

Synthesis, characterization, and utilization of a lignin-based adsorbent for effective removal of azo dye from aqueous solution

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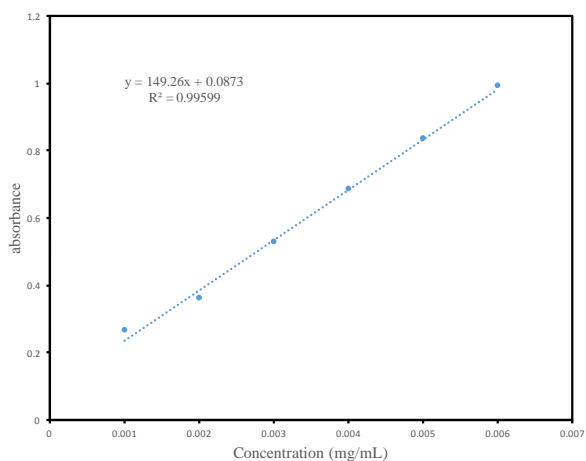


Figure S1. A calibration curve of absorbance against concentration of methylene blue according the Beer's law.

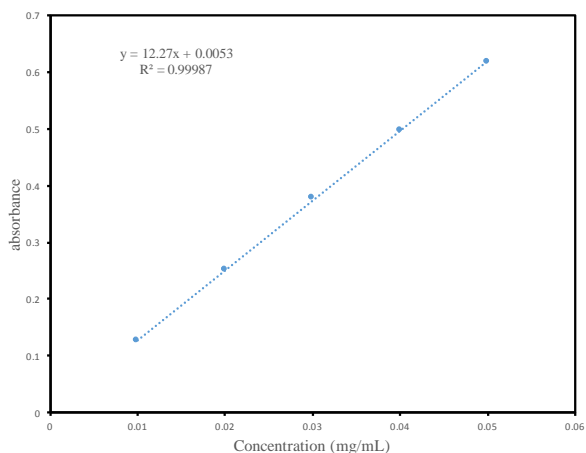


Figure S2. A calibration curve of absorbance against concentration of direct blue 1 according the Beer's law.

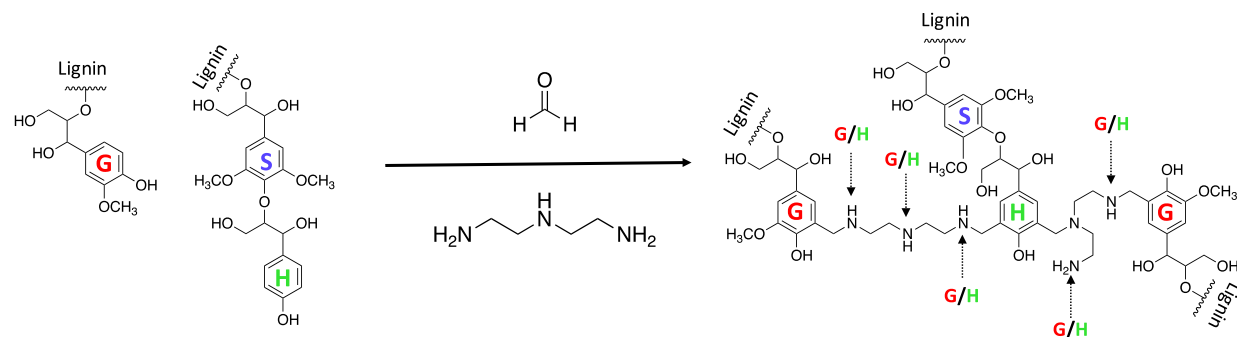


Figure S3. A schematic diagram of Mannich reaction and the structure transformation of CELF lignin during the amination reaction.

Ninhydrin test

Primary and secondary amines were visually test by Ninhydrin. ~10 mg of Ninhydrin (1,2,3-Indantrione monohydrate) was dissolved in 2 mL of dimethyl sulfoxide in a test tube. Around 2 mg of the lignin sample as added into the test tube. The solution was heated and boiled for about 5 min, and the color of the solution was observed and recorded.

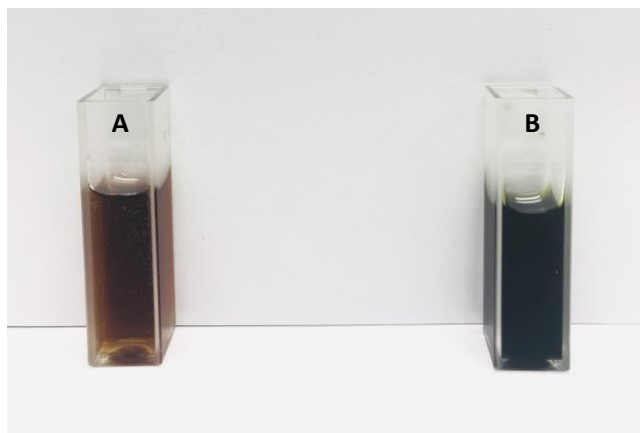


Figure S4. Ninhydrin test of CELF lignin (A) and the aminated lignin (B).

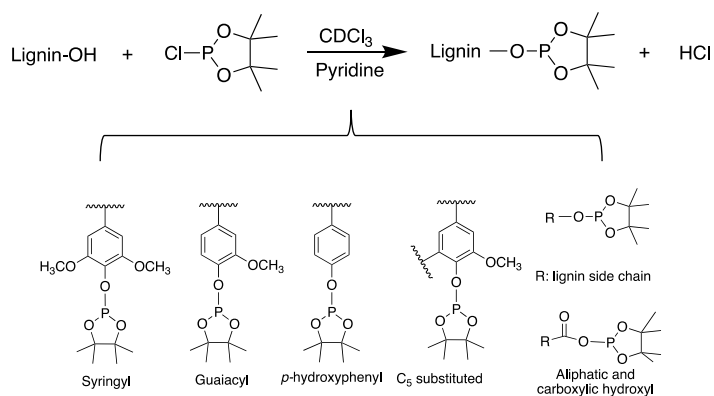


Figure S5. Phosphitylation of various OHs in lignin structural units with TMDP.

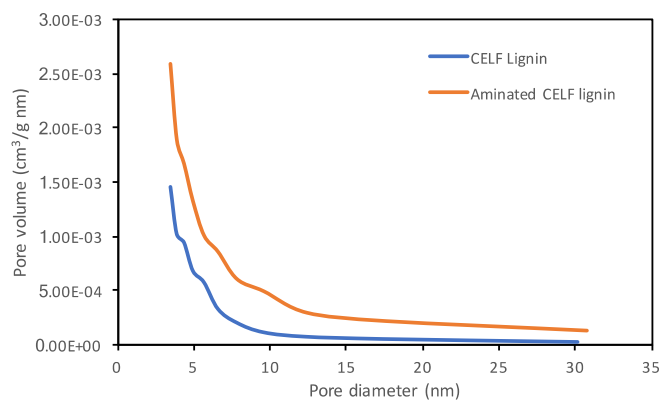


Figure S6. Pore size distribution of lignin samples before and after amination.

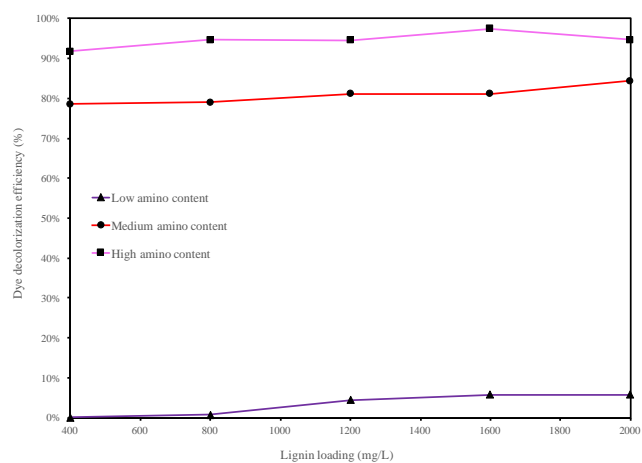


Figure S7. The effect of amino content on the adsorptivity of aminated CELF lignin.

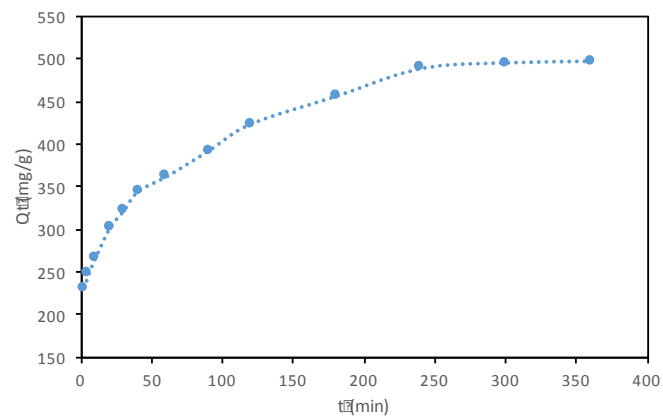


Figure S8. Effect of contact time on adsorption of DB 1 dye by aminated CELF lignin.

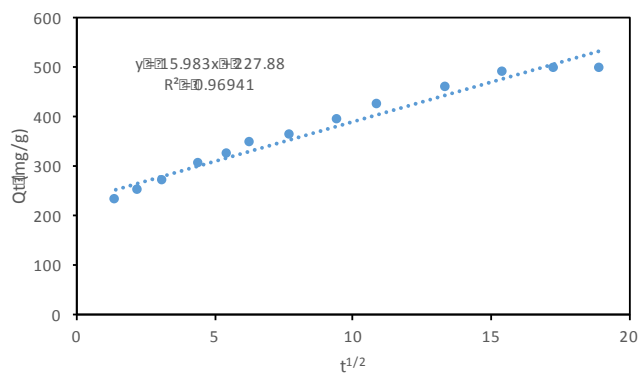


Figure S9. Intraparticle diffusion kinetic of DB 1 dye.

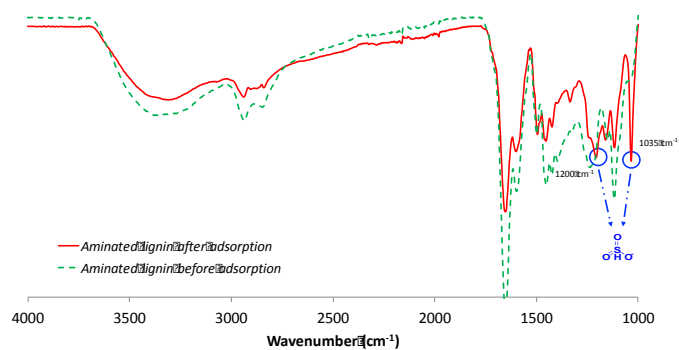


Figure S10. FTIR spectra of the aminated CELF lignin before and after adsorption of DB 1 dye.