Electronic Supplementary Material (ESI) for Materials Advances.

Supporting Information

Biodegradable Zn-Ion Battery with lignin composite electrode and Bio-Ionic Liquid Based Electrolyte: Possible In Situ Energy Generation by Lignin Electrocatalysis

Abhishek Lahiri[1,2] *, Li Yang[1], Oliver Hoefft[1], Frank Endres[1]*

[1]Institute of Electrochemistry, Clausthal University of Technology, Arnold-Sommerfeld-Str. 6, 38678 Clausthal-Zellerfeld, Germany

[2]Department of Chemical Engineering, Brunel University London, London UB8 3PH, UK

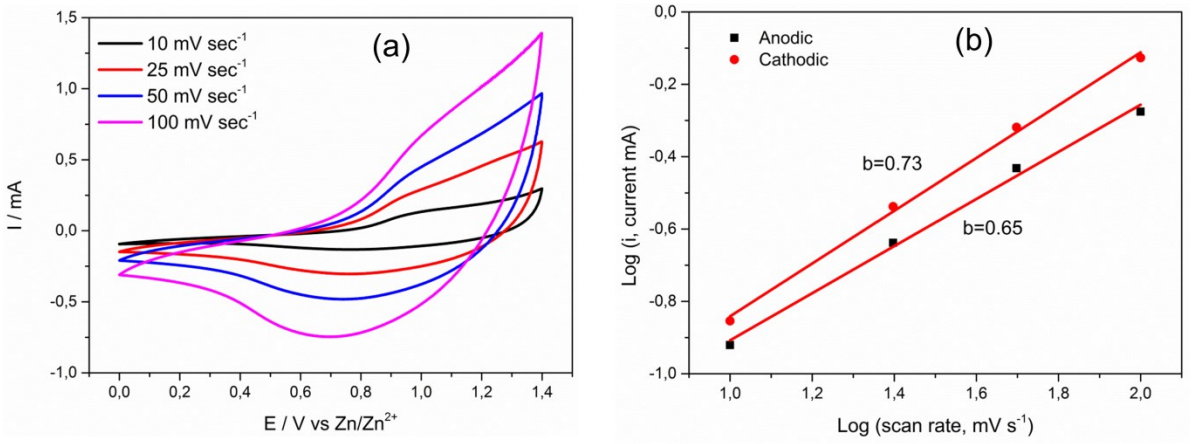

Figure S1: (a) CV cycles at different scan rates of PPylignin in 1 mol/kg $ZnAc_2$ in (50 wt% ChAc + 50 wt% water) (b) Relationship between log i and log υ plots for the cathodic and anodic sweeps of CV

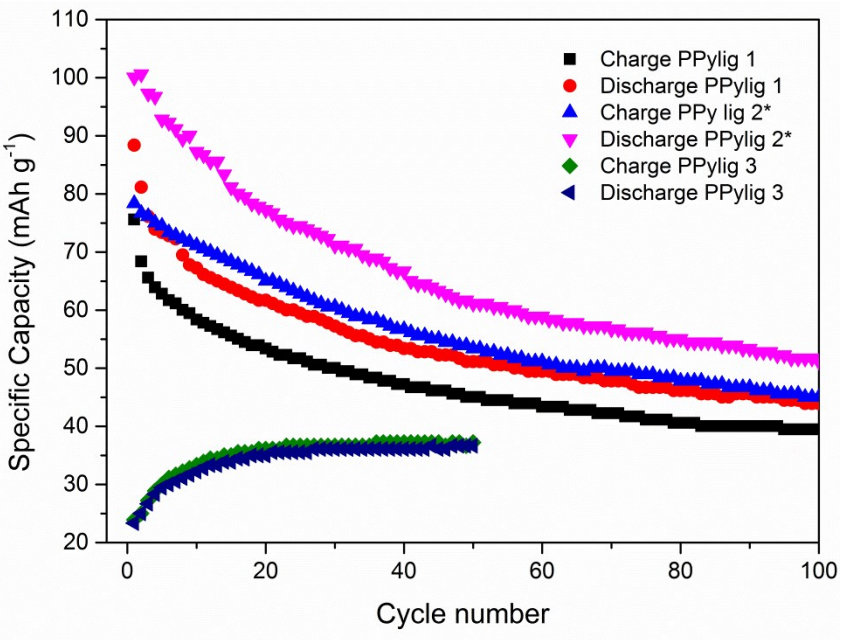

Figure S2: Galvaostatic charge-discharge curves of PPylig 1, PPylig 2* and PPylig 3 at 200 mA g^{-1} in 1 mol/kg $ZnAc_2$ in (50 wt% ChAc + 50 wt% water)

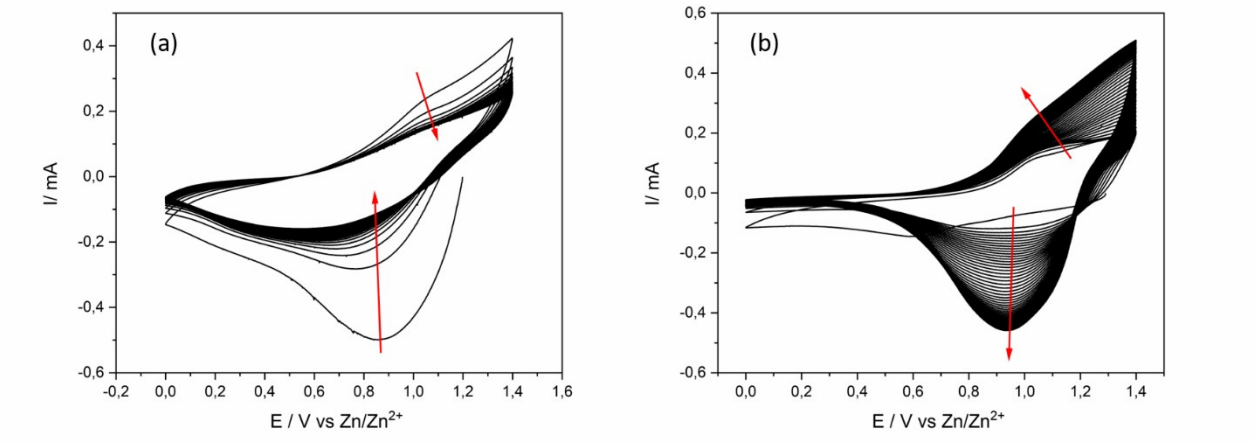

Figure S3 (a) 50 CV cycles of PPy, (b) 50 CV cycles of PPylig in 50 wt% ChAc+ 50 wt% water

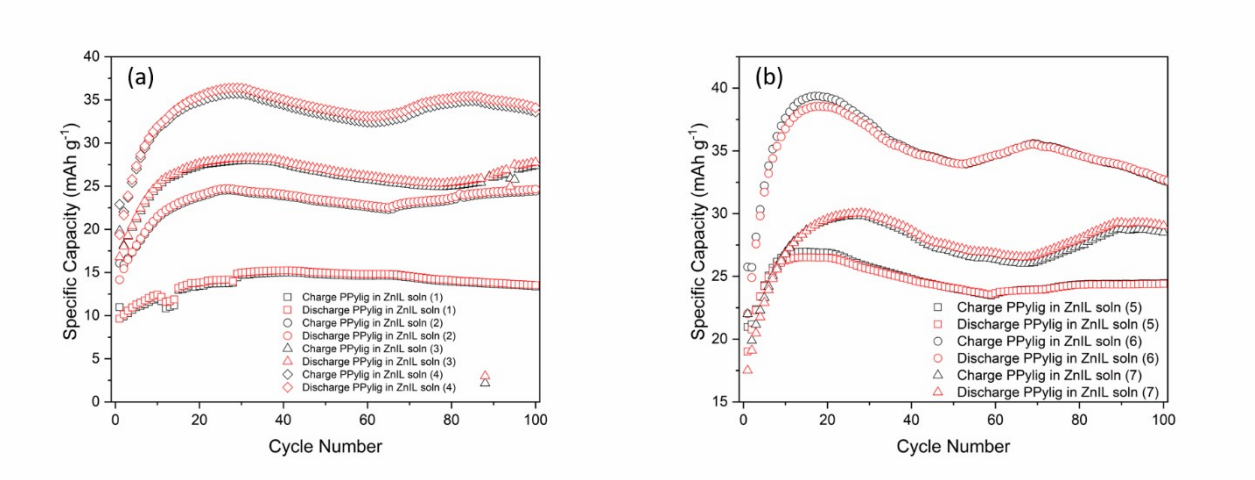

Figure S4 (a, b) Repeated charge-discharge curves of PPylig 2 at at 200 mA g^{-1} in 1 mol/kg $ZnAc_2$ in (50 wt% ChAc + 50 wt% water)

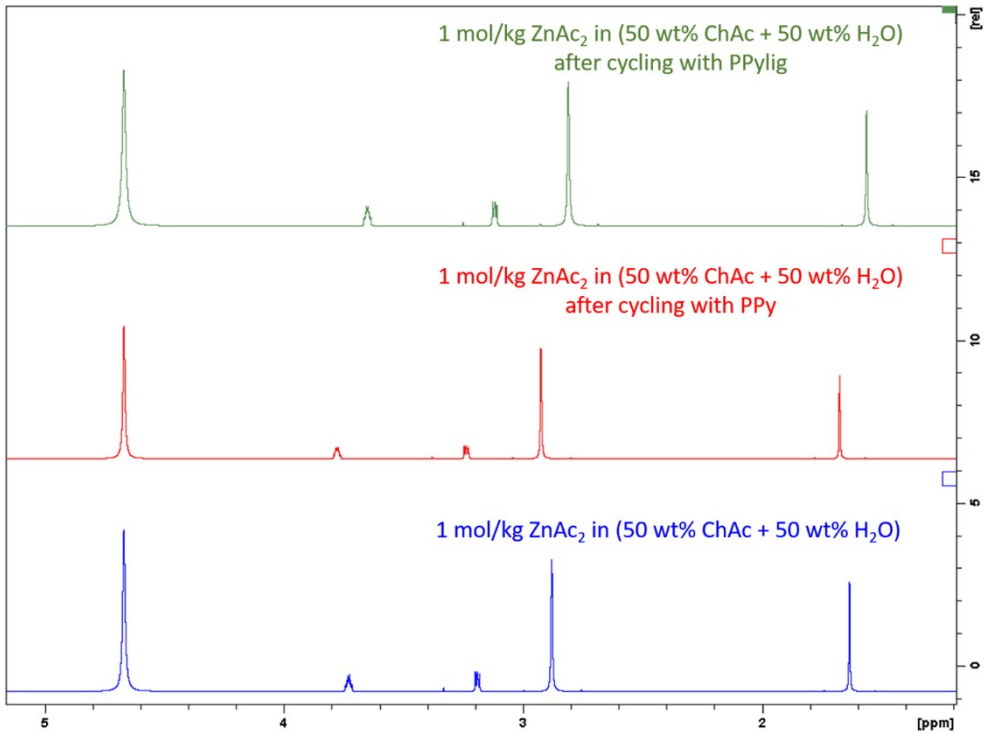

Figure S5: Comparison of ^{1}H-NMR spectra of 1 mol/kg $ZnAc_2$ in (50 wt% ChAc + 50 wt% water) before and after cycling with PPy and PPy/lignin

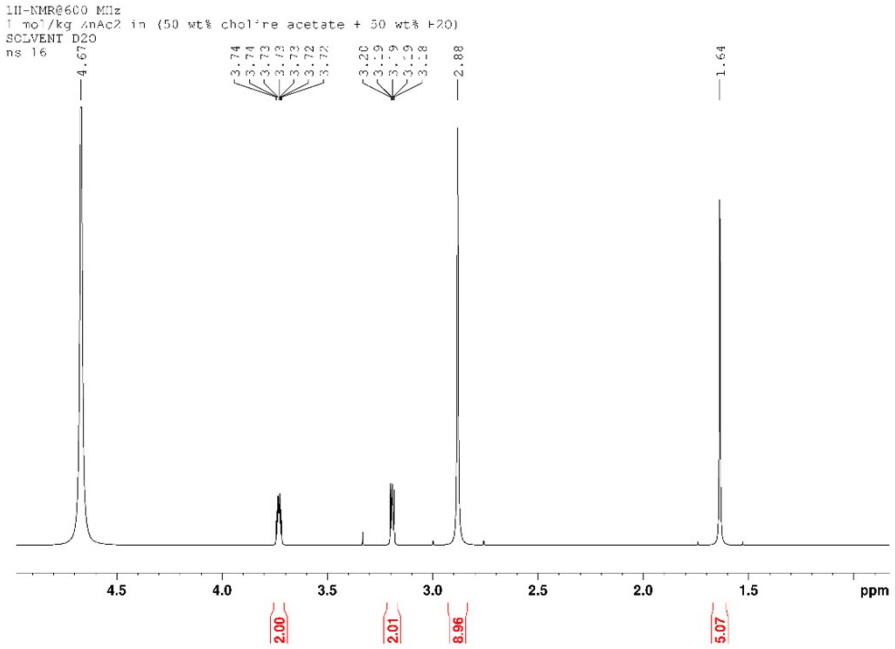

Figure S6: Detailed ^{1}H-NMR of 1 mol/kg $ZnAc_2$ in (50 wt% ChAc + 50 wt% water)

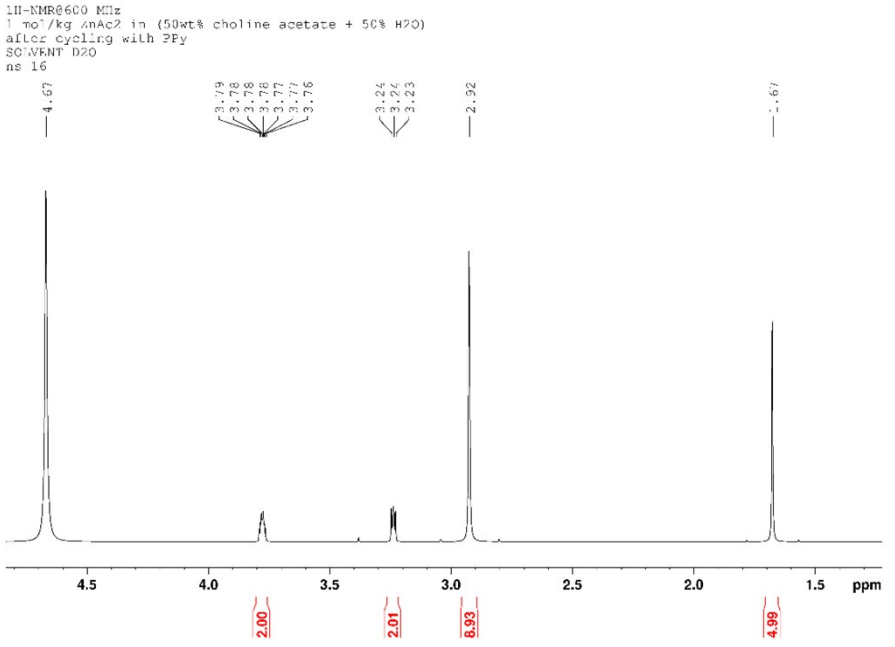

Figure S7: Detailed ^{1}H-NMR of 1 mol/kg $ZnAc_2$ in (50 wt% ChAc + 50 wt% water) after cycling with PPy

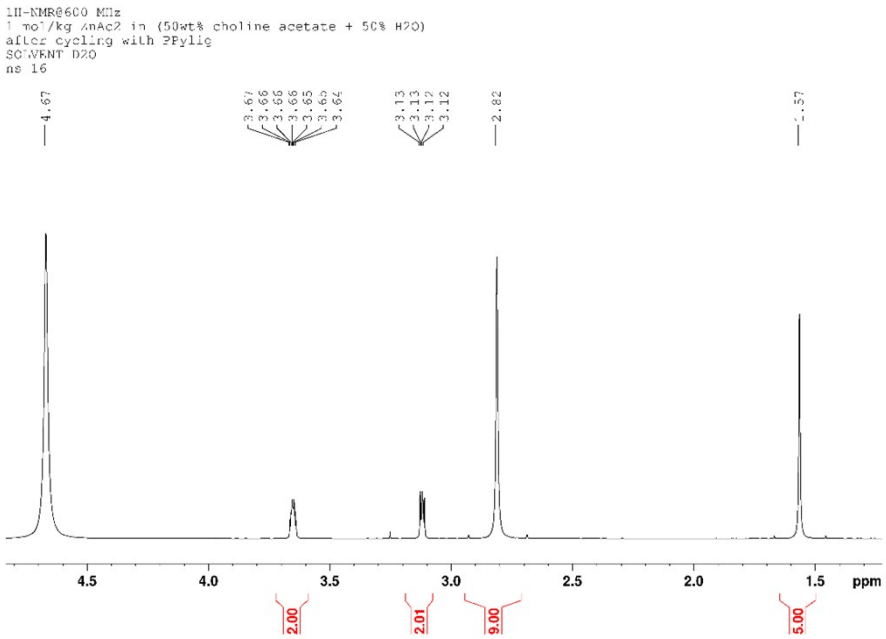

Figure S8: Detailed ^{1}H-NMR of 1 mol/kg $ZnAc_2$ in (50 wt% ChAc + 50 wt% water) after cycling with PPy/lignin

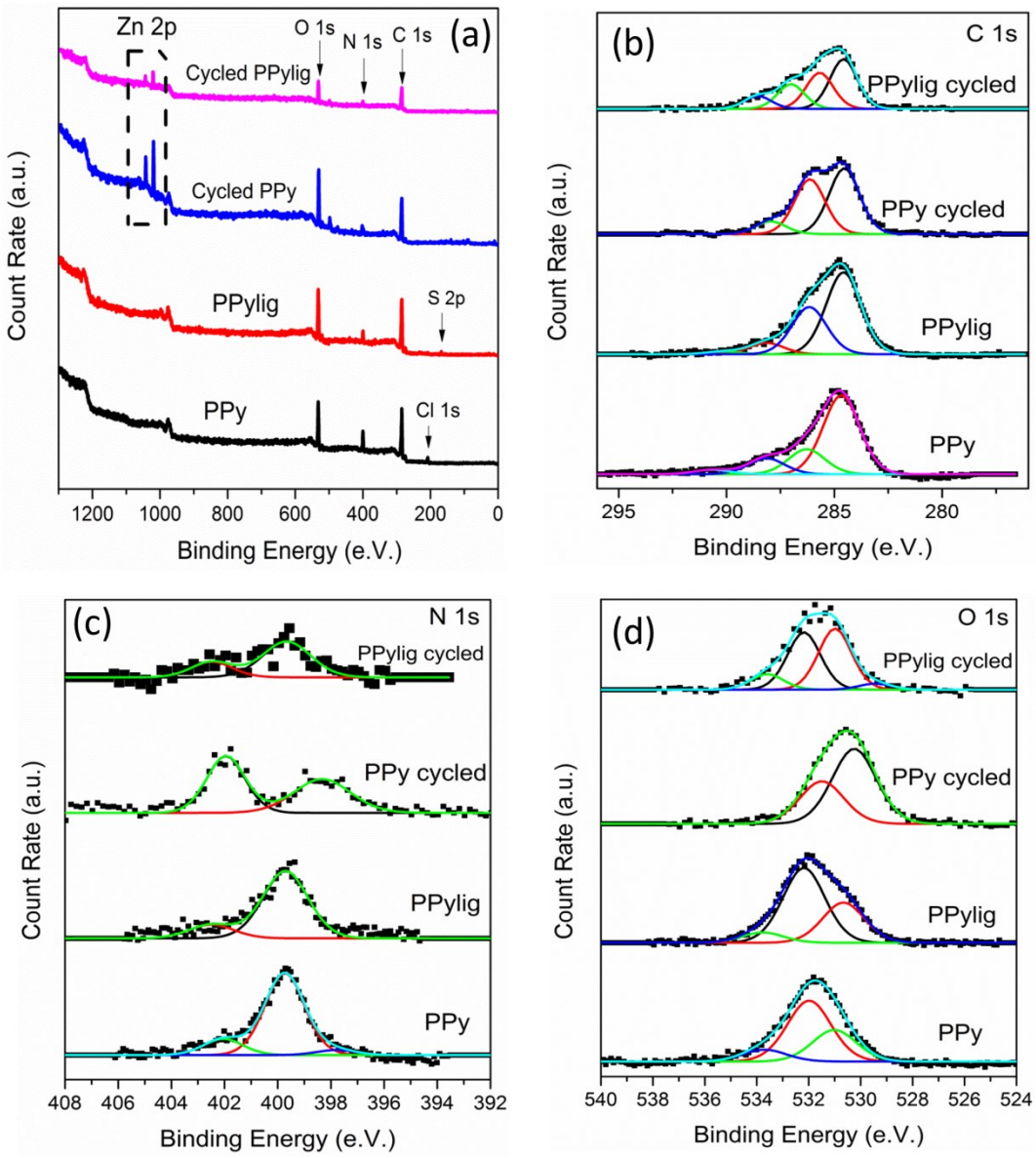

Figure S9: (a) Survey spectra (b) C 1s spectra (c) N 1s spectra (d) O 1s spectra of PPy and PPy/lignin before and after cycling in Zn-ion battery

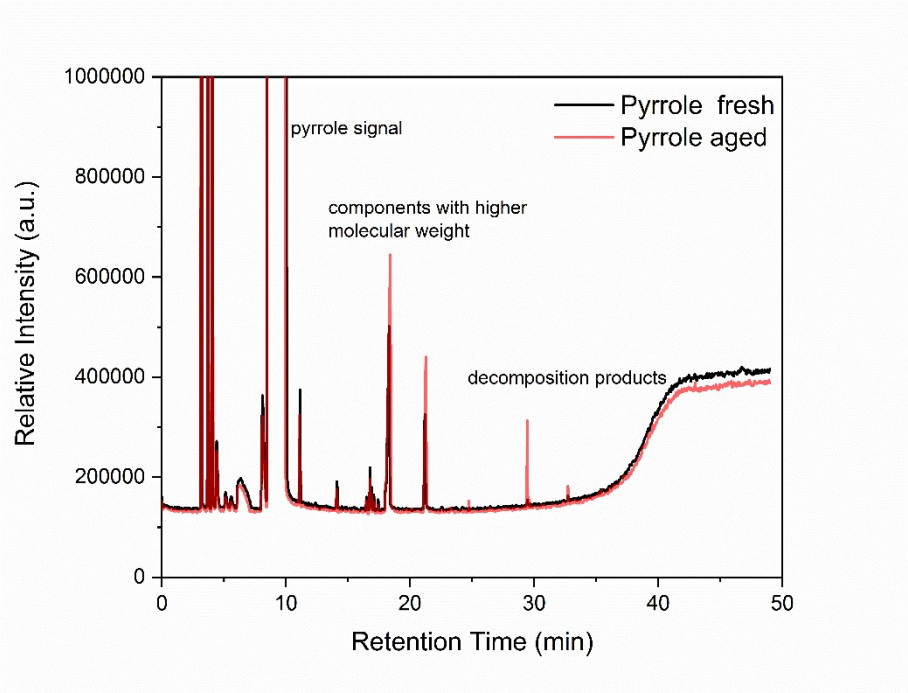

Figure S10: GCMS of freshly distilled pyrrole and pyrrole aged for 3 weeks in a refrigerator

Nomenclature

PPy: Polypyrrole

PPylig 1: Polypyrrole/lignin composite made from 0.1 M pyrrole + 0.05 M $LiClO_4$ + 0.5 mg/mL of lignosulfonate in the electrolyte

PPylig 2: Polypyrrole/lignin composite made from 0.1 M pyrrole + 0.05 M $LiClO_4$ + 2.5 mg/mL of lignosulfonate in the electrolyte

PPylig 2*: Polypyrrole/lignin composite made from 0.1 M pyrrole + 0.05 M $LiClO_4$ + 3.75 mg/mL of lignosulfonate in the electrolyte

PPylig 3: Polypyrrole/lignin composite made from 0.1 M pyrrole + 0.05 M $LiClO_4$ + 5 mg/mL of lignosulfonate in the electrolyte