

Isolation, Characterization of Fiber and Its Reinforcement in Film Formation

Kanimozhi R, Vijayaram R, Gokul D

Abstract: The aim of this project is to segregate the fiber from agricultural waste in three distinct stages such as alkali treatment, bleaching process, acid hydrolysis. Agricultural wastes such as cassava bagasse, sorghum stalk, corn stalk were selected. Initially the raw materials were subjected to chemical processes like alkali treatment and bleaching process to remove lignin and hemicellulose. The chemically purified cellulose was then subjected to acid hydrolysis for isolation of fiber. Characterization of FTIR result shows that hemicellulose and lignin was partially eliminated. TGA was carried to know the thermal properties of the sample. The film was formed by casting method using isolated fiber, maize starch, agar, Tween 80. The fibers were incorporated into the film and their properties such as tensile strength, moisture content and solubility were studied

Keywords : Fiber, lignin, hemicelluloses, film

I. INTRODUCTION

Biopolymers utilized as a part of films. They offer ecological advantages in view of their accessibility, biocompatibility, organic degradability, maintainability, low energy consumption, furthermore cellulose fibers act by expanding the mechanical properties as simpler procedure because of their non-rough nature. Production of biodegradable film using cellulose fiber from agricultural waste such as cassava bagasse, sorghum stalk, maize stalk. During film formation, plasticizer are normally added, to overcome films brittleness. Films were formed by starch are brittle and difficult to handle. Water permeability for plasticizer is low. Due to the addition of fibers the water permeability of starch based films was decreased. This behavior was due to the hydroscopicity of cellulose fiber. Simultaneous effect of water diffusivity in the polymeric matrix and the solubility based on the Water vapour permeability

II. MATERIALS AND METHODS

Cassava bagasse was collected from Sri Gopalakrishna Sago industries in Namagiripet (Namakkal district). Sorghum stalk and Corn stalk also collected from Namagiripet (Namakkal district).

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A. Alkali Treatment

The cellulose was purified by Alkali treatment. This treatment is used to remove the lignin and hemicellulose from cassava bagasse. Alkali solution (4 wt % KOH) was treated with cassava bagasse and this mixture performed at 80°C into round bottom flask for 1 hour. This mixture was washed and filtered by using distilled water for several times. This treatment was repeated for twice.

B. Bleaching Process

Bleaching process solution was prepared acetic acid, aqueous chlorite and distilled water at 70°C for 1 h. This mixture was cool and filtered using distilled water. The process is repeated several times.

C. Acid Hydrolysis

After alkali process and bleaching, The solution was under centrifugation process before that solution was maintained at 60°C for an hour and 6.5 M of sulphuric acid was added. This hydrolysis was washed several by distilled water.

III. FILM FORMATION

Solutions was prepared by different composition of fiber, maize starch, sorbitol, agar and Tween-80. Casting method was used to prepare the film. The starch and distilled water was mostly used to prepare film solution and then prepared solution was heated up to 80°C. The prepared solution was performed at magnetic stirrer and transferred into glass plate. The Glass plate was placed in hot air oven at 70°C for 12h. exclusion of references, it should be less than 5%.

IV. RESULTS AND DISCUSSION

A. FTIR Spectra of Cassava Bagasse

FTIR spectroscopy is a non-destructive technique. This linkage shows the presence of raw fiber at the peak of 1627.6 cm⁻¹. The peak present at the range of 1200–1300 cm⁻¹ exhibit characteristic group of lignin which is corresponding to the aromatic skeletal vibration.

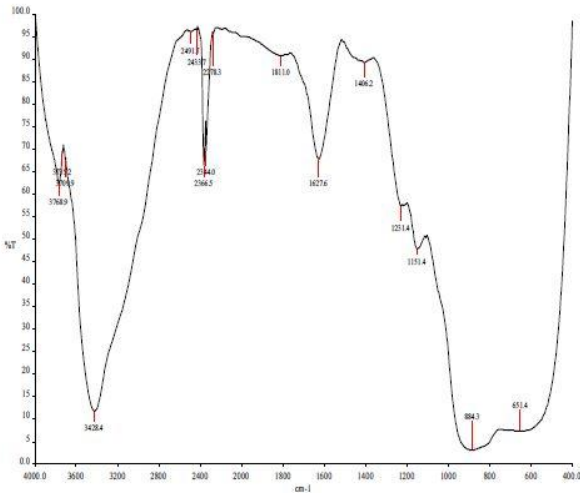


Fig. 1. FTIR Spectra of Cassava Bagasse

B. FTIR Spectra of sorghum stalk

The presence of cellulose can also be expected from the appearance of the signal at 896.0 cm-1, which is typical structure of cellulose

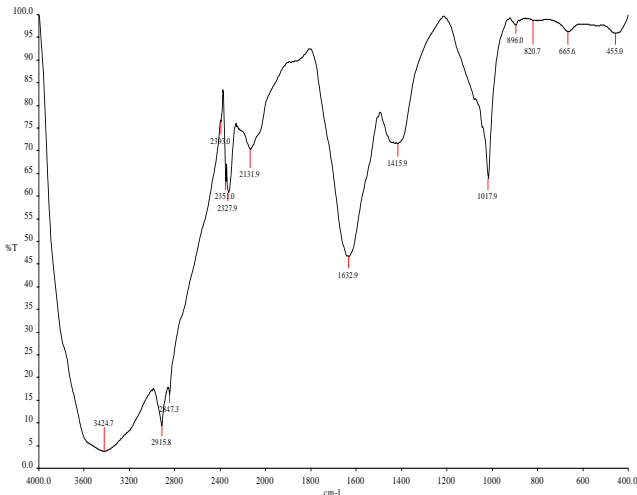


Fig. 2. FTIR Spectra of sorghum stalk

C. FTIR Spectra of maize stalk

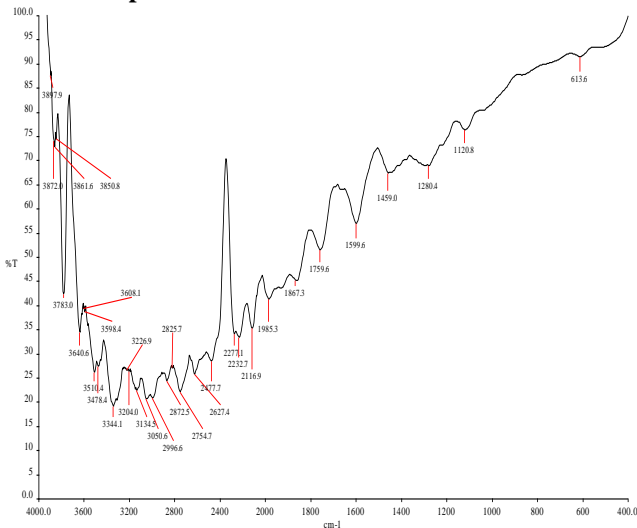


Fig. 3. FTIR Spectra of maize stalk

The presence of cellulose can also be expected from the appearance of the signal at 613.6 cm-1

D. TGA of Treated Cassava Bagasse

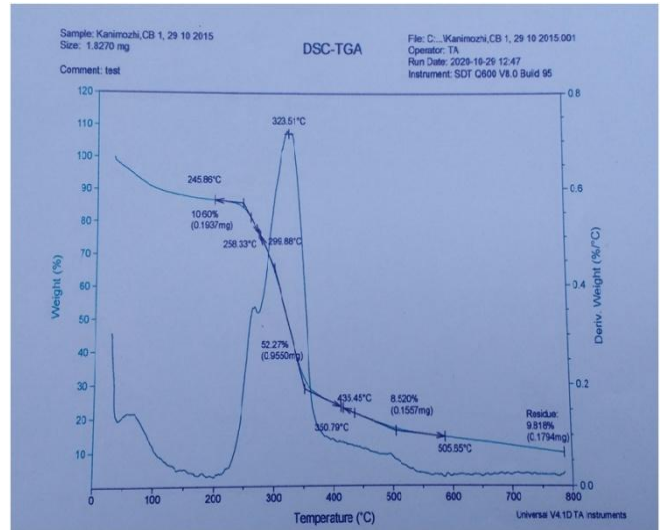


Fig. 4. Thermo gravimetric analysis of cassava bagasse

The thermal degradation of cassava bagasse sample was carried out using TGA in order to know the thermal properties. The below figure shows the normalized weight loss of the sample as a function of temperature. The degradation of cassava bagasse occurred between 245.86°C to 258.33°C. First derivative peak temperature is 323.51°C. The DSC decomposition peak is in exothermic pattern.

E. TGA of Treated Sorghum Stalk

The thermal degradation of sorghum stalk sample was performed by TGA to know the thermal properties. The degradation of sorghum stalk occurred between 285.87°C to 342.14°C. First derivative peak temperature is 325.92°C. The DSC decomposition peak is in exothermic pattern.

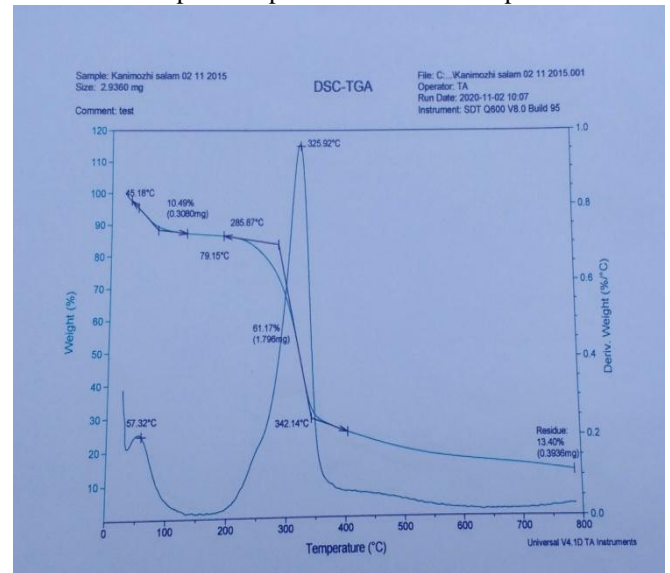


Fig. 5. Thermo gravimetric analysis of sorghum stalk

F. TGA of Treated Maize Stalk

The degradation of maize stalk sample was performed by TGA to know the thermal properties. The degradation of maize stalk occurred between 296.11°C to 351.30°C. First derivative peak temperature is 335.56°C. The DSC decomposition peak is in exothermic pattern.

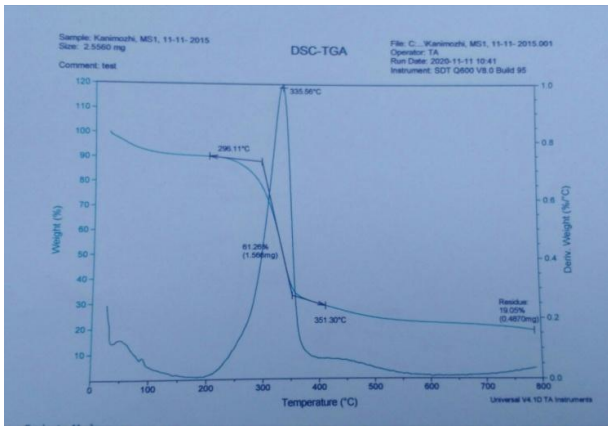


Fig. 6. Thermo gravimetric analysis of maize stalk
G. XRD of Treated Cassava Bagasse

Before and after chemical treatment. This fibers was under XRD test to study the crystalline structure of the fibers. The crystallinity index of before and after treatment of cassava bagasse was calculated and found to be 21.9% and 22.9%. The result of his test show that increase in crystallinity

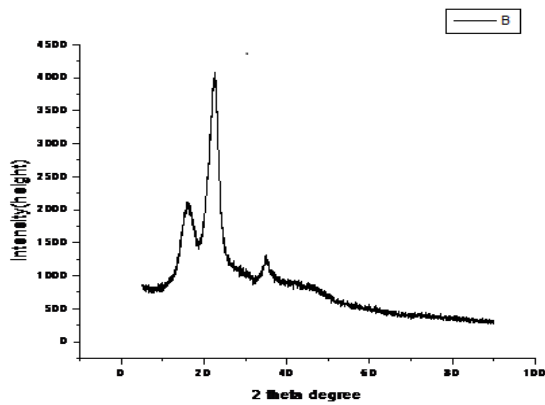
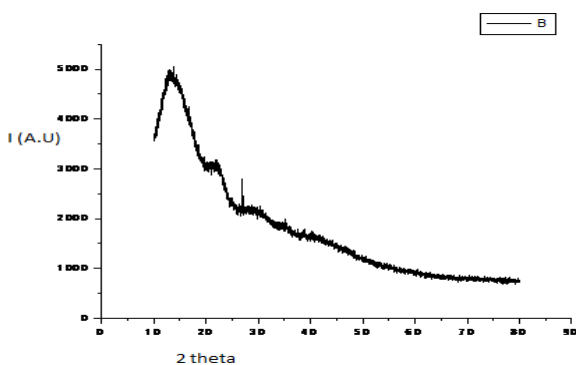


Fig. 7. XRD of Treated Cassava Bagasse

H. XRD of Treated Maize Stalk



Nagendra Reddy (2005) reported that maize stalk fibers contain 52% crystalline cellulose. Nagendra Reddy (2005) reported that fibers have an microfibrils fiber axis (MFA) of about 11°. The treated maize stalk fiber have an MFA of about 15°. A means the stronger fiber with lower elongation. I. **Tensile Properties** may vary with specimen thickness. Due to higher content of fibers, there is increase in

the particle density which cause the more interaction between the fiber particles leads to the formation of aggregates.

V. CONCLUSION

Isolation of fibers from agricultural waste such as cassava bagasse, sorghum stalk, maize stalk by chemical treatment Thermo gravimetric analysis of cassava bagasse, sorghum stalk, maize stalk has first derivative peak temperature is 323.51°C, 325.92°C and 335.56°C respectively. X- ray diffractometer shows the increase in crystalline structure from 21.9% in cassava bagasse to 22.9%, maize stalk fiber have an microfibril axis of about 15°. The film were obtained by casting method. It can be concluded that incorporation of cellulose fiber in film solution shows low moisture content, solubility in water and improves the tensile strength of films.

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