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Phosphomolybdic acid and ferric iron as efficient electron mediators for coupling biomass pretreatment to produce bioethanol and electricity generation from wheat straw

Yi Ding [a,§], Bo Du [a, §], Xuebing Zhao [a, b,*], J.Y. Zhu [c], Dehua Liu [a, b]

[a] *Institute of Applied Chemistry, Department of Chemical Engineering, Tsinghua University, Beijing 100084, China.*

[b] *Tsinghua Innovation Center in Dongguan, Dongguan 523808, China.*

[c] *USDA Forest Service, Forest Products Lab, 1 Gifford Pinchot Dr, Madison, WI 53726, USA*

[§] *Both authors contributed equally to this work.*

* **Corresponding author**: Xuebing Zhao, *Email: zhaoxb@mail.tsinghua.edu.cn; Tel: +86-10-62772130; Fax: +86-10-62772130*

Abstract: Phosphomolybdic acid (PMo_{12}) was used as an electron mediator and proton carrier to mediate biomass pretreatment for ethanol production and electricity generation from wheat straw. In the pretreatment, lignin was oxidized anaerobically by PMo_{12} with solubilization of a fraction of hemicelluloses, and the PMo_{12} was simultaneously reduced. In an external liquid flow cell, the reduced PMo_{12} was re-oxidized with generation of electricity. The effects of several factors on pretreatment were investigated for optimizing the conditions. Enzymatic conversion of cellulose and xylan were about 80% and 45% after pretreatment of wheat straw with 0.25 M PMo_{12}, at 95^{o}C for 45 min. $FeCl_3$ was found to be an effective liquid mediator to transfer electrons to air, the terminal electron acceptor. By investigating the effects of various operation parameters and cell structural factors, the highest output power density of about 11 mW/ cm^2 was obtained for discharging of the reduced PMo_{12}.