MoS_2-gCN/RGO Ternary Composite for Electrochemical Detection of Serotonin

Neethu Sebastian, Yu-Chen Chiu, Wan-Chin Yu*
*Wan-Chin Yu: wanchin@ntut.edu.tw
Institute of Organic and Polymeric Materials, National Taipei University of Technology, Taipei 106, Taiwan.

A sensitive and selective electrochemical sensor for the detection of serotonin (5-hydroxytryptamine) was developed by modifying the surface of screen-printed carbon electrode (SPCE) with a new nanocomposite (MoS_2-gCN/RGO) consisting of three-dimensional reduced graphene oxide (RGO) decorated by molybdenum disulfide (MoS_2) and graphitic carbon nitride (gCN) nanosheets. Serotonin is a neurotransmitter that plays an important role in the regulation of neural activities and mood-related behaviors. Abnormal concentrations of serotonin are linked to diseases like depression, sleep-disorders, and Parkinson's disease, and therefore the sensitive measurement of serotonin is of interest. The hydrothermally prepared ternary nanocomposite was subjected to various materials characterizations including scanning electron microscopy, X-ray diffraction, and Raman spectroscopy. Cyclic voltammetry and differential pulse voltammetry (DPV) were utilized to study the electrochemical aspects of the prepared nanocomposite. The MoS_2-gCN/RGO nanocomposite exhibited fast electron transfer kinetics and high electrocatalytic activity for serotonin detection. The nanocomposite modified SPCE (MoS_2-gCN/RGO/SPCE) exhibited higher peak current and lower peak potential compared to other electrodes, including bare SPCE, MoS_2/SPCE, gCN/SPCE, RGO/SPCE, and MoS_2-gCN/SPCE. Based on the DPV technique, the MoS_2-gCN/RGO modified electrode could detect serotonin with a wide linear range of 1.8 – 3693.8 μM and a very low detection limit of 0.0152 μM. Moreover, the MoS_2-gCN/RGO-based sensor also showed good selectivity and anti-interference ability, suggesting its applicability for sensitive detection of serotonin.