INTERNATIONAL CONFERENCE **Dehli, India, 2025**
https://eijmr.org/conferences/

OBTAINING CELLULOSE FROM MISCANTHUS PLANT STALKS BY THE ORGANOSOLVENT METHOD

N.Y.Giyasova

O. O.Xoliqulov

S.S.Sidiqov

Tashkent State Technical University

Cellulose is usually sourced from wood and cotton fibers. Sources like these take a long time to grow, and using them a lot is making natural resources scarce. Because of this, lots of studies now look at getting cellulose from plants that grow each year. Examples include rice straw, wheat straw, corn stalks, miscanthus, kenaf, flax, and other biomasses that contain lignocellulose. This way not only helps recycle waste but also lets people create new bio-based stuff.

To get cellulose out of plant stalks, there are different methods, such as hydrothermal, chemical (alkaline, sulfate, sulfite), organosolvent, and biological ways. The organosolvent method stands out because it's good at separating things, works at lower temps, allows lignin to be processed again, and doesn't hurt the environment. Usually, this method uses solvents like ethanol, acetone, methanol, organic acids, or mixes of them. This softens the links between lignin, hemicellulose, and cellulose, so the cellulose can be separated with almost nothing else mixed in.

Cellulose made from yearly plants using the organosolvent method is seen as a good raw material for making things like paper, biocomposites, biofuel, biosorbents, biopolymers, and nanocellulose. The tech also allows industries to recycle waste and farm leftovers in a way that is cost-worth it.

This study made use of the organosolv cooking process. In oxidative-organosolv cooking, peroxidic compounds like peracetic acid (CH3CO3H) and hydrogen peroxide act as key cooking reagents. Since peracetic acid has strong oxidation properties, it breaks down the aromatic structure of lignin. The reaction is as follows: Lignin + CH3CO3H → breakdown products + H2O + CH3COOH. This leads to easy isolation of the cellulose fibers, making cellulose separation easier. These compounds are sensitive to heavy and transition metal ions, which become catalysts in their breakdown. To get the most out of peroxidic compounds, stabilizers from the organophosphonate class are added to the cooking mix.

During cooking, the temperature and pressure were kept stable. After the reaction, the mixture was cooled and separated by vacuum filtration. The residue (cellulose) was rinsed many times with warm water, followed by 70% ethanol. After that, it was processed in a 0.1 M NaOH solution for 30 minutes to get rid of any remaining traces of lignin. The purified cellulose was rinsed with distilled water until it reached a neutral pH and then dried at 60°C.

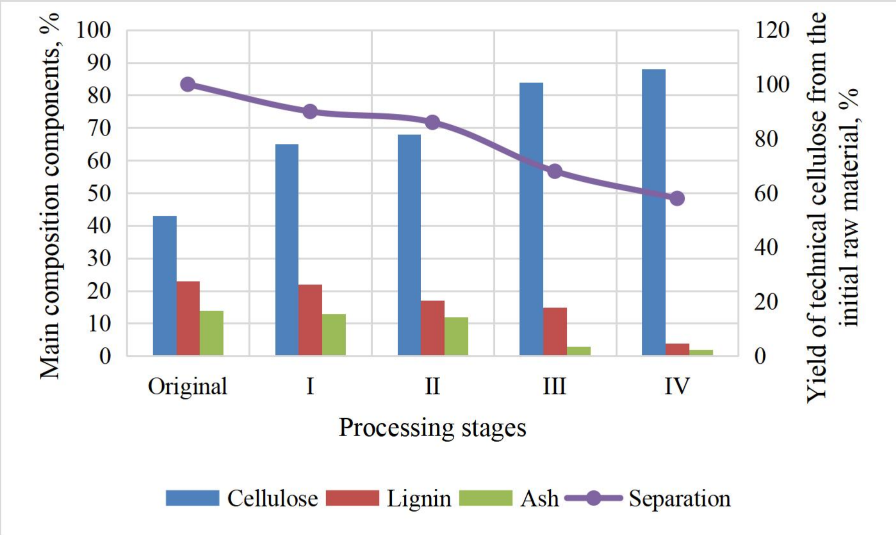

Figure 1 — The content of main components during the step-by-step processing of Miscanthus

Analysis of experimental data confirms that pre-extracting components from miscanthus leads to raw material enriched with cellulose because of reduced lignin and ash content. This is a favorable factor for obtaining technical cellulose using the oxidizing organosolv method. To assess how the composition of boiling affects the delignification process, the relationship between the consumption of boiling components over time was studied (Figure 2).

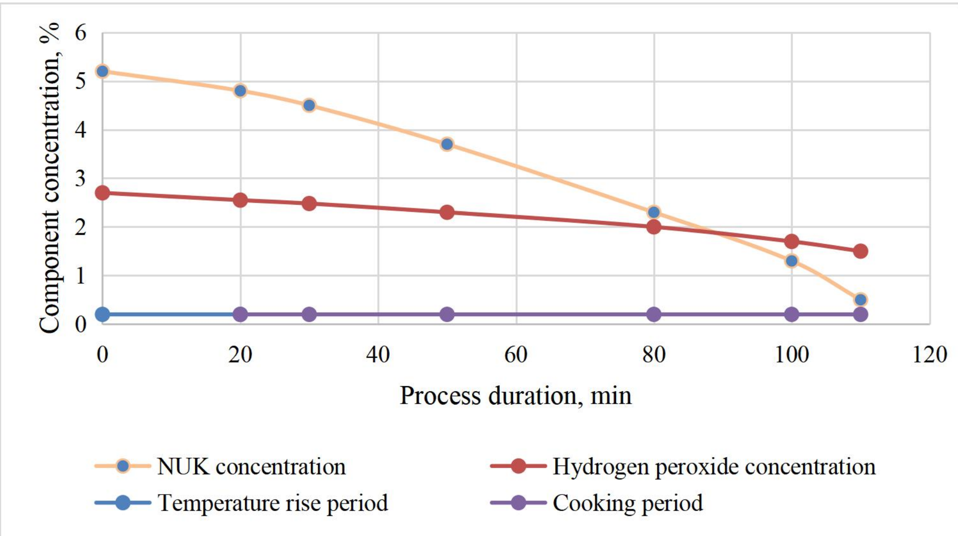

Figure 2 — Dependence of the consumption of cooking components on the process duration

As shown in Figure 2, the concentration of hydrogen peroxide remains almost constant during the first 60 minutes. This implies that peracetic acid (PAA) is the main agent for removing lignin. So, PAA handles the lignin removal and some bleaching. In this case, hydrogen peroxide keeps the PAA concentration stable.

The research shows that using the orgonosolvent method to get cellulose from crop straws and miscanthus biomass is an eco-friendly, energy-saving, and efficient option. In oxidation-orgonosolv pulping, peracetic acid (CH_3CO_3H) is the main reagent for lignin removal, breaking down the aromatic structure of lignin well. Hydrogen peroxide helps by keeping the PAA concentration balanced. The best results occurred with PAA usage at 0.3-0.4 g/g, giving technical cellulose yields of about 57-60% and a brightness level of up to 90%.