

An electroanalytical sensor for the detection of oxyfluorfen (Goal)

Ayanthi Navaratne* and Sanjeewa B Gamagedara
Department of Chemistry, University of Peradeniya, Peradeniya

Oxyfluorfen [2-chloro-1-(3-ethoxy-4-nitrophenoxy)-4-(trifluoromethyl) benzene] is a selective pre and post emergence diphenyl-ether herbicide used to control certain annual broadleaf and grassy weeds in vegetables, fruit, cotton, ornamentals and rice. Here we report the use of a non electroactive stearic acid modified glassy carbon electrode as an amperometric sensor for the detection of Oxyfluorfen. Preliminary electrochemical characterisation was carried out by cyclic voltammetry. Analytical characteristics of the sensor were evaluated by steady state amperometry.

Cyclic voltammetric experiments of 1.0×10^{-4} mol dm⁻³ Oxyfluorfen in an ethanol water (4:6) mixed solution of 0.1 mol dm⁻³ NaCl showed two reduction peaks at potentials of -0.39 V and -0.80 V, vs saturated calomel reference electrode. Oxidation peak, was obtained at -0.28 V. Scan rate dependence studies of the peak at -0.15 V vs saturated calomel electrode showed that it is a diffusion controlled reaction. The potential of the working electrode was optimised and the optimum operational potential range for the amperometric experiments was found to be between -0.800 V and -0.900 V with respect to the saturated calomel electrode. The amperometric measurements at the above potentials suffered interference from the noise with the sequential addition of Oxyfluorfen at bare glassy carbon electrode. This difficulty can be overcome by modifying the electrode surface with a suitable modifier. In this study, non electro active stearic acid (0.5% w/v) was used as the electrode modifier. When stearic acid was deposited on the electrode surface noise levels of the amperometric results were substantially reduced. This may be due to prevention of adsorption of the analyte molecules on the electrode surface.

Calibration of the sensor with respect to Oxyfluorfen was done over the concentration range 3.85×10^{-7} mol dm⁻³ to 3.42×10^{-6} mol dm⁻³ using steady state amperometry and calibration curves were constructed. Slope of calibration curve was taken as the sensitivity of the sensor. At the potential of -0.800 V, the slope is 9.828×10^5 μ A mol⁻¹ dm³ while at -0.900 V it is 1.1982×10^6 μ A mol⁻¹ dm³. The minimum detection limit of the sensor was estimated to be 2.31×10^{-7} mol dm⁻³ at signal to noise ratio of 3. The steady state amperometric response time (t_{90}) of the sensor was 6.3 s. The coefficient of variation of the sensor was estimated to be 8.7%. Since the problematic noise levels can be successfully overcome by stearic acid coated glassy carbon electrode, this study demonstrates the potential utility of the sensor as an amperometric detector for Oxyfluorfen.

* ayanthin@pdn.ac.lk