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4 to 5 pages

Isolation and characterization of cellulose, hemicellulose and lignin from rachis

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Abstract

In the present study, rachis was explored as a source of raw material for production of lignin, hemicellulose and cellulose. For isolation of cellulose fibers, first rachis the was subjected to different chemical treatments to eliminate non-cellulosic compounds.The extracted cellulose were confirmed by SEM, FT-IR and XRD results indicated chemical treatment employed was effective in removing compounds other than cellulose. Hence, the lignin, hemicellulose were examined by FT-IR the production of lignin, hemicellulose and cellulose can add high value to rachis.

key words: rachis, lignin, hemicellulose, cellulose

1. Introduction

The major components of plant fibers for cells are lignin, hemicellulose and cellulose. Among the main source of a renewable and biodegradable structural biopolymer is Cellulose. It is a linear homopolymer composed of repeating units of glucose that are linked by beta-1,4-glycosidic bonds [1].

Hemicellulose is the second most-abundant polysaccharide in nature. it is composed of various different sugar units, arranged in a different proportions and with different substituents.

Lignin is a class of complex hydrocarbon with a Large amounts of both aliphatic, aromatic components [2] [3].

lignin, hemicellulose and cellulose are linked by different types of bounds which results Lignocellulosic materials. this bounds make the extraction and seperation of ech one difficult process.

these components have different applications, medical, industrial (paper making, Cosmetics, etc.), water treatment, etc. thus researtchers interested in studying such components and finding its resources. tomato stalk [3] peanut products [4], cotton products [5], flax shiv [6], and eggplant [7].

2. Our approach:

2.1 Isolation of cellulose fibers (CFs):

Cellulose was extraxtion from rachis by modifited extraction method of (Prerna Khawas,Sankar C. Deka,2016) is shown in figure (01) (a)[8].

2.1.1. first alkali treatment:

The aim of this step is to partially solubilize pectin, lignin and hemicelluloses. After the treatment, the rachis pulp was washed with distilled water to remove those pectin, lignin and hemicelluloses.

2.1.2. bleaching treatment:

The insoluble remained after the first alkali treatment was further delignified as shown in figure (02).

After first bleaching treatment, it was washed and second bleaching treatment was given again, maintaining the same condition as in the first bleaching process which resulted in further effective discoloration and confirming the leaching out of phenolic compounds and lignins

2.1.3. second alkali treatment:

This treatment helped in elimination of residual hemicelluloses.

2.1.4. Acid hydtolysis:

The acid hydrolysis treatment helped in leaching out traces of minerals, residual starch and also hydrolyzed amorphous cellulose

Then, the insoluble compositions were washed with ultra-distilled water and the fiber were neutralized using centrifugation (10,000 rpm, 20 min, 4 ◦C). The fibers were conserved in water-swollen to stop any reason can generate a strong hydrogen bonding during each steps of chemical treatment.

2.2. Precipitation of lignin and hemicelluloses:

The hemicelluloses and lignin was isolated by precipitation method from The obtained solution of the first alkali treatment (Black liquors) as illustrated in **figu**re (02) (b).

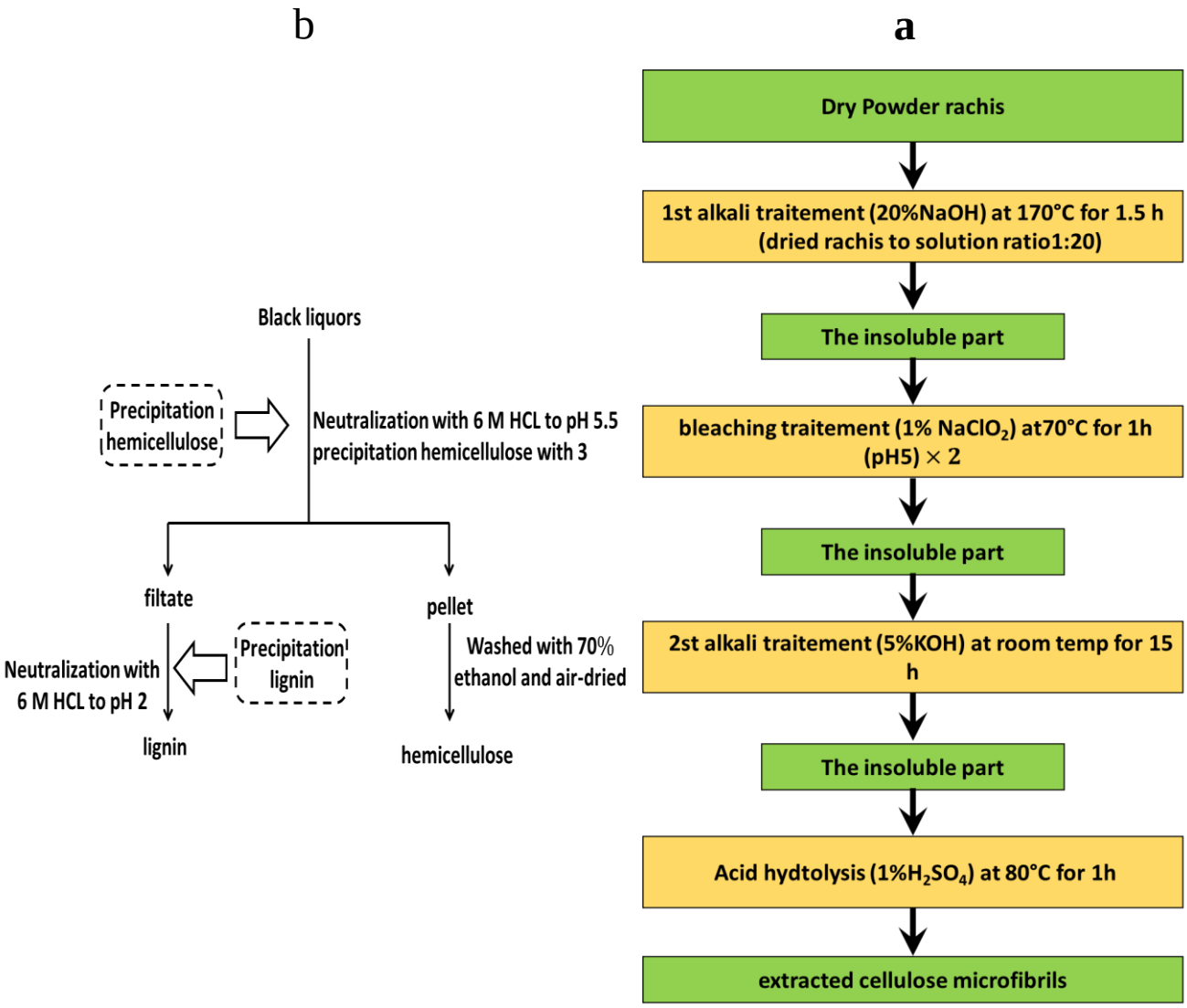


Figure 01: (a) steps of cellulose isolation (b) streps of lignin and hemicelluloses precipitation

3. Results and Discussion:

After dying the sample, the yield was calculated starting from the initial mass.The results are presented in table (01).

Table 1. The yield of cellulose hemicelluloses and lignin

Cellulose %	**39.51**
lignin %	**19.43**
hemicelluloses%	**11.20**
Other materials %	**29.86**

3.1 Fourier transform infrared spectroscopy (FT-IR)

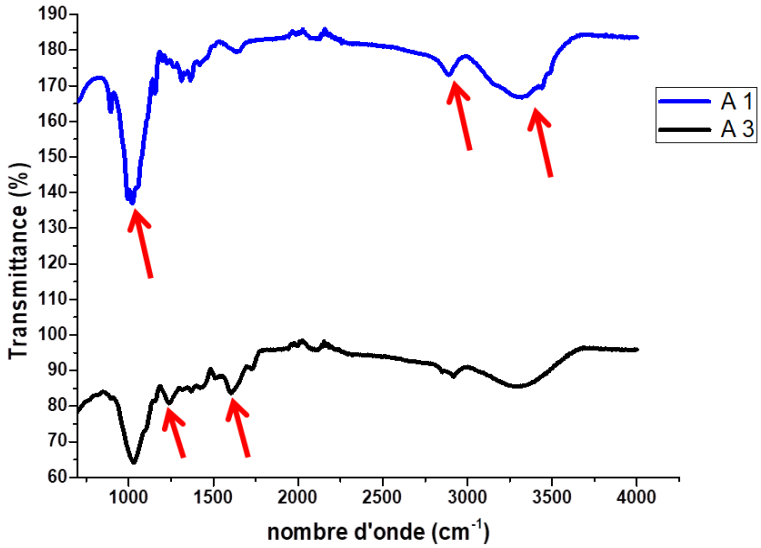


Figure 02: FTIR spectra of cellulose fibers (A1) raw materials (A2)

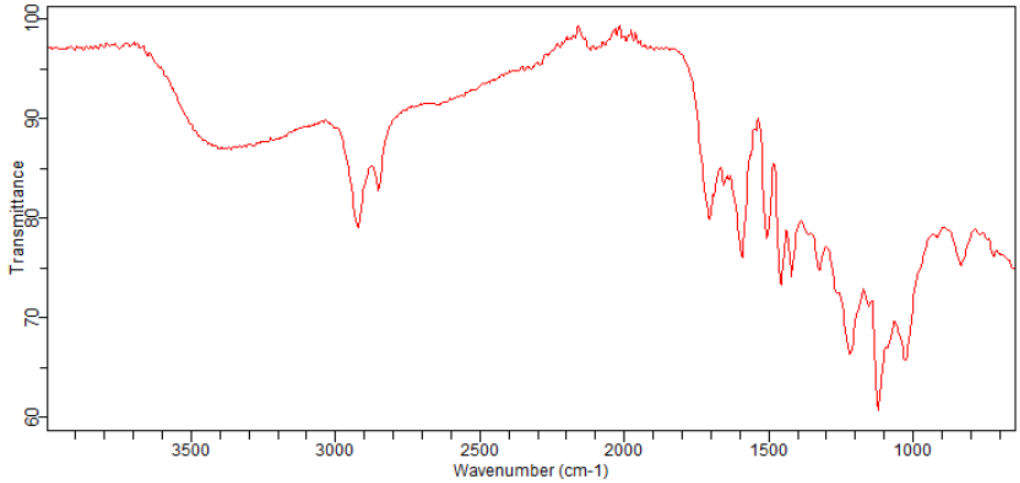
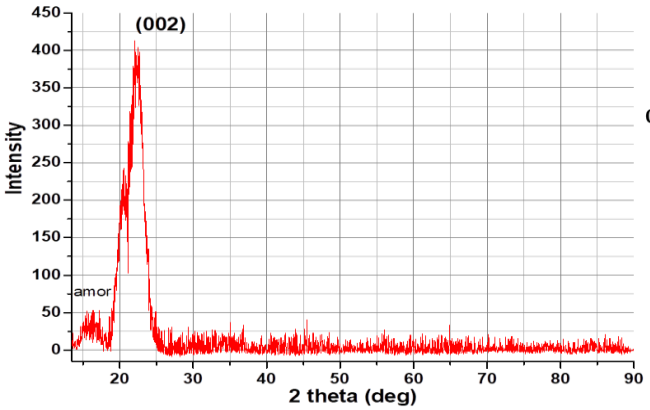


Figure 03: FTIR spectra of lignin

3.2 X-ray diffraction (XRD)



$$\%Cr = \frac{I_{002} - I_{amor}}{I_{002}} * 100$$

$$Cr\% = 86.2\%$$

Figure 04: XRD diffraction pattern of cellulose fibers from rachis

3.3 Microstructure evaluation by scanning electron microscopy(SEM)

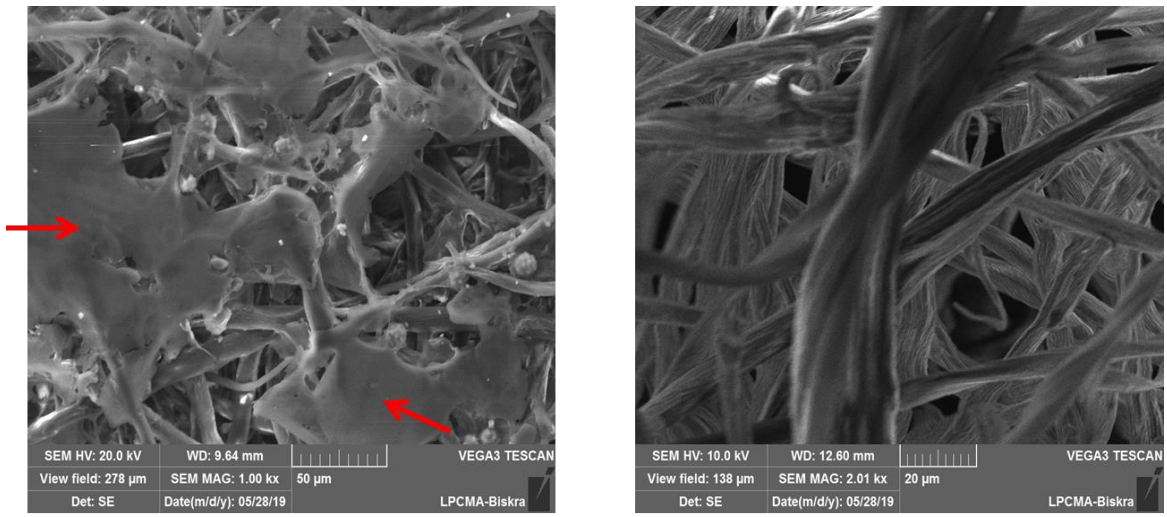


Figure 05: SEM micrographsof cellulose fibers and raw materials

4. Conclusion

In this study the rachis is used as a raw material to produce lignin, hemicellulose and cellulose. The purification of cellulose was confirmed. The FT-IR and SEM indicate absence of lignin, hemicellulose and non-cellulosic materials. While the DRX indicates higher crystallinity of celloluse., the lignin, hemicellulose were examined by FT-IR. It concluded that the rachis can be used as a resource to produce lignin, hemicellulose and cellulose.

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