Thermal properties of organosolv lignin from different species

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INTRODUCTION

Lignin organosolv was evaluated for its thermal properties from species *Eucalyptus botryoides* Sm, *Eucalyptus paniculata* Sm, *Eucalyptus tereticornis* Smith and *Corymbia citriodora* Hook.

MATERIALS AND METHODS

Trees of 3 species Eucalyptus and 1 Corymbia from Southern of Brazil was utilized for lignins were extracted by organosolv process 60/40 ethanol-water solution; solid/liquid 1/10; 180°C, 90 min. The lignin was separated for black liquor with two volumes of acidified water with sulphuric acid at pH 2, then filtration, washed with acidified water and vacuum dried at 50°C.

Thermogravimetric analysis of organosolv lignins were realized between 25 and 800 °C at a constant heating rate of 10°C min^{-1} under constant inert atmosphere of nitrogen (N_2).

RESULTS AND DISCUSSION

The thermal degradation of lignins from different species occurred in three distinct regions (Fig. 1). In this study, all samples showed a low moisture content (dry basis), ranging from 2.2 % and 3.3 % for *E. paniculata* and *E. botryoides* respectively. The *E. botryoides* (54.9%) and *C. citriodora* (60.5%) showed high percentage of volatile matter. The hemicelluloses degradation occurs at temperatures due to its amorphous structure. This may explain the result for sample Cc that present the highest mass loss rate (0.004).

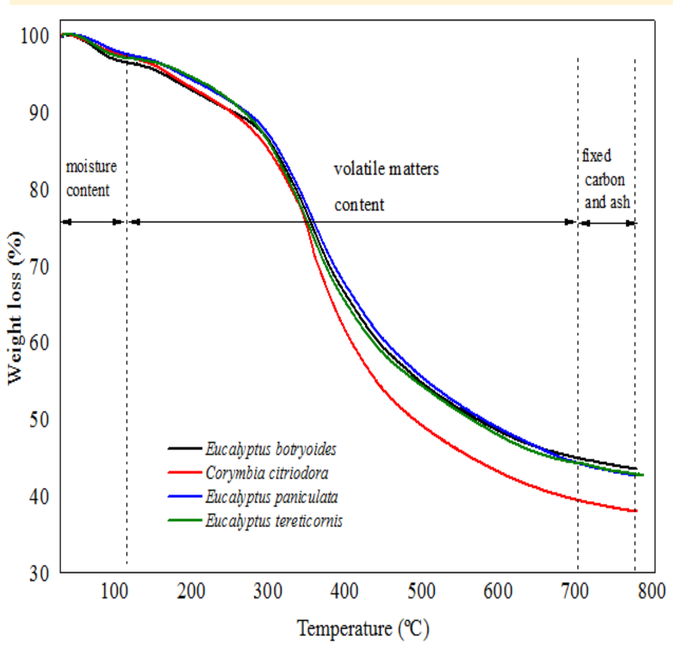

Fig. 1. Mass loss of organosolv lignin as function of temperature.

In previous studies [1], the C. citriodora showed higher content of hemi-cellulose with a high ratio xylose /arabinose suggests with more linear chains that easily ther-mally degraded, resulting in a lower residual mass.

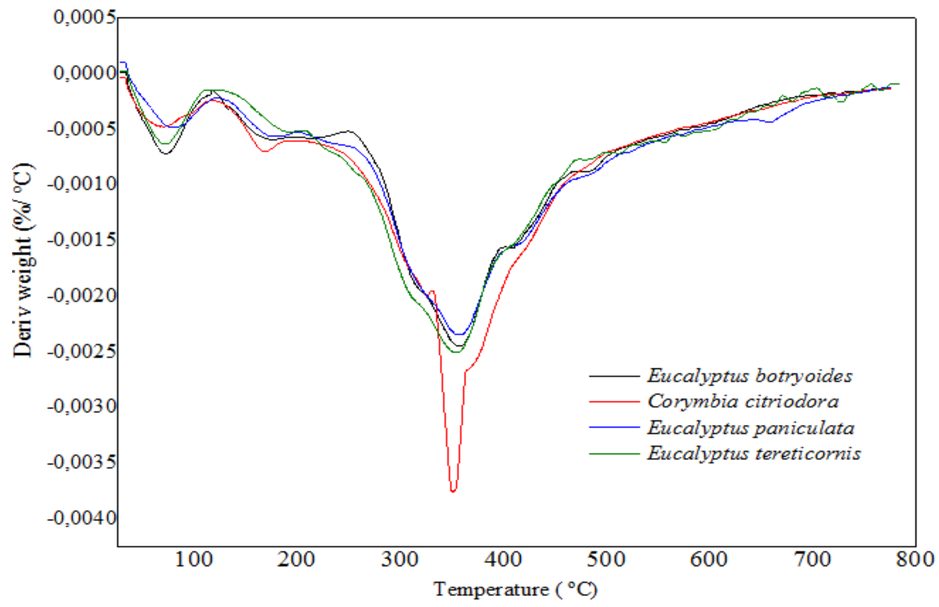

Fig. 2. Thermal decomposition of the organosolv lignins.

The C. citriodora (Fig. 2) showed a sharp peak at 351 °C due to deterioration at greater speed. Large amounts of fixed carbon and ash (37.9 to 43.4%) present in the lignin from C. citriodora and E. botryoides respectively, indicate a high thermal stability due to greater complexity structure of lignin.

Table 1. Yields (%, wt/wt) of the detected phenolic acids and aldehydes compounds released from the lignins alkaline nitrobenzene oxidation.

	E. botryoides	*C. citriodora*	*E. tereticornis*	*E. paniculata*
Vanillic acid	0.5	1.4	0.3	0.1
Syringic acid	0.9	0.03	0.4	0.03
Vanillin	20.5	4.6	15.5	28.8
Syringaldehyde	37.0	25.4	36.1	58.9
Acetovanillone	0.6	0.3	0.4	0.8
Total	59.3	31.7	52.7	88.8
S/G ratio	1.8	4.1	2.2	2.0

The results of nitroben-zene oxidation showed that vanillin and syrin-galdehyde presented the highest contents in all lignins (Table 1). Lignin from *C. citriodora* sho-wed the highest S/G ratio (4.09). It was 45-57% higher than values of other organosolv lignins.

CONCLUSION

All samples presented higher fixed carbon and ash content. Lignins from C. citriodora showed the highest value of volatile matter (60.5%) and the highest loss mass ratio (0.004), probably due to high hemicellulose content. The vanillin and syringaldehyde showed the highest content in all lignins by nitrobenzene oxidation analysis.

REFERENCES

[1] Dos Santos, P. S., de Cademartori, P. H. G., Prado,R., Gatto,D., Labidi, J., Wood science and technology, 2014, **48(4)**, 873-885

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