

In order to better understand the structural changes of lignins under hydrothermal conditions, the milled wood lignin (MWL) was isolated from shrub *Tamarix ramosissima* stems before and after hydrothermal treatment. The chemical structure was characterized by carbohydrate analysis, elemental analysis, methoxy group determination, FT-IR spectroscopy, quantitative ^{13}C NMR spectroscopy, 2D heteronuclear single quantum coherence spectroscopy (HSQC), and gel permeation chromatography (GPC). The results indicated that the main reaction responsible for the lignin degradation was the homolytic cleavage of aryl-ether bonds resulting in a reduced amount of β -O-4' inter-linkages and, as a consequence, in elevated amounts of β - β' and β -5' linkages. Moreover, the MWL isolated from the pretreated solid residue showed that it was more condensed and had a lower molecular weight than the MWL isolated from untreated material. These results would provide critical insights on the impact of lignin degradation on enzyme digestibility and accessibility of the recalcitrant lignocellulosic substrates.

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Effect of hydrothermal treatment on lignin of two *Paulownia* species

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The effect of hydrothermal treatment on lignin of two *Paulownia* wood species, namely *P. elongata* and *P. tomentosa*, was studied. The genus *Paulownia* is one of the fastest growing hardwoods making it an attractive species for hydrothermal treatment in a lignocellulosic biorefinery. Milled wood samples were extracted with hot-water after which the wood meal was filtered and the recovered hydrolysate was acidified and ultrafiltrated. The retentate collected after ultrafiltration was analyzed by 2D-HSQC and the permeate was extracted with ethyl acetate and analyzed by GC/MS for lignin degradation products. The filtered wood meal was tested for residual lignin content, free phenolic hydroxyl group content and S/G ratio and these results were compared with native wood. Changes in the structural composition of lignin will help in understanding the chemistry of lignin from the *Paulownia* species under hydrothermal treatment conditions. Potential applications of the recovered lignin/lignin degradation products will be discussed.

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Biochar prepared by pyrolysis of castor oil cake discard from biodiesel industry in Brazil

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We are seeking to determine the best parameters for pyrolysis of biodiesel industry castor (*Ricinus communis*) discard aimed to obtaining biochar [1]. Eight samples were prepared in a factorial design 2^3 using two temperatures i.e. 300°C and 350°C, two heating velocities 5°C and 10°C min⁻¹ and two period of heating 30 min and 60 min. NMR ¹³C spectroscopy data of the obtained solid samples were submitted to MCR analysis. The results can be resumed by means of two component mixture. One more carbonized material (Component 1), with aromatic groups presenting some ring condensation. The other estimated component (Component 2) presenting NMR ¹³C spectra features of oxygenated functions as carboxylic acid. The samples treated at lower temperature presenting the greater percentage of the component 2.

Acknowledgements: CNPq, INCT E&A, DQ/UFPR, Prof. Dr. R. R. Ribeiro. [1]Novotny et al. *J. Braz. Chem. Soc.*, 20(6), 1003-1010, **2009** .

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Pyrolizing lignin to create a new foundry fuel source

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It has been discovered that lignin has the ability to serve as a binder for a new foundry fuel source consisting primarily of briquetted anthracite fines. This new fuel would be a more economic, efficient and environmentally-friendly alternative than the current fuel source, coke. With less than 10% composition, lignin has been shown to provide the mechanical strength necessary for the compressive loads in the foundry cupola furnace's "heat zone" of 500°C - 1100°C. Solid-state NMR was used to analyze a series of pyrolyzed lignin samples to better understand the transformation that lignin undergoes at elevated temperatures. At approximately 400°C, the structure of hardwood lignin substantially changes to what seems to be a more polycyclic aromatic hydrocarbon structure, possibly similar to that of graphite. Most functional groups are released pyrolytically, leaving behind a rigid, fused ring network. Infrared and Raman spectroscopy have helped confirm these solid-state NMR results.

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Comparative characteristics of surface-active properties of aromatic polymers lignin and humic nature

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