# Supporting Information

# Layer by Layer Supported Laccase on Lignin Nanoparticles catalyzes the selective Oxidation of Alcohols to Aldehydes

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**Contents**



**SI #1** *SEM analysis of catalyst **IV** after the sixth run of oxidation of alcohol **3**.*

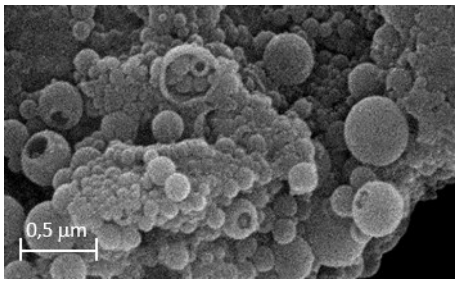


Figure S1. SEM analysis of catalyst IV after the sixth run of oxidation of alcohol **3**. The analysis showed a complete integrity of the support.

**SI #2** *Phosphorus Nuclear Magnetic Resonance ($^{31}$P-NMR) analysis of phosphitylated lignin organosolv and cationic lignin (CATLIG) samples*

The qualitative and quantitative analysis of phenolic moieties in organosolv lignin (OL) and in cationic lignin (CATLIG) were determined by $^{31}$P-NMR analysis[1]. Typically, the appropriate sample (10 mg) was dissolved in pyridine/$CDCl_3$ (300 µL; ratio 1.6/1.0 v/v), followed by addition of chrome (III) acetylacetonate solution (50 µL, 11.4 mg/ml) as relaxing agent. Then, the phosphitylation reagent 2-chloro-4,4,5,5-tetramethyl-1,3,2-

dioxaphospholane (200 μl) was added under magnetic stirring at 45 °C for 2 hours. NMR analysis was performed in the presence of *N*-hydroxy-5-norbornene-2,3-dicarboxylic acid imide (10 μmol) as an internal standard on a Bruker 400MHz apparatus. The $^{31}$P NMR (ppm) characteristic range for any OH groups have been derived from literature[2,3].

The increase of the signal relative to aliphatic OH groups and the decrease of remaining OH aromatic groups confirmed the cationization reaction of lignin organosolv to yield CATLIG (Figure 1).

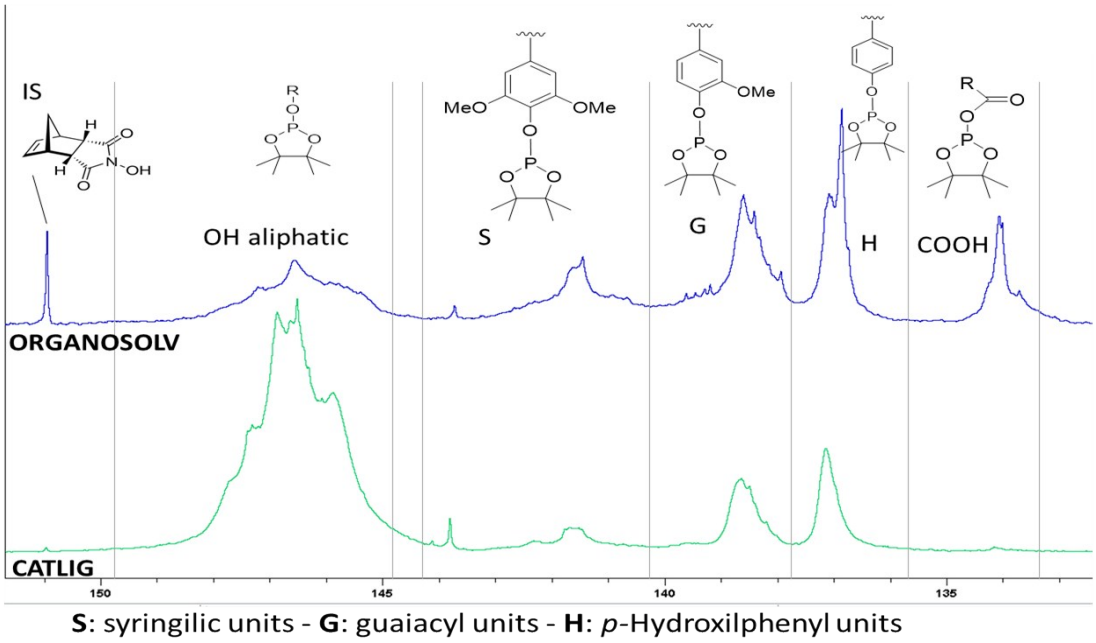


Figure S2. $^{31}$P NMR analysis of phosphitylated lignin organosolv and cationic lignin (CATLIG) in presence of internal standard (N-hydroxy-5-norbornene-2,3-dicarboxylic acid imide).

## References


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2 F. Melone, R. Saladino, H. Lange, C. Crestini, *J. Agric. Food Chem.* 2013, **61**, 9307

3 Y. Pu, S. Cao, A.J. Ragauskas, Energy Environ. Sci. 2011,**4**, 3154-3166.