12 Volt) in room temperature Electrical conductivity were $5.3x10^{-8}$ also calculated according to the following law As (18):

$$\sigma = \frac{d}{A} x \frac{I}{V} \dots \quad (1)$$

I: - Circuit current and measured (Ampere)
V: - The voltage of the circuit (Volt).
A - The area of the pole is measured (cm).
d: - thickness of the membrane (cm).

Fig (5) shown this fig that the current increases with increasing voltages, Electrical conductivity was, $5.3x10^{-8}$ S/cm. here it is within semiconductor [18].



Fig(5): characterization (I-V) from calluses extraction.

4. Conclusion

It can be concluded here that cellulose extracted from millet shells can have good industrial applications, given the effective groups present within the composition, as well as it may be more crystalline when tainted with other polymeric materials as well as temperatures, i.e. it can be said that industrial applications such as the manufacture of solar cells.

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