An electrochemical sensor based on graphene and hemin composites for the determination of carbaryl
Patcharee Pakhate¹, Jatuporn Duangtong¹, Preeyanuch Butmee¹, Kurt Kalcher², Anchalee Samphao¹*¹
¹Department of Chemistry, Faculty of Science, Ubon Ratchatanı University, Warin Chamrap, Ubon Ratchatani 34190, Thailand
²Institute of Chemistry-Analytical Chemistry, Karl-Franzens University, Graz 8010, Austria
*E-mail: anchalee.s@ubu.ac.th

Abstract: Carbaryl is widely used to control insects in an agricultural. It is a cholinesterase inhibitor and is toxic to humans. The focus of this research is to develop an electrochemical sensor based on graphene and hemin for high sensitivity and selectivity. The modified electrode was characterized by scanning electron microscopy (SEM), electrochemical impedance spectroscopy (EIS) and differential pulse voltammetry (DPV). The optimal conditions and analytical performances were investigated. The results were shown in ratio of graphene per hemin of 0.10:0.010, phosphate buffer solution at pH 6.5, pulse amplitude and step potential at 0.125 and 0.010 V versus Ag/AgCl with scan rate of 0.010 V/s. The electrochemical sensor was experimentally evaluated with respect to a linear response range from 0.50 to 10.0 µM carbaryl (r²=0.998) with a sensitivity of 0.70 A.µM⁻¹.cm⁻², a limit of detection and quantification at 0.25 and 0.5 µM, respectively.

Keywords: Electrochemical sensor; Graphene; Hemin; Carbaryl; Carbon paste electrode