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

J.A.F. Gamelas[1*], M.J.R. Santinho[1], M. Oliveira[1], R.O. Almeida[1], R. Moreira[2], A. Serra[2], M.G.V.S. Carvalho[1]

[1] University of Coimbra, CIEPQPF, Department of Chemical Engineering, Pólo II, R. Sílvio Lima, PT – 3030-790 Coimbra, Portugal; e-mail: jafgas@eq.uc.pt; Tel: 00351239798700
[2] University of Coimbra, CEMMPRE, Department of Mechanical Engineering, Pólo II, Pinhal de Marrocos, PT – 3030-788 Coimbra, Portugal

ABSTRACT

Lignin is one of the major polymers present in lignocellulosic materials and one of the most abundant polymers in nature. In the production of cellulosic kraft pulp this aromatic polymer is often only used for energy production (about 98% of the lignin present in the black liquor is burnt), which is far from being the most adequate approach, considering the high potential of this polymer. Recent trends in biorefinery have tried to valorise lignin by its transformation into other value-added products. In fact, lignin can be transformed into other products such as vanillin or syringaldehyde. Other possibility is to isolate it, trying to preserve the lignin structure, and take advantage of its intrinsic characteristics, such as antioxidant and antimicrobial properties, high barrier to UV light, or hydrophobicity, in the production of other materials.

In this work, it will be presented 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). Kraft lignin obtained from the black liquor of *Acacia dealbata* cooking for a kappa level of ca. 16 was used as reference. The methods of lignin extraction and isolation using "green" solvents have been optimized in order to obtain high purity lignin(s) in a high yield. Lignins were characterized for their yield, purity, structural features and thermal behaviour. The results showed that it was possible to obtain yields of lignin recover approaching 100% for the more severe conditions of lignin extraction (140 ºC; 24 h using IL + H_2O and 180 ºC; 24 h using the DES). For less severe conditions of extraction (120 ºC; 24 h and 140 ºC; 8 h using IL + H_2O, and 160 ºC; 24 h and 180 ºC; 8 h using the DES), lignin yields were in the range of 68-81%. On the other hand, the isolated lignins showed total lignin (Klason lignin plus acid-soluble lignin) values between 83 and 93%, revealing high-purity lignins. Interestingly, the ratio of Klason lignin/total lignin was remarkably lower for the lignins extracted using deep eutectic solvent (a more selective system for the lignin extraction [1]). Minor amounts of polysaccharides were found (less than 1%) in the isolated lignins. 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.

Keywords: bioresources, circular economy, composites, invasive species, lignin.

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