Supporting information

Spectroelectrochemical Investigation of Redox States in a Polypyrrole/Lignin Composite Electrode Material

F. N. Ajjan †,[a], M. J. Jafari †,[b], T. Rębiś[c], T. Ederth[b] and O. Inganäs*.

[a] F.N. Ajjan, Prof. O. Inganäs
Biomolecular and organic electronics
IFM, Linköping University
S-581 83, Linköping, Sweden
E-mail: fataj@ifm.liu.se.com; oling@ifm.liu.se
[b] M.J. Jafari, T. Ederth
Division of Molecular Physics
IFM, Linköping University
S-581 83, Linköping, Sweden
[c] T. Rębiś
Institute of Chemistry and Technical Electrochemistry
Poznan University of Technology
Piotrowo 3, 60–965, Poznan , Poland.

As it is observed in Figure S1A. the continuous redox reaction, in the presence of only lignin, occurs at very high potential (line red). Probably, at this current conditions, lignin starts to be oxidized at ca. 1.2 V (Figure S1B.). However, the kinetics of this process may be slow and potential increase fast reaching the value of electrolyte decomposition/gold oxidation.

In the presence of Py and Lig/Py the potential is much lower (ca. 0.6 V). This indicates that in such current conditions the only expected process is Py oxidation and lignin doping.

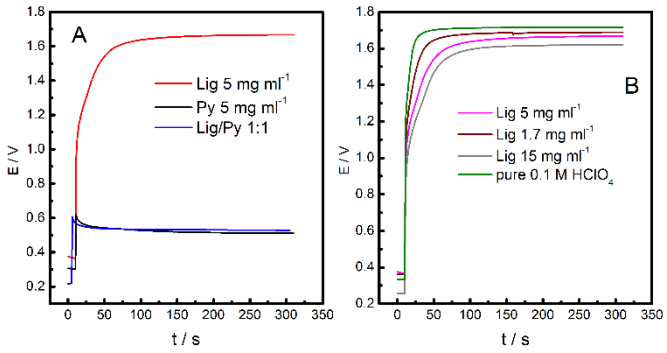

Figure S1. (A) Galvanostatic curves recorded at current density of 0.25 mA cm^{-2} in the presence of 5 g L^{-1} of Lig (red line), 5 g L^{-1} of Py (black line) and mixture of 1:1 Lig/Py (5 g L^{-1} of Lig and 5 g L^{-1} of Py) (blue line). (B) as (A) different concentration of Lig and pure 0.1 M $HClO_4$.

From the analysis of the potentiodynamic curves (Figure S2.) it can be assumed that oxidation of Py occurs at lower potential than lignin. This behavior means that Py is oxidized before lignin reaches its oxidation potential.

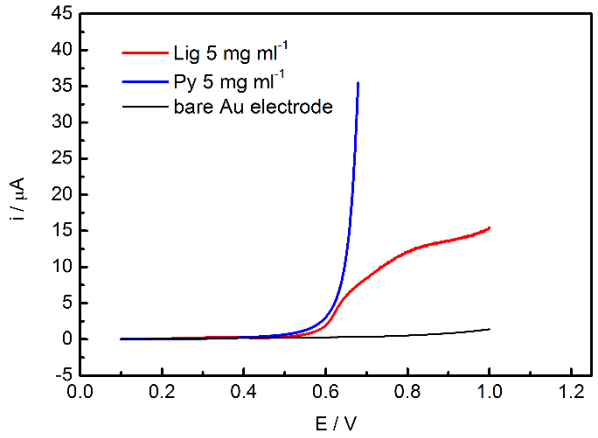

Figure S2. Potentiodynamic curves recorded at rotating disc electrode (500 r.p.m.) at scan rate of 5 mV s^{-1} for 5 g L^{-1} (red line) of lignin and 5 g L^{-1} (blue line).

Figure S3. shows the main evidence that only incorporation of lignin takes place during electropolymerization. The activation (oxidation) of lignin in the composite is completed after 20 subsequent CV scans in the range of potential exceeding 0.6 V vs Ag/AgCl.

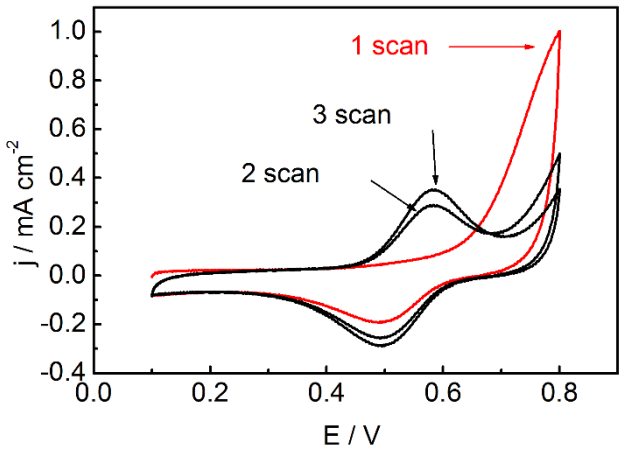

Figure S3. Cyclic voltammograms for PPy/Lig composite showing oxidation of Lig.