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Coir Pith Lignin Isolation and Spectroscopic Structure Elucidation

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Lignin can be considered as one of the most promising renewable resource for the future. Reduction of synthetic adhesive usage in wood composite production by the development of lignocellulosic materials is a challenge. Lignin has been extracted from coir pith and utilized to create an epoxy-lignin hybrid adhesive system. Extraction was done by alkaline [7.5(%wt.) NaOH, 90 min, 90^{o}Cand 1:10 ratio] and organosolv [formic: acetic acid 6:11 (v/v), 85(%wt.), 120 min, 90^{o}C and 1:8 ratio] pulping methods in laboratory scale. The yield of lignin in alkaline pulping was high (25 %wt.) compared toorganosolv pulping (2 %wt.). Fourier transform infrared spectroscopy (FTIR) studies showed a shift of carbonyl band in the organosolv lignin to longer wavelength at 1702 cm^{-1} indicating a partial acetylation due to the acetic acid usage.

Enhancement of reactivity of lignin has been a huge challenge in its applications. Alkaline lignin was chemically modified by two protocolsviz, hydroxymethylation and phenolation separately. The obtained FTIR data of modified lignin supported that the contents of hydroxymethyl and phenolic hydroxyl had been increased.^{1}H and^{13}C CP-MAS NMR resultsillustrated that the two lignins have different types and extents of hydroxyl functional groups. MALDI-TOF mass spectrometry analysis indicated that oligomeric structures of corresponding functional groups of lignin.UV-vis data revealed a good interpenetration of lignin within epoxy matrix. A lignin-epoxy adhesives system was prepared by polyblending alkaline lignin and epoxy resin varying from 5 to 20 (%wt.). Fracture testing data measured by an Instron machine revealed the decrease of lap shear strength with the gradual increase in the lignin portion of the polyblends. The findings of this research project in lignin isolation by two methods viz., alkali and organosolv and modification can be of high interest in utilizing coir pith as a valuable bio-resource.

***Keywords**: Lignin; UV-Vis, MALDI-TOF-MS; ^{13}C, ^{1}H NMR, FTIR*

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