E2-22 An electroanalytical sensor for the detection of Gramoxone (Paraquat)

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Gramoxone is a non-selective contact herbicide. It is a quaternary ammonium compound and belongs to the group of bypyridinium herbicides. Active ingredient of Gramoxone is paraquat (1,1,-dimethyl-4,4'-bypyridinium dichloride). Gramoxone is highly poisonous and the LD_{50} value is (orally in rats) 125 mg/kg.

Cyclic voltammetric experiments of 5 mM Gramoxone in an aqueous solution of 0.1 M NaCl showed a complete reversible system at the bare glassy carbon mini electrode (-0.65 V and -0.6 V vs. Ag/AgCl electrode for reduction and oxidation respectively). Cyclic voltammetric experiments of the bare glassy carbon electrode conducted at a constant scan rate (50 mV/sec) of Gramoxone with different concentration yielded a straight line when a peak current (ip) was plotted against concentration (C). Furthermore scan rate dependence study of constant concentration of Gramoxone (5 mM) yielded a straight line between the log of the peak potential (log ip) and log of the scan rate (log υ) with a slope of 0.57.

Amperometric experiments conducted at the bare glassy carbon electrode with the sequential addition of 0.2 ml of 0.160 M Gramoxone interfered with the noise level. This problem was successfully overcome by applying a thin coating of stearic acid (0.5% in CH_2CL_2) on the bare glassy carbon electrode surface and noise-free amperometric responses were obtained. Subsequently, calibration curves (linear dynamic range of 1.02×10^{-3} M to 1.07×10^{-2} M Paraquat) were constructed in phosphate buffer medium. Analytical parameters of the sensor i.e. sensitivity (210 μA/mol), response time (5.4 sec.) and lower detection limit (6.37×10^{-4} M at S/N=3) were also evaluated.