

Synthesis and characterization of poly(lactic acid) composites with organosolv lignin

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I. Methods

Quantitative ³¹P-NMR analysis was performed on an Agilent 500 spectrometer (Agilent 171 Technologies, Santa Clara, CA). In more detail, 40 mg of pre-dried lignins were dissolved in 0.5 ml of a deuterated chloroform/anhydrous pyridine solution (1:1.6, v/v) (Solvent A) and 100 µl of a solution of chromium(III) 2,4-pentanedionate (5 mg/mL) (relaxation agent) and N-hydroxy-5-norbornene-2,3-dicarboxylic acid imide (NHND, 18 mg/mL) (internal standard) dissolved in Solvent A. The solution was stirred until the lignins were fully dissolved. Finally, 100 µl of 2-Chloro-4,4,5,5-tetramethyl-1,2,3-dioxaphospholane (TMDP) was added dropwise. For the measurement, 128 scans and a relaxation delay of 10 sec were selected. Prior to the quantification analysis, the sharp peak corresponding to the TMDP+H₂O was shifted and assigned to 132.2 ppm. NMR data were processed with MestReNova (Version 14.0.2-26256, Mestrelab Research).

II. Tables

Table S1. Quantitative assignments of functional groups and their abundance present in OBS and OBSBM8 lignins, as determined ³¹P-NMR analysis

Lignin functional groups – Abundance (mmol/gr)	OBS	OBSBM8	Chemical shifts (δ _p)
Aliphatic OH	1.52	2.12	145-150
Phenolic OH	3.45	3.08	137-144.5
COOH	0.08	0.07	134-136
Total OH content	5.05	5.27	134-150

III. Figures

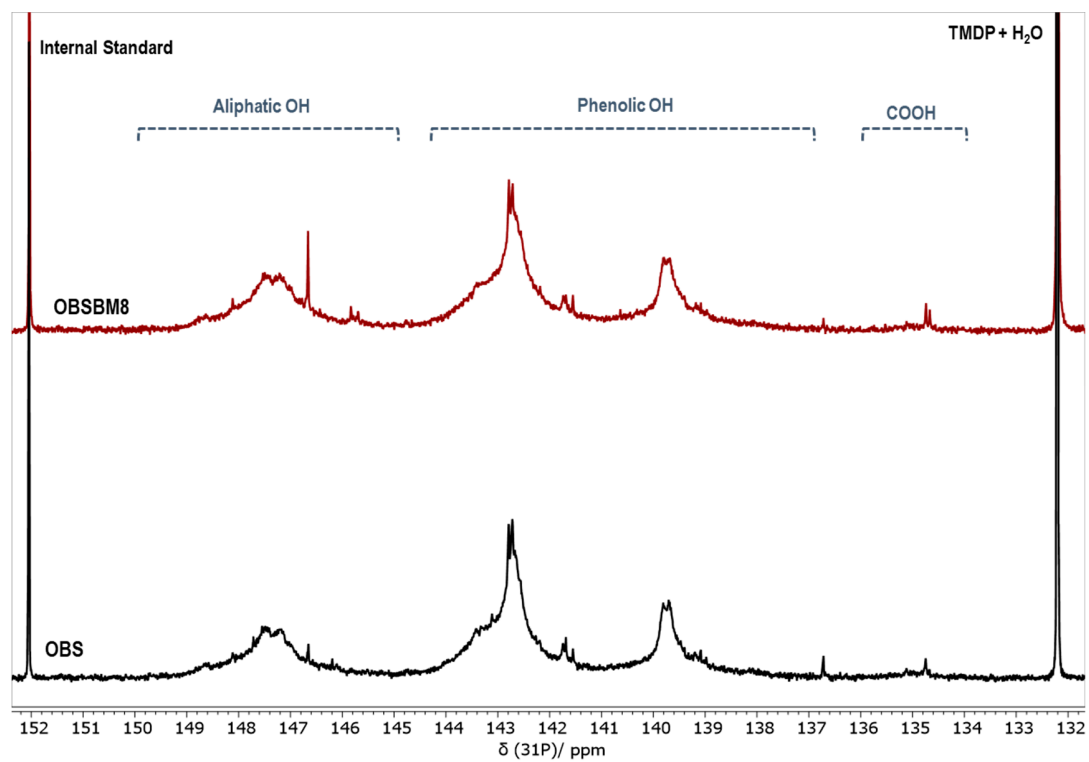


Figure S1. ^{31}P -NMR spectra of OBS and OBSBM8 lignins

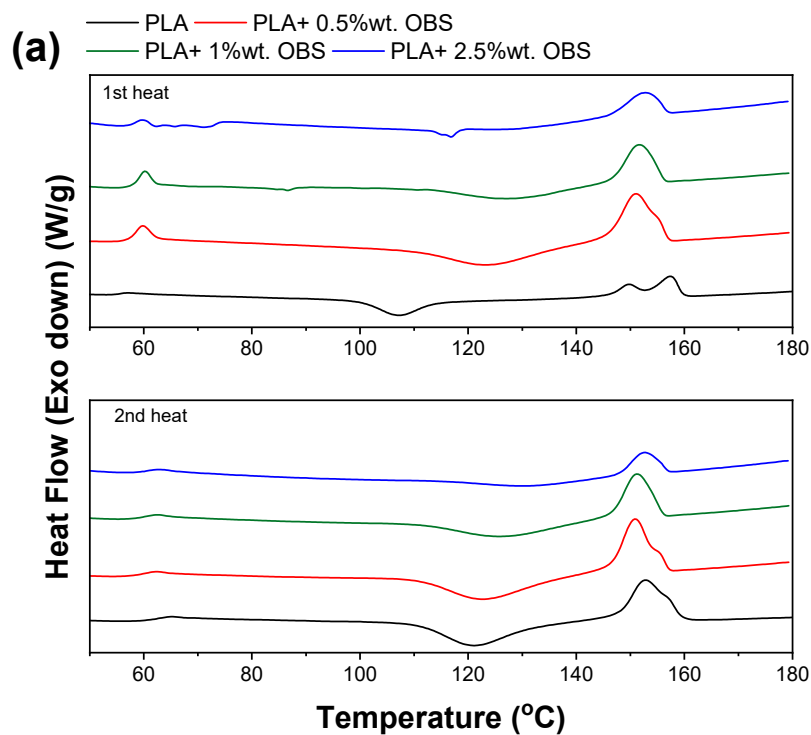


Figure S2. DSC scans of PLA/OBS composites.

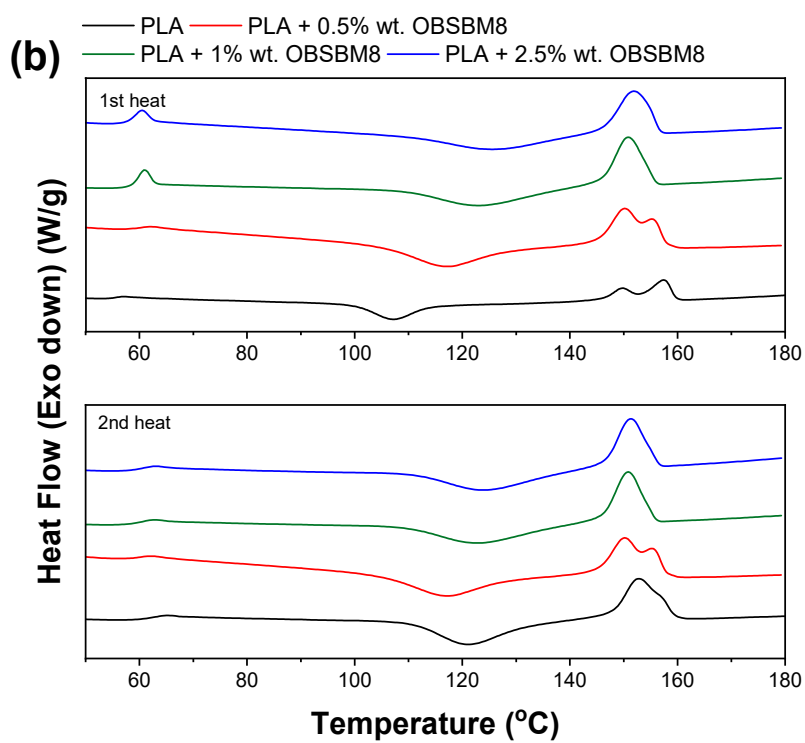


Figure S3. DSC scans of PLA/OBSBM8 composites.

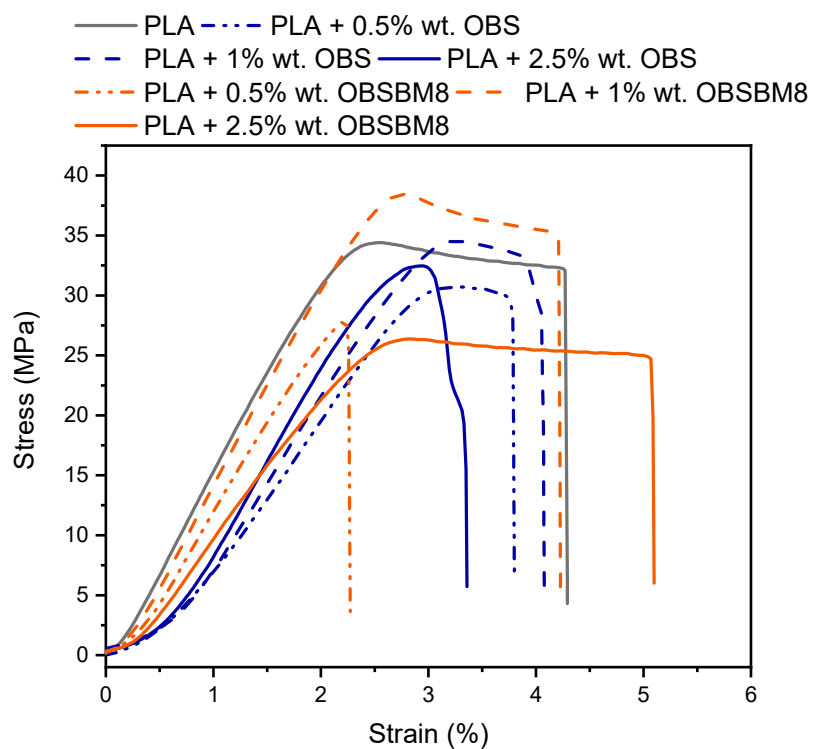


Figure S4. Indicative stress-strain curves of PLA and its composites with OBS and OBSBM8 lignin.