Supplemental Information to:

Simultaneous determination of hydroquinone and catechol using electrode modified by composite of graphene/lanthanum hydroxide nanowires

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Optimization of experimental conditions

Effect of solution pH

The influence of buffer pH on current responses of 5.0×10^{-5} M HQ at the GR-$La(OH)_3$/GCE was investigated in a range of pH from 3.0 to 8.0 by CV (Figure S1A). With the increase of pH value, the peak potential shifted negatively, indicating that protons were involved in the electrode reaction. The effect of pH on current responses of CC presented the same CV behaviours as HQ (Figure S1B). A good linear relationship between E_{pa} and pH was constructed with linear regression equation as $E_{pa}(V) = -0.058pH + 0.403$ ($r=0.998$) for HQ, and $E_{pa}(V) = -0.058pH + 0.524$ ($r=0.996$) for CC (Figure S1C). The result was in agreement with the potential shift predicted by the Nernst equation, suggesting that 2-electron and 2-proton were involved in the oxidation reaction.[1] Both HQ and CC exhibited largest current responses at pH 4.0 (Figure S1D), therefore it was used as the optimum pH condition for the following experiments.

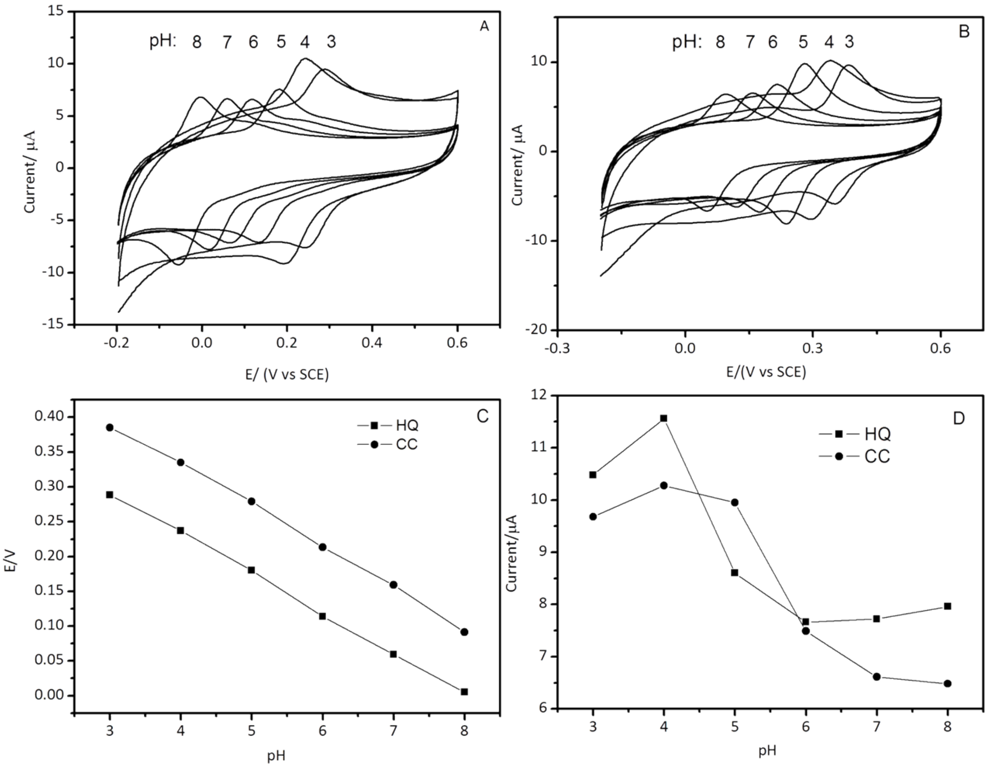

Figure S1. Cyclic voltammograms of GR-La(OH)$_3$/GCE in 0.1 M Na_2HPO_4-$C_4H_2O_7$ buffer solution containing 5.0×10^{-5} M of HQ (A) and CC (B) at different pH (pH value from 3.0 to 8.0), dependence of peak potentials of HQ and CC on the pH of the buffer (C), and the effect of pH on the peak current of HQ and CC at GR-La(OH)$_3$/GCE (D).

Effect of scan rate

In order to investigate the electrode process of HQ and CC at the GR-La(OH)$_3$/GCE, the effect of scan rate on redox peak current of the two chemicals was studied by CV. As shown in Figure S2, the oxidation peak potentials of HQ and CC were observed to shift positively with the increased scanning rate, which suggests that the electron transfer is quasi-reversible.[2] The oxidation peak currents of HQ and CC at the GR-La(OH)$_3$/GCE are directly proportional to the scan rates, indicating that the electrode processes for HQ and CC are both surface controlled redox process. The linear equations for HQ and CC are obtained as represented in Equation (1) and (2), respectively.

$I_{pa} = 0.75 + 0.177\nu$ (r=0.998) (1)

$I_{pa} = 0.90 + 0.187\nu$ (r=0.996) (2)

where I_{pa} is the anodic peak current (μA), ν is the potential scanning rate ($mV.s^{-1}$) and R is the correlation coefficient.

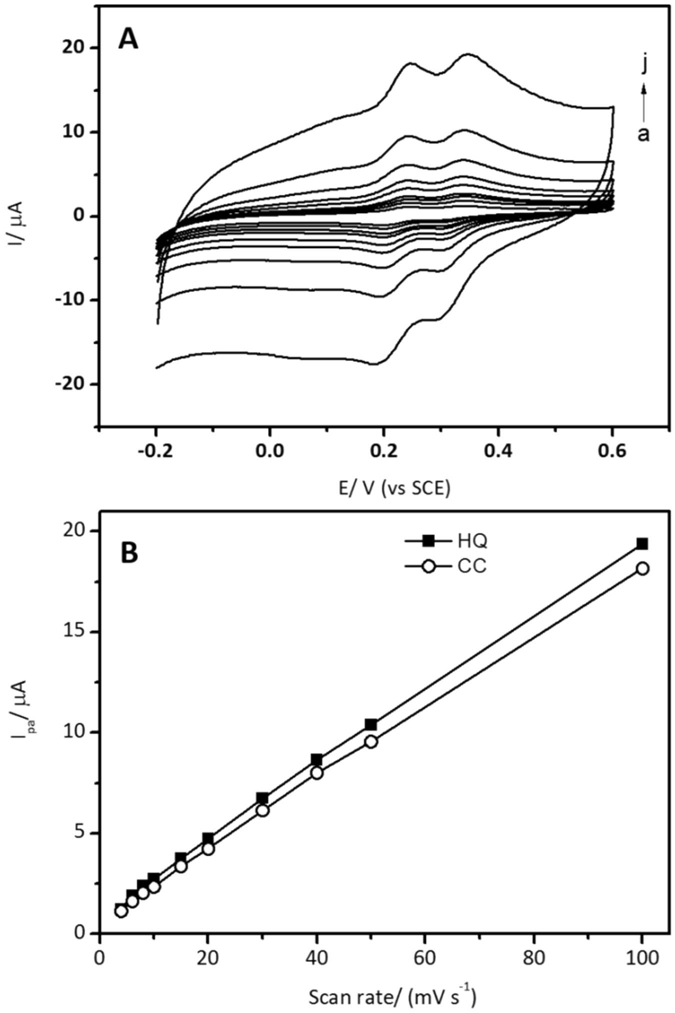

Figure S2. (A) CVs acquired at GR-$La(OH)_3$/GCE with $1x10^{-5}$ M HQ and $1x10^{-5}$ M CC in 0.1 M buffer solution (pH 4.0) at different scan rates (a-j) of 4, 6, 8, 10, 15, 20, 30, 40, 50 and 100 mVs^{-1}. (B) Plot of peak current vs. scan rates for HQ and CC.

Effect of the concentration and mass ratio of GR and $La(OH)_3$

The amperometric responses of HQ and CC at modified electrode were related to the mass ratio (Figure S3A) and the concentration (Figure S3B) of GR and $La(OH)_3$ composite. When the mass ratio of GR and $La(OH)_3$ was 1.5:1 (Figure S3A), the current reached the maximum. It can be seen from Figure S3B that the optimal concentration of GR-$La(OH)_3$ for modification of the electrode was 1.0 mg.mL^{-1}.

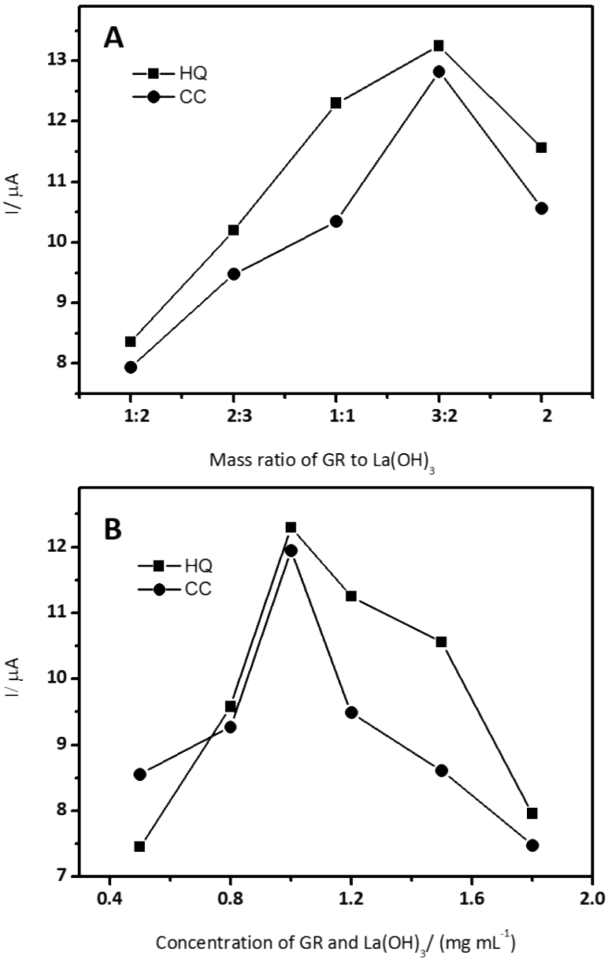

Figure S3. (A) Effect of the mass ratio and (B) effect of the concentration of GR and $La(OH)_3$ on the current response of HQ and CC at GR-$La(OH)_3$ modified GCE.

Effect of interaction time

The interaction between HQ and GR-La$(OH)_3$/GCE depends on the interaction time. We examined the reaction of 50 μM HQ by monitoring the cyclic voltammograms at intervals at room temperature. The anodic and cathodic peak currents of HQ exhibited increase with 5min and reached a constant value over the next 5 min, revealing that the reaction between 50 μM HQ and GR-La$(OH)_3$/GCE is almost complete within 5 min under this condition. Therefore, 5 min was chosen as the reaction time to detect HQ. In CC also showed the same results.

References.

1. H. Qi and C. Zhang, *Electroanalysis*, 2005, **17**, 832-838.
2. J. Dong, Y. Hu, J. Xu, X. Qu and C. Zhao, *Electroanalysis*, 2009, **21**, 1792-1798.