

The Summer Undergraduate Research Fellowship (SURF) Symposium
6 August 2015
Purdue University, West Lafayette, Indiana, USA

Towards *in situ* measurements of platinum dissolution using metallothionein-based biosensor

Stephanie Cerner¹, Hyowon Lee, Ph.D.^{1,2}
¹Weldon School of Biomedical Engineering
²Birck Nanotechnology Center, Purdue University

ABSTRACT

Platinum-based (Pt) electrodes are used ubiquitously in neurostimulation for their high charge capacity and safety. However, Pt electrodes are known to dissolve during stimulation in the presence of chloride (Cl) to form Pt-Cl byproducts. These byproducts may have deleterious effects on surrounding tissue by preventing cell division and causing apoptosis. Several studies have quantified the amount of neurostimulation-induced Pt dissolution *in vivo* using various analytical methods; however, these approaches require disruptive sampling of tissue. Periodic measurements from a stimulating electrode using an *in situ* sensor may provide additional insights into Pt dissolution process. To create the sensor for detecting Pt dissolution, metallothionein (MT), a protein with high affinity for heavy metals, and MT-antibody were incorporated into a mixture of graphite powder and mineral oil. The mixture was packed into pipette tips to create carbon paste electrodes (CPE). These electrodes were connected to a potentiostat with stainless steel wires. Four solutions were created with varying cisplatin concentrations (0, 10, 50, 100 $\mu\text{g}/\text{mL}$). Square wave voltammetry (SWV) using a potentiostat (SP-200, Bio-Logic, Knoxville, TN) and EC-Lab software (v.10.40, Bio-Logic, Knoxville, TN) was performed for each electrode at each concentration. SWV was swept from -1.2 V to 1.2 V vs Ag/AgCl sat. with a 25 mV pulse height, 5.0 ms pulse width and 0.5 mV step height. Overall, the peak currents between -0.6 V to -0.4 V seem to linearly correlate with concentration of cisplatin. This data suggests that the electrodes modified with MT may be used for detecting cisplatin due to neuromodulation dissolution, but further evaluation is needed to understand the reproducibility of the electrodes and to understand the complexes present in current solutions.

KEYWORDS

Cisplatin, biosensor, carbon paste electrodes, metallothionein, platinum dissolution, neurostimulation