Enhanced glucose detection via one-shot electrochemical enzymatic platform

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Glucose detection is crucial across industries, with excessive sugar intake linked to health issues like cardiovascular diseases and diabetes. Diabetes affects millions globally, demanding accurate monitoring for effective management. The demand for rapid, non-invasive glucose testing methods is growing, driving advancements in electrochemical sensors [1,2]. While numerous sensors have been introduced to the market, there remain considerable opportunities for further enhancements. The emergence of catalytic materials, such as two-dimensional layered materials (MXenes), Multi-walled Carbon Nanotubes (MWCNT), and bismuth ruthenate pyrochlore oxide ($Bi_2Ru_2O_7$), has opened doors to innovative sensor designs. These materials offer an array of favourable characteristics, including exceptional metallic conductivity, hydrophilicity, and biocompatibility, making them ideal candidates for next-generation electrochemical sensors. By exploiting these materials in combination with cost-effective screen-printed electrodes modified with various metals, metal oxides, polymers, carbon-based nanomaterials, and enzymes, researchers have established a robust platform for achieving highly sensitive, selective and efficient glucose detection [3]. This strategic usage of advanced materials holds tremendous promise for addressing the remaining challenges in glucose sensing, paving the way for more accurate and accessible monitoring solutions.

In this work, we will present the preparation and characterization of a novel one-shot electrochemical sensor modified with multiple layers for instant glucose detection. The sensor's design incorporates layers tailored to enhance sensitivity and selectivity, enabling immediate and accurate glucose detection. We will also discuss the sensor's advantages, shortcomings, and potential application scenarios for glucose monitoring.

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