Supporting Information

Metal-free aqueous flow battery with novel ultrafiltered lignin as electrolyte

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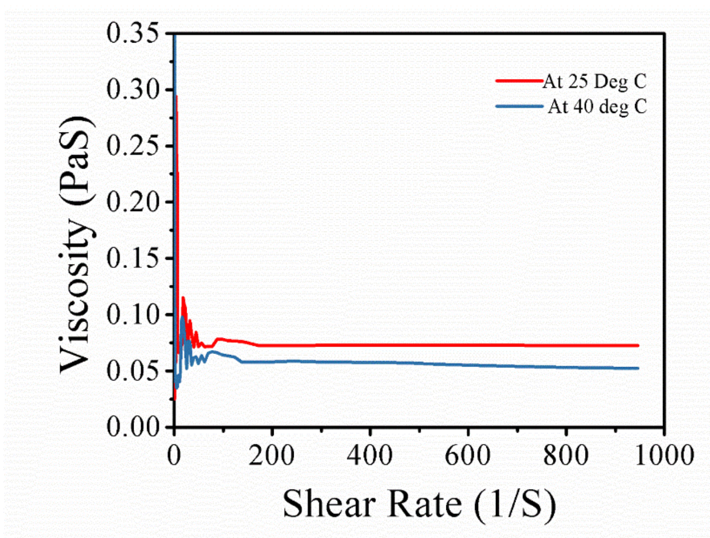

Figure S1: Dynamic viscosity at different shear rate at 25 and 40˚C

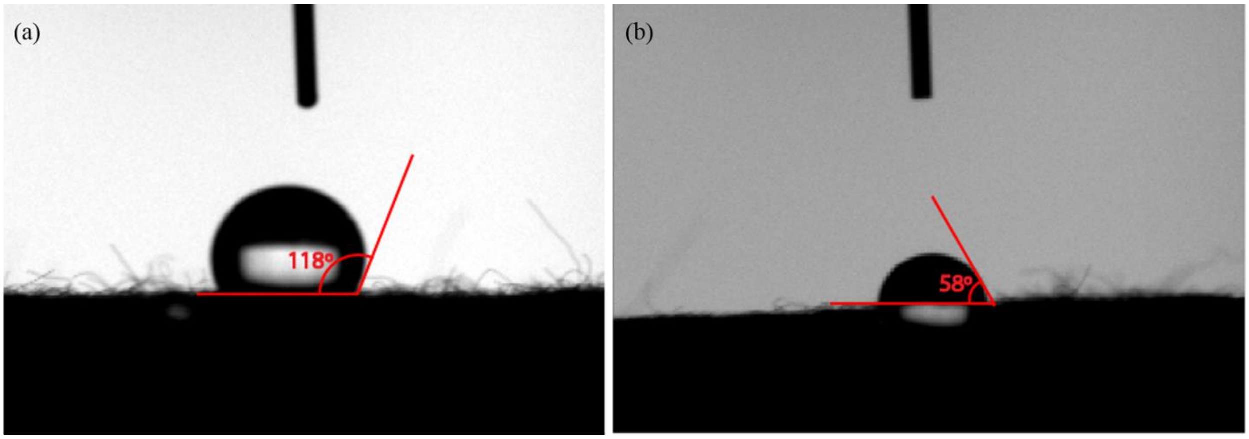

Figure S2: Contact angle of carbon felt (a) before plasma treatment (b) after plasma treatment

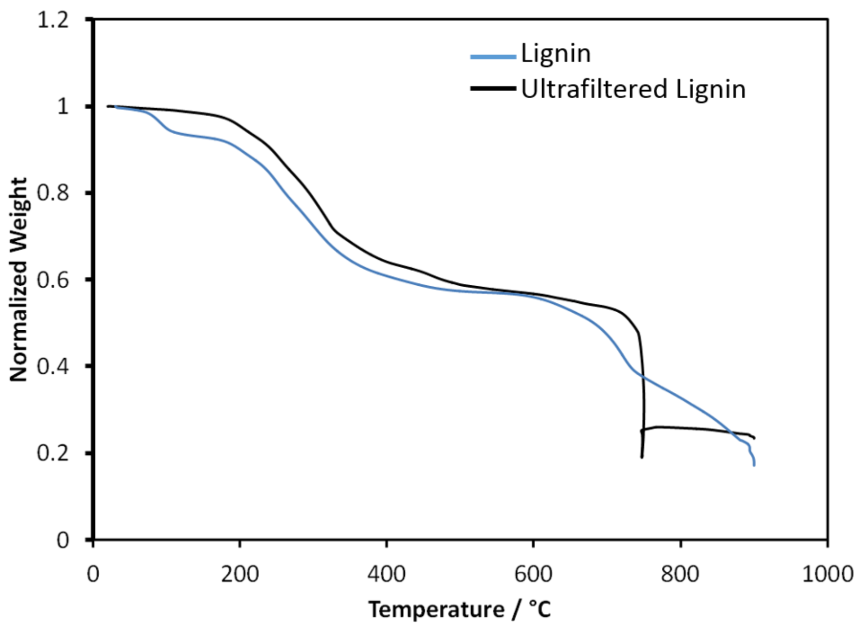

Figure S3: TGA of lignin

Cost Estimation:

An approximate cost estimation was performed for the Lignin/Bromine Flow Battery following the method described by Liu et al. [2] Compare to the current state of the art Vanadium Redox Flow Battery (VRFB), Lignin/Bromine flow battery can reduce the cost drastically by reducing the cost of the active electrolyte material. Based on the bulk price provided in Alibaba.com, the costs of the sodium lignosulfonate and bromine are ~\$0.26/kg and \$3/kg, respectively. This leads to an average material cost of \$1.63/kg, whereas the costs of two most widely used vanadium electrolytes, Vanadyl Sulfate and Vanadium Pentoxide, are around \$30/kg and \$24/kg, respectively. In a 4 MWh and 1 MW VRFB, the vanadium electrolytes contribute to ~43% (~\$192) of its total cost of ~\$447/kWh. Therefore, this idea of using lignin as an electrolyte can cut down the electrolyte cost by at least \$22 and thus lower the cost down to \$200/kWh.