PRODUCTION OF POLYMER COMPOSITES USING LIGNIN OBTAINED BY HIGH YIELD WOOD EXTRACTION WITH GREEN SOLVENTS

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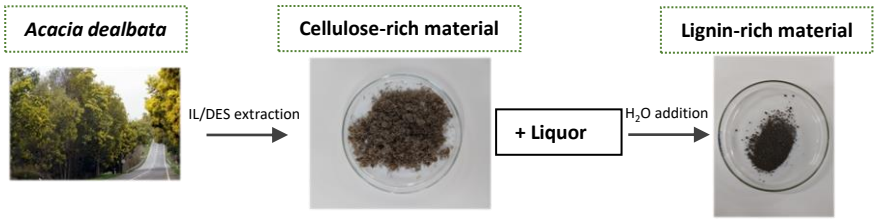
ABSTRACT

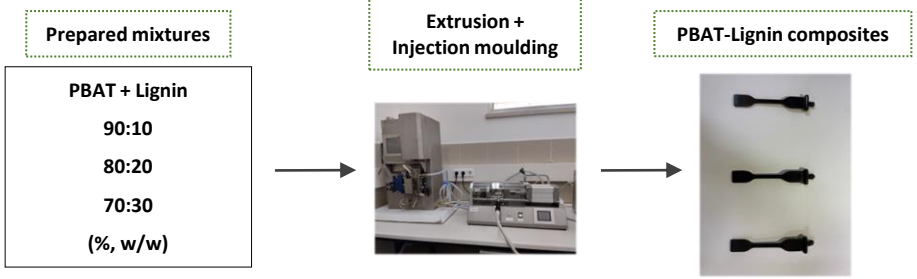
Recent trends in biorefinery have tried to valorize lignin by its transformation into other value-added products. In this work, the results of the lignin extraction from *Acacia dealbata* wood (an invasive tree species) using a selected ionic liquid (IL) and a deep eutectic solvent (DES) are presented. A Kraft lignin obtained from the black liquor of *Acacia dealbata* cooking was used as reference. The results showed that it was possible to obtain high-purity lignins, with yields of lignin recover approaching 100% under optimized conditions of lignin extraction (140 ºC; 24 h using IL + H_2O and 180 ºC; 24 h using the DES). Lignins were then used in the production of composites with polybutylene adipate terephthalate (PBAT), a promising polymer for plastic production with good biodegradability and mechanical properties. It was found that lignin could improve stiffness in the composites with this polymer.

EXPERIMENTAL

Lignin extraction and isolation from wood (*Acacia dealbata*)



PBAT-Lignin composite's preparation

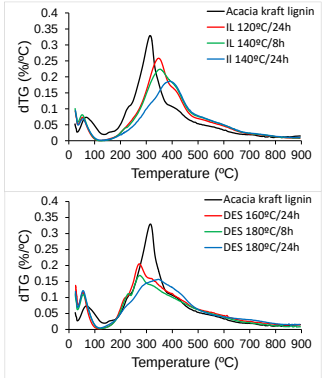


RESULTS

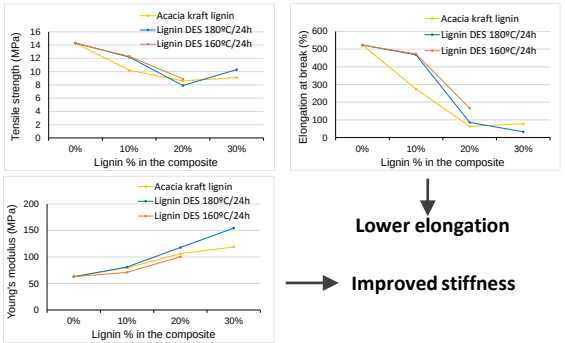
Yield and chemical composition of the lignins precipitated from *A. dealbata* wood

IL/DES treatment	T (˚C)	t (h)	Lignin yield (%)	Total lignin (%)	Polysaccharides (%)
[BMIM] $MeSO_4$ + H_2O	120	24	67.8± 1.5	88.3 ± 3.1	0.89 ± 0.17
[BMIM] $MeSO_4$ + H_2O	140	8	80.9 ± 1.3	83.2 ± 0.2	0.59 ± 0.03
[BMIM] $MeSO_4$ + H_2O	140	24	112.4 ± 1.4	92.6 ± 1.4	0.30 ± 0.05
ChCl:imidazole	160	24	75.7 ± 2.7	92.7 ± 0.2	0.61 ± 0.03
ChCl:imidazole	180	8	68.2 ± 1.5	90.9 ± 2.0	0.33 ± 0.08
ChCl:imidazole	180	24	98.4 ± 0.8	85.2 ± 2.2	0.17 ± 0.05

Thermal stability studies



Composites of PBAT-Lignin: mechanical properties



Conclusions

- It was possible to obtain high-purity lignins (>90% purity) with yields of lignin recover approaching 100% using IL and DES treatments.
- Some of the isolated lignins were more thermally stable than the kraft lignin obtained from the black liquor of *Acacia dealbata* cooking.
- Composites of PBAT and lignin showed lower elongation at break and improved stiffness compared to PBAT alone.

ACKNOWLEDGMENTS

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