

DEVELOPMENT OF AN ELECTROANALYTICAL DETECTION SCHEME FOR FIPRONIL INSECTICIDE

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Fipronil is a widely used insecticide with serious health hazards. This study aimed at comparatively evaluating the performance of glassy carbon electrode (GCE) and stearic acid-modified GCE (SAGCE), for rapid, inexpensive detection of Fipronil in aqueous samples. Electrochemical behaviour of Fipronil was studied using a GCE. Cyclic voltammogram (CV) for GCE was obtained under optimised conditions (0.5 mmol L⁻¹ Fipronil in 0.1 mol L⁻¹ HClO₄/acetone solution 50:50 v/v; scan rate 50 mV s⁻¹; potential range -0.1 V to +1.8 V), which peaked at 1.5 V. When the Fipronil concentration was gradually increased, the peak current (PC) of the CVs increased with a linear variation between 0.04 and 3.00 mM (slope = 6.695; $R^2 = 0.979$), where the slope corresponds to sensitivity. Scan rate dependence was assessed using the Randles-Sevcik relationship, and the slope of 0.5 of the log (peak current) vs. log (scan rate) plot indicated that the oxidation reaction was diffusion-controlled, permitting chronoamperometric analysis. Amperogram was obtained with 0.26 mM increments of Fipronil concentration at 60 s intervals for 10 times, resulting in 4 μ A increments until six additions. To reduce the noise level and increase detection limits, SAGCE was designed. The above analyses were repeated, resulting in a linear variation in PC increment between 1.28 and 3.28 mM (slope = 3.521; $R^2 = 0.988$). Diffusion control of the oxidation reaction at SAGCE was confirmed by scan rate dependence analysis, which resulted in a slope of about 0.5 in the log (peak current) vs. log (scan rate) plot permitting chronoamperometry. An amperogram obtained under similar conditions showed 3 μ A increments. The SAGCE reduced noise level; however, exhibited lower sensitivity compared to GCE. By optimising the thickness of the SA coating on the working electrode to leverage PC, this can potentially be developed into a method for low-cost pesticide monitoring in resource-limited settings.

Keywords: Amperogram, Cyclic voltammogram, Fipronil, Glassy carbon electrode, Stearic acid