

CHARACTERIZATION OF CELLULOSE EXTRACTED FROM DIFFERENT WASTES SOURCES

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Lignocellulose is one of the natural and renewable sources of free major macromolecular polymers. The plant biomass consists of cellulose (35–60%), hemicellulose (20–40%), and lignin (10–25%) [1]. In the plant's cellulose acts as a main structural component, providing essential rigidity, tensile strength, and structural integrity to plants. Cellulose possesses a linear polymeric structure composed of β -D-glucose monomers linked by β -(1 \rightarrow 4) glycosidic bonds. The abundance of hydroxyl (–OH) groups along the polymer chain enables the formation of extensive intra- and intermolecular hydrogen bonding. These interactions may be different in lignocellulose feedstocks and can have effect on crystallinity [2]. It is well known that cellulose can be obtained by using secondary materials such as waste. In view of this, this study was investigated and compared cellulose from softwood and hardwood.

Cellulose extraction procedure was performed by using bleaching method. First part was alkali pretreatment; different wood sawdust was placed in a chemical beaker and heated up with sodium hydroxide solution for 3 hours at 90°C. After that the solution was placed in oven for 24 hours at 60°C. When the solution was filtered and the wood sawdust washed to remove the residual of sodium hydroxide. The second part was bleaching. The wood sawdust was placed in a chemical beaker and heated up with hydrogen peroxide solution for 1,5 hours at 80°C. This step was repeated twice. When the solution was filtered and solid residue was heated up with sodium hydroxide and hydrogen peroxide solution for 3 hours at 80°C. After this, the solution was filtered, washed with distilled water and collected cellulose was dried in an oven.

The cellulose was extracted from three different sources: softwood (mix of pine and spruce) and hardwood (oak, mahogany). The extracted cellulose was characterized by SEM, EDX and XRD. Firstly, it was noticed that cellulose after extraction have white color. The efficiency of the extraction was around 76%. Additionally, the scanning electron microscopy describes the structure of cellulose surface. While from elemental analysis it is seen the dominance of carbon and oxygen atoms. Also, the X-ray diffraction analysis was performed and shows that cellulose have crystalline and amorphous regions. Characterization results show that different wood cellulose have nearly similar structures.

[1] A. Darmanbayeva et al., "Cellulose-Based Sorbents: A comprehensive review of current advances in water remediation and future prospects," *Molecules*, vol. 29, no. 24, p. 5969, Dec. 2024, doi: 10.3390/molecules29245969.

[2] V. K. Yadav et al., "Recent advances in synthesis and degradation of lignin and lignin nanoparticles and their emerging applications in nanotechnology," *Materials*, vol. 15, no. 3, p. 953, Jan. 2022, doi: 10.3390/ma15030953.