2D-MoS_2-chitosan nanocomposite as a novel electrochemical platform for highly selective and sensitive urinary dopamine detection.

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Two-dimensional (2D) nanomaterials are layered nanostructures with outstanding characteristics, that are very promising in electrochemical sensing [1]. They can be produced in large scale by liquid phase exfoliation and their morphological properties tuned by liquid cascade centrifugation [2-3]. 2D materials can be used to modify the screen printed electrodes (SPE), which are the core element in electrochemical sensors, enhancing theirs sensitivity, selectivity, stability. In this paper, molybdenum disulfide (MoS_2) nanosheets were produced via liquid phase exfoliation and functionalized with chitosan (Cs) nanoparticles. The resulting nanohybrid materials (Cs-MoS_2) were used to modify SPE for the detection of Dopamine (DA), an essential neurotransmitter serving as a critical indicator for neurological disorders, such as Parkinson's disease. The nanohybrid material was characterized using UV-visible spectroscopy and atomic force microscopy. Cyclic voltammetry (CV), electrochemical impedance spectroscopy (EIS), and differential pulse voltammetry (DPV) were employed to evaluate the electrochemical and analytical behaviour of Cs-MoS_2 towards DA oxidation. The sensor exhibited two distinct linear concentration ranges: 0 to 40 µM and 40 to 440 µM. Both ranges demonstrated high sensitivity, that is 4.482 $\mu A \mu M^{-1} cm^{-2}$, and 1.672 $\mu A \mu M^{-1} cm^{-2}$, respectively, with a limit of detection (LOD) of 0.8 µM (Fig.1). Furthermore, the sensor demonstrated good stability, reproducibility, and excellent selectivity without interference from common coexisting species found in body fluids. This study represents a convenient and cost-effective synthesis approach for developing a novel electrochemical sensor dedicated to dopamine detection.

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References

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Figures

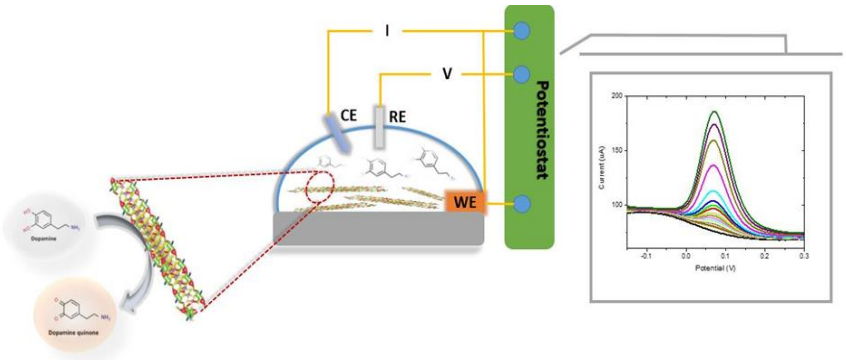

Figure 1: Schematic Dopamine detection using 2D-MoS_2-Chitosan based sensor.