Extraction of Lignin from Sawdust (*Chlorophora excelsa*)

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Introduction

❖Biomass (*Chlorophora excelsa*, olive tree etc)
➢cellulose, hemicellulose and lignin
✓Cellulose: 30-50 wt%
✓Hemicellulose: 20-35 wt%
✓Lignin: 15-30 wt% (Deepa, 2014)
➢Most abundant renewable source of aromatics ~ Attractive replacement of petroleum-based equivalent.
➢Multiple hydroxyl functionality ~ resulted in divers monolignols.

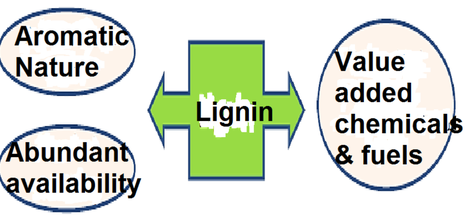

Figure 1: Value addition of lignin (Deepa, 2014)

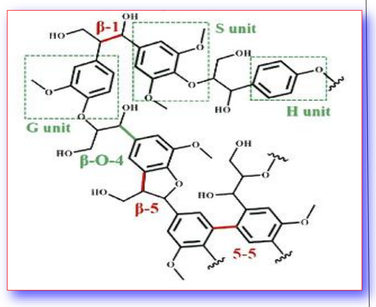

Figure 2: Three primary monolignols: Coniferyl (G), Sinapyl (S) and p-Counmaryl (H), alcohols. Zhu *eta l*., (2022)

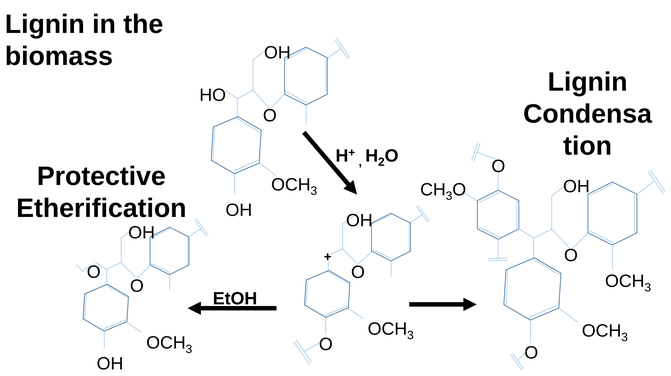

Figure 3: Lignin Extraction Mechanism in Organosolv Process (Du *et al*., 2021).

objective

Extraction of lignin from sawdust, determination of the yield of the lignin and characterization, using FTIR, CHNS, density, melting point, ash and moisture content analyses

Method

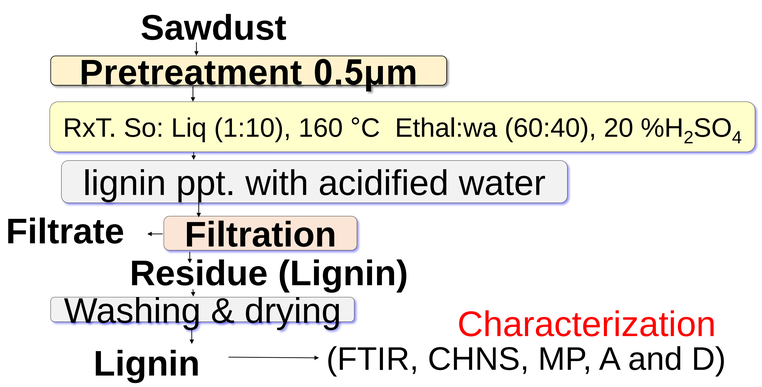

Figure 4:Experimental Procedure for Lignin Extraction

Results and Discussion

❖The proximate composition of the sawdust used: cellulose (41.15%), hemicellulose (28.63%) and lignin (26.13%)

Table 1: Percentage Yield of Sawdust Lignin

S/N	Description	Lignin yield (%)
1	Treated at100 °C	15.17±0.28
2	Treated at 120 °C	27.41±0.12
3	Treated at 140 °C	28.70±0.32
4	Treated at 160 °C	49.81±0.56
5	Treated at 180 °C	29.90±0.33
6	Treated at 200 °C	24.68±0.19

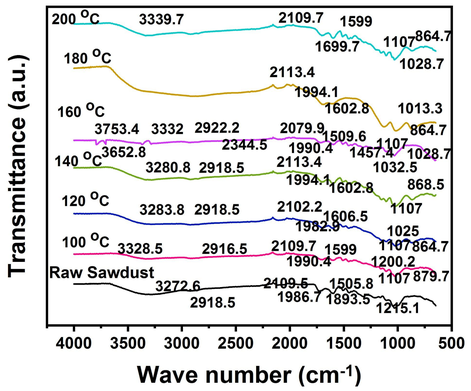

Figure 5: FTIR Analysis of Lignin from sawdust at 100, 120, 140, 160, 180 and 200 °C

Table 2. Properties of lignin extracted from sawdust

Properties	Composition (%)	Related Works
Carbon	60.00±1.99	>55 (Graglia, 2016)
Sodium	0.02±0.002	5 (Graglia, 2016)
Nitrogen	0.40±0.03	0.1-0.4 (Graglia, 2016)
Sulphur	0.88±0.01	0.4-0.9 (Graglia, 2016)
Ash (inorganic)	0.95±0.02	0.95-4.5 (Naron et al., 2017)
Moisture content	1.88±0.01	
Bulk Density (g/cm³)	0.264±0.01	0.45-0.60 g/cm³ (Biopiva, 2024)

Conclusions

The sawdust used consist of 41.15% cellulose, 28.63% hemicellulose and 26.13% lignin. The highest yield of lignin was 49.81% at 160 °C.

The elemental analysis for sawdust lignin indicated carbon (60.00%), sodium (0.02%), nitrogen (0.40%), sulphur (0.88%), ash (0.95%), bulk density (0.264g/cm³) and moisture content (1.88%)

References

Deepa A.K and Paresh L Dhepe (2014). Depolymerization of lignin over heterogeneous catalyst having acidic functionality, *RSC* pg 190-194, 29 31,4

Du, X., Tricker, A.W., Yang,W., Katahira, R., Liu,W., Kwok, T.T., Deng, Y. (2021). Oxidative Catalytic Fractionation and Depolymerization of Lignin in a one-pot Single-catalyst ACS 9(23) https://doi.org/10.1021/acssuschemeng.0c08448

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