Supplementary materials for

Electro-mineralization of aqueous phenazopyridine using platinum nanoparticles deposited onto multiwalled carbon nanotubes
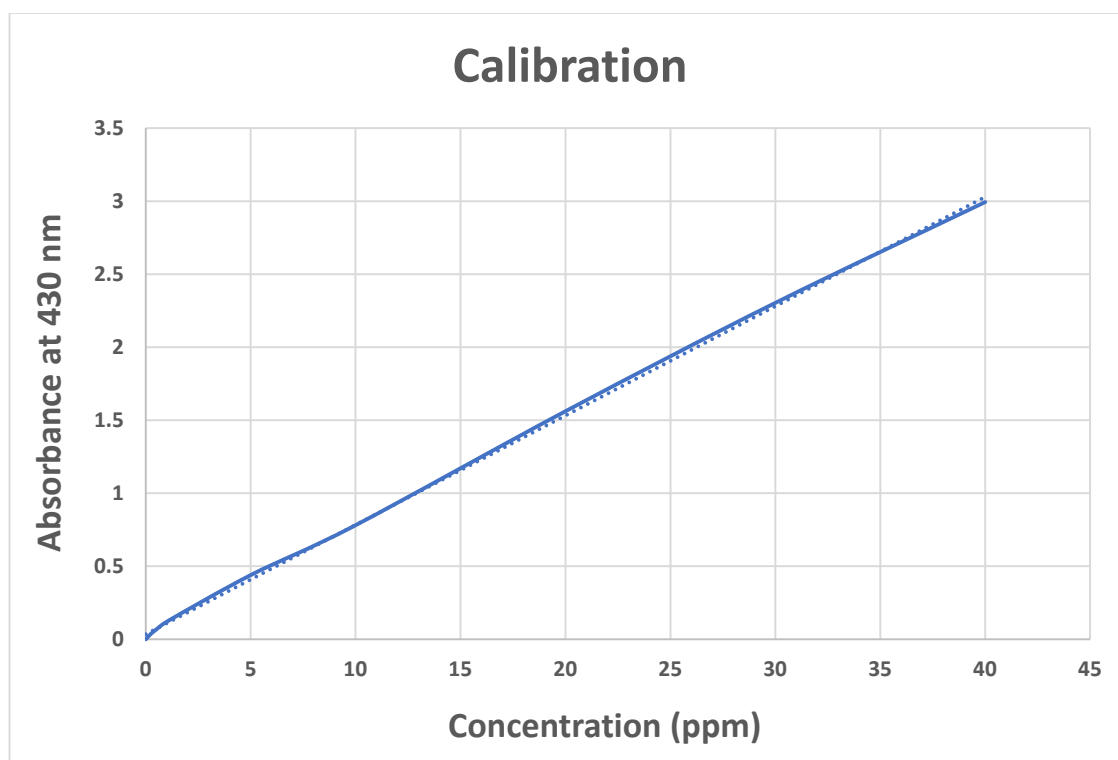

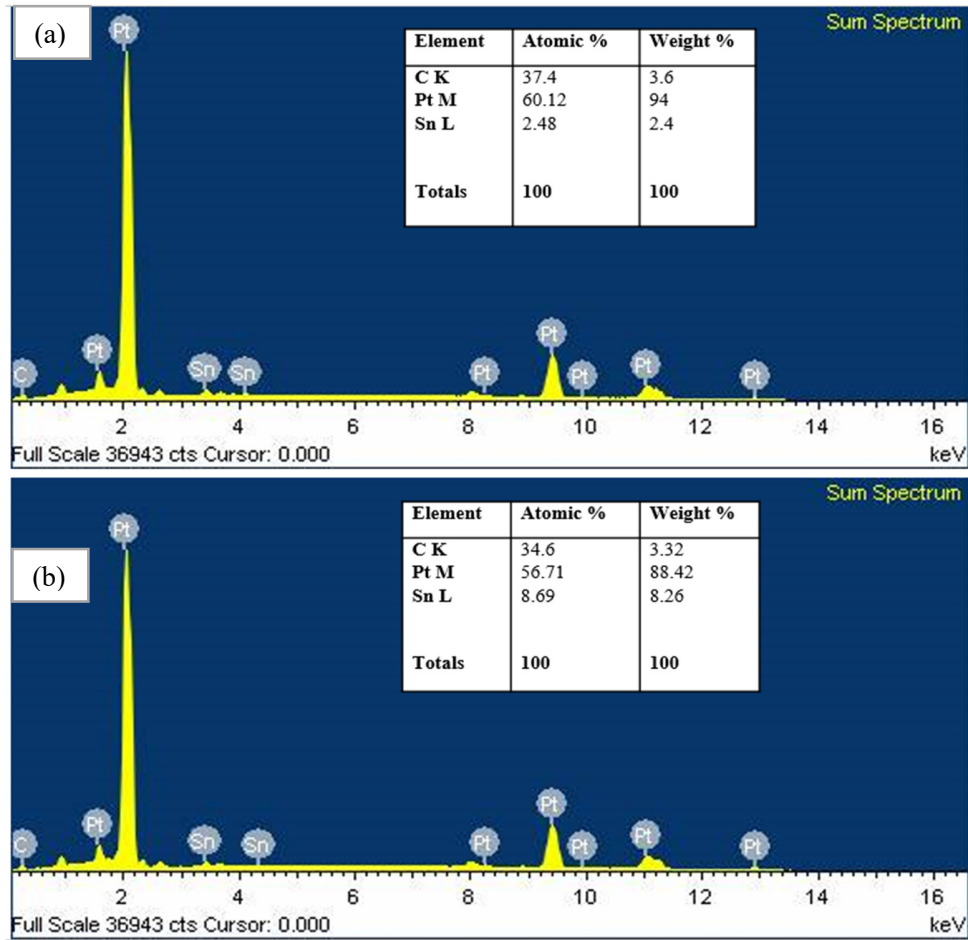Figure S1: Calibration curves phenazopyridine determination.

Figure S2: EDS spectral results measured at the surfaces of fresh (a) and used (b) PtNP@MWCNT-FTO-E electrodes. Error is 15%.

The integrated rate law calculations:

In the integrated rate law method, has been checked for possible zero order, first order and second order behaviours, using the relations shown in Equations (4.1)-(4.3)

Zero order reaction: $[C]t = -kt + [C]o$ (4.1)

First order reaction: $\ln[C]t = -kt + \ln[C]o$ (4.2)
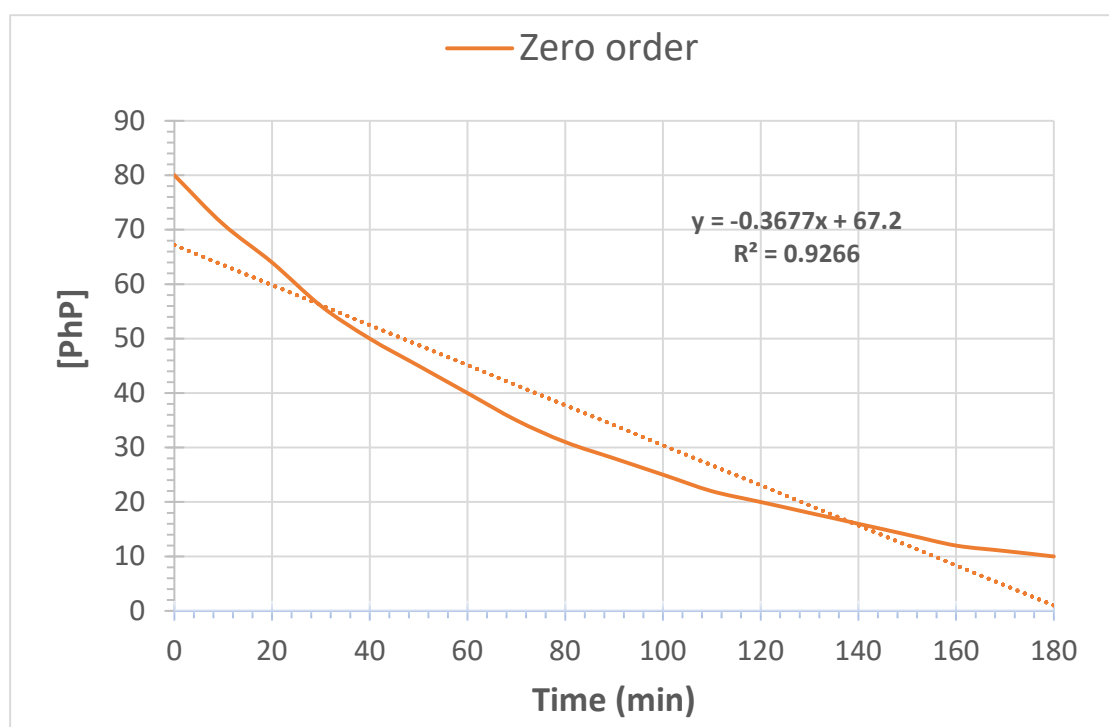
Second order reaction: $1/[C]t = kt + 1/[C]o$ (4.3),

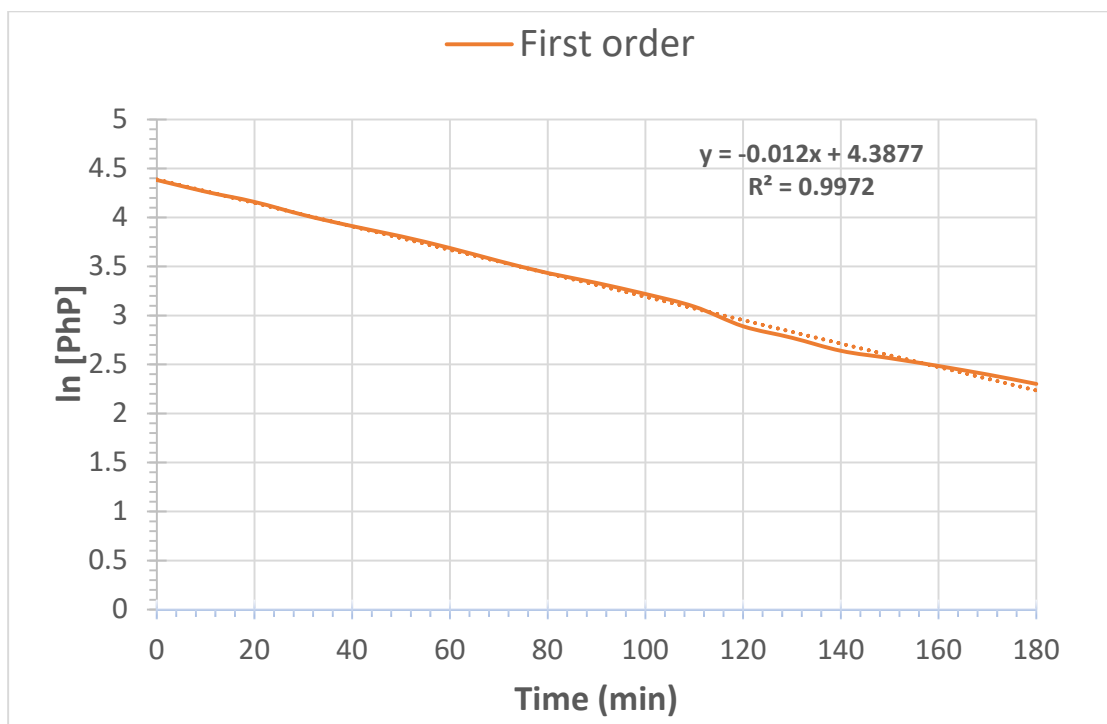where $[C]o$ is the initial phenazopyridine molar concentration, $[C]t$ is

phenazopyridine molar concentration at time t (min) and k is the rate constant.

Supplementary Figures S2(a, b and c) summarize plots based on all equations.
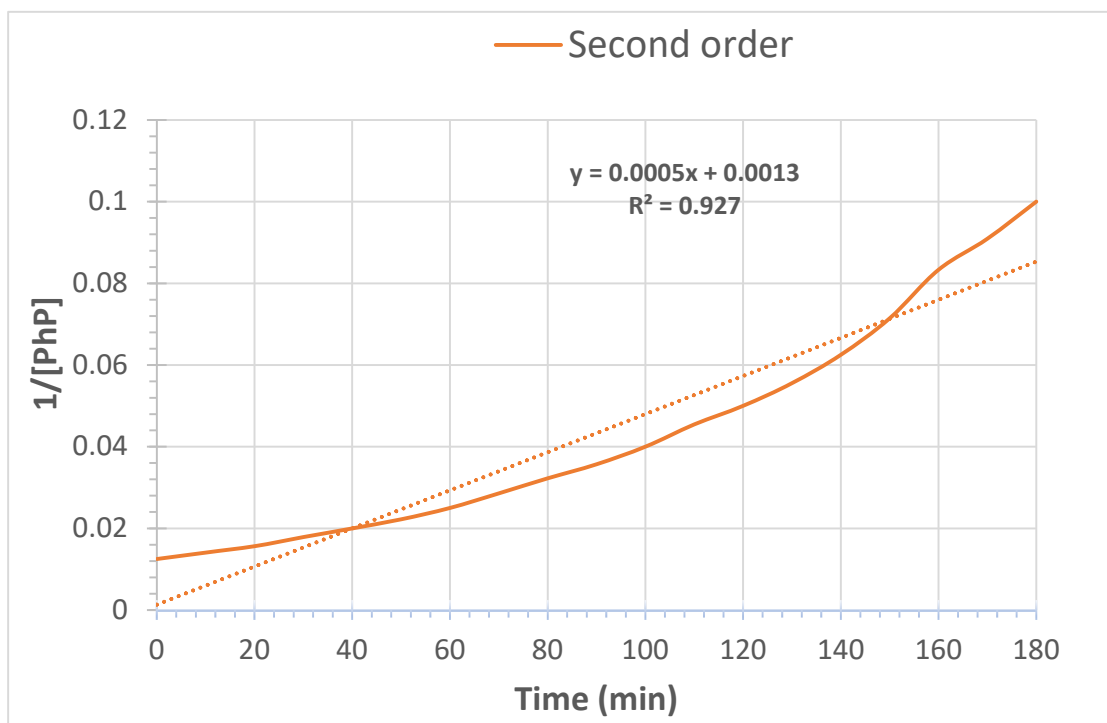
(a)

(b)

(c)

Figure S3: Plots describing the kinetics of phenazopyridine electrooxidation on PtNP@MWCNT/FTO-E electrode. (a) zero-order, (b) first-order and (c) e second-order.

Experiment is conducted using phenazopyridine solution (70 mL, 80 ppm), at +1.60 V (vs. SCE) at room temperature for 3 h. Interelectrode spacing is 1.2 cm.

The initial rate law calculations:

The reaction order with respect to phenazopyridine has been calculated using the initial rate method [45][46, 47]. Three electrooxidation experiments with various phenazopyridine initial concentrations (40 ppm, 80 ppm and 120 ppm) has been conducted. The general formula of the reaction order is given in equation (4.4).

ln(initial Rate) = ln k + n ln$[C]_0$ **(4.4)**

 Where n is the order of the reaction. From the plot of ln Rate initial vs. ln $[C]_o$ (Figure 4.20), the order of the reaction with respect to phenazopyridine is (0.69) while the rate constant k is 8.35×10^{-2} min^{-1}. Literature also showed that, the electrooxidation and photodegradation of other toxic dyes obeys the pseudo first order [48-52]. Values of (n < 1) reveals that phenazopyridine is adsorbed at the electrode surface and oxidized, while co-adsorption of other species may also occur [50, 53, 54].
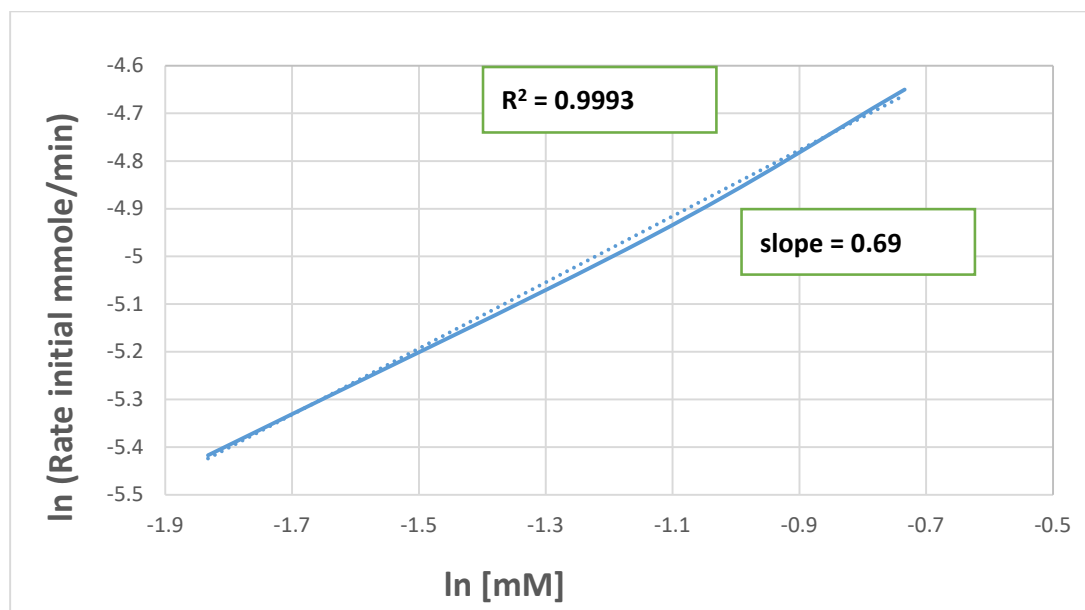
Figure S4: Plot of ln (Rate_initial) vs. ln(mM) for phenazopyridine electrooxidation on PtNP@MWCNT/FTO-E electrode. Experiments are conducted using 70 mL solutions of varying contaminant concentrations, at +1.60 V (vs. SCE), room temperature and intrinsic pH for 2 h. Interelectrode spacing is 1.2 cm.