

Synthesis of Styrene / Lignin-Based Polymeric Materials

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Lignin is a complex macromolecule derived from wood, which is considered one of the toughest materials in nature. In spite of being used as feedstock for energy production, the lignin may be employed to obtain high added value materials with such as polymers [1]. Due to the heterogeneity of the reaction medium and the low affinity of lignin microparticles with the monomeric phase mainly in the beginning of polymerization, the sequential bulk-suspension polymerization process is very indicated in order to ensure the proper dispersion of lignin into polystyrene matrix [2-3]. In this work, polymeric materials based on styrene and lignin were synthesized through sequential bulk-suspension polymerization process carried out in two stages: *i*) a bulk polymerization, which was performed at 85 °C under constant stirring of 1200 rpm, benzoyl peroxide concentration ranged from 32 g/L to 64 g/L and lignin fraction in the range from 5 wt.% to 10 wt.% (with average particle size of 50 μm) until a conversion of approximately 55 %; *ii*) followed by addition of 135 mL an aqueous solution of suspending agent [poly(vinyl alcohol), 5 g/L] to the highly viscous polymeric mixture, consisting of lignin microparticles, unconverted styrene monomer and polystyrene formed during the first stage of polymerization. The heterogeneous step of the polymerization was carried out at 85 °C and agitation speed of 500 rpm for four hours. As illustrated in Fig. 1, micro-sized particles of polystyrene / lignin composite presenting spherical morphology can be successfully obtained through bulk-suspension sequential polymerization process. Thermal characterization of polymer particles showed that the glass transition temperature (T_g) decreased in approximately 10 °C in comparison to the one observed to pure polystyrene (98 °C). According to Figure 1, the composite materials present good thermal stability with a significant weight loss observed in the range from 340 °C to 470 °C, exhibiting degradation profile similar to the one observed for the pure polystyrene.

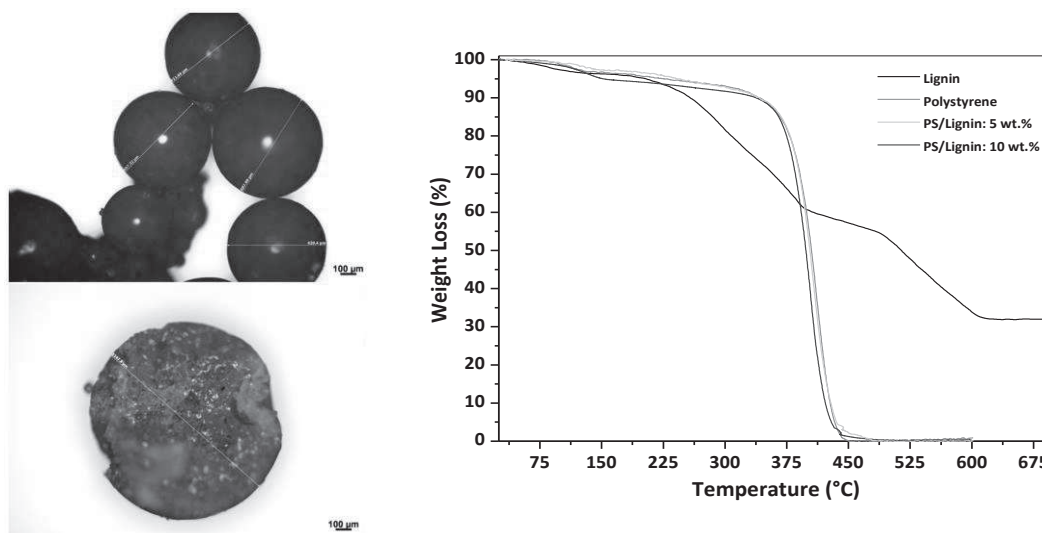


Fig. 1: Microscopy Image and Thermal Stability of Polymeric Materials.

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