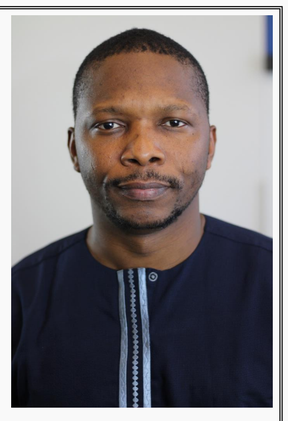
Structural variation of organosolv lignin isolated from tropical ramial chipped wood after their soil incorporation for sustainable agriculture



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1. Introduction

Background: Ramial Chipped Wood (RCW), as ecological and sustainable farming practices, are promoted to restore soil fertility (Daassi et al, 2020). It refers to twigs, and undried branches (diameter < 7 cm) subsequently fragmented, buried or mulched in the soil as an organic amendment.

Challenge: Fate of RCW lignin in soil and its contribution in soil C stabilization.

Objective: Monitoring the structural variation of organosolv lignins isolated from RCW of *Gmelina arborea* and *Sarcocephalus latifolius* after their incorporation in soil.

2. Material & Methods

In situ and lab experiences

RCW of *Gmelina arborea* and *Sarcocephalus latifolius* incorporated in soil, sampled after 0 (RCW0), 6 (RCW6), 12 (RCW12) and 18 (RCW18) of incubation in soil

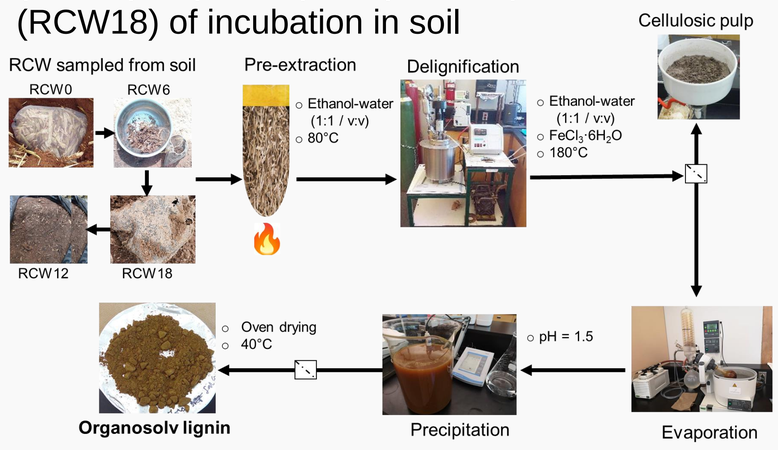

Figure 1: Organosolv lignin process

Analysis

- Chemical constituents
- Elemental analysis
- HPLC
- NMR 2D-HSQC
- Py-GC/MS -TMAH

Figure 2: Analytical pyrolysis

3. Results & Discussion

Variation of chemical content during RCW decomposition

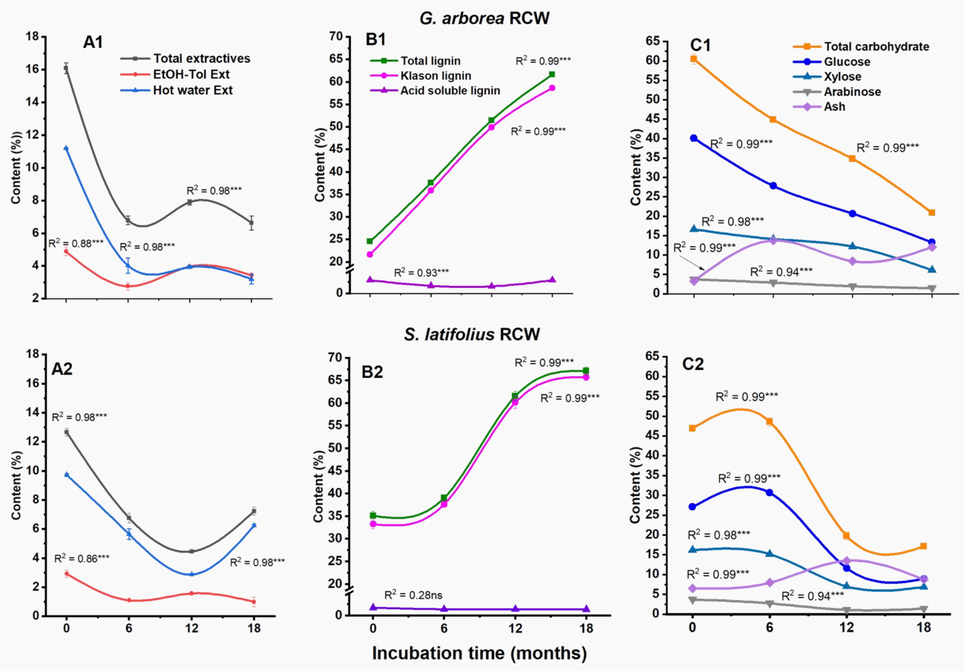

Figure 3: Chemical content of RCW

- ► RCW lignin content increased as RCW decomposition progressed in soil
- ► Ash contents increased significantly after 18 months of RCW decomposition which suggests the potential contribution of microbial activity to mineralization, leading to release of minerals favourable for soil fertility and crop nutrition.
- ► Studied lignins are GS type and β-O-4’ linkage were the main substructures present in all studied lignins
- ► S/G ratio of studied lignin increased during RCW decomposition in soil and were more prominent in *G. arborea* species than in *S. latifolius* species

Structural variation of lignin during RCW decomposition

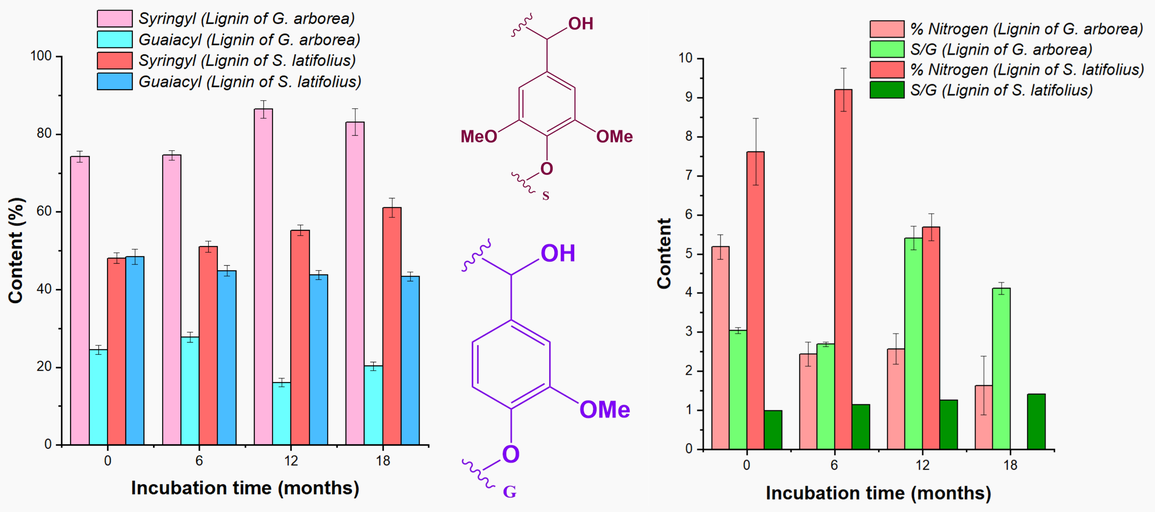

Figure 4: S, G, N and S/G ratio by Py-GCMS-TMAH

Lignin interunit linkage during RCW decomposition

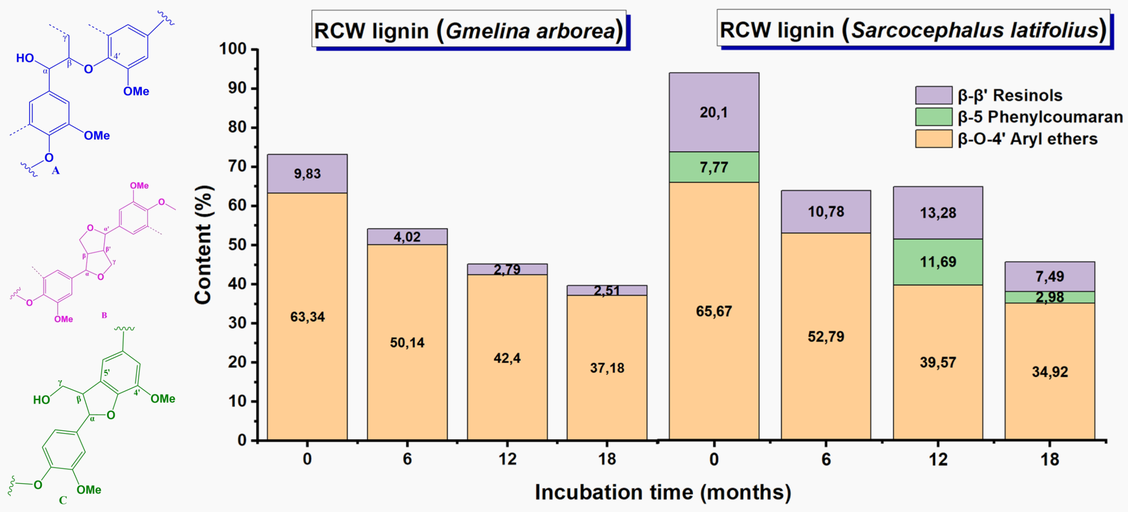

Figure 5: Variation of main lignin interunit linkages by 2-D HSQC NMR

Conclusions

- ➢ As RCW decomposition advanced , total carbohydrate and extractive contents decreased, while lignin content of RCW increased
- ➢ **An increase in S/G ratio** was determined for isolated lignins with the progress of soil decay. These ratios, determined by Py-GC-MS analysis which was **more prominent for *G. arborea* than for the *S. latifolius* lignin**
- ➢ The S/G ratio trend indicated a pattern of **slower decomposition** *in S. latifolius* samples in soil compared to *G. arborea* samples, that could **be favorable to soil organic carbon stabilization.**
- ➢ The **β-O-4' substructures were the main substructures** of all studied lignins; and they remained to be important throughout the process of RCW decay

References

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