INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

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Thesis Title: Design and Development of Novel Electrochemical Biosensors Based on Metal and Metal Oxides Nano-composites

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SHORT ABSTRACT

The performance of electrochemical biosensors is continually being enhanced to attain better sensitivity and selectivity with the integration of novel metal and metal oxides nanocomposites. In this doctoral research, the sensing surfaces have been sequentially modified and tuned with novel metal and metal oxides nanocomposites to develop various signal amplification strategies for electrochemical biosensors of clinically relevant diseases. Moreover, the research carried out in the doctoral study is motivated to resolve the significant contemporary problems, such as food analyte detection and silent diseases *viz*. fatty liver diseases, hyperglycemia, and carcinoma.

In this work, four different electrochemical biosensors have been designed not only for sensitive analyses but also to detect the analytes of industrial/clinical importance. An electrochemical sensing surface has been designed for sinapic acid (food analyte) using nanotuned gold nanoparticles and solvothermally reduced graphene oxide nanocomposite in the first work. In the second work, a nanocomposite encompassing gold and iron bimetallic system and reduced graphene oxide has been applied to detect fatty liver diseases. In the next work, gold has been replaced with gadolinium to make the sensor system cheap, designed for glucose detection. It has been extensively studied for real sample analysis and validated for clinical relevancy. A non-invasive immuno-sensor for oral cancer detection has been designed using electrochemically active nanoparticles in the fourth work. In which no external mediator is used for redox coupling, unlike the recently reported works on cancer biomarkers and other protein biosensors. The sensor was developed based on the sensing surface's self-signal generation capacity, which was designed using a redox-active nanomaterial. This type of sensing surface can be used to develop simple handheld protein biosensors, eliminating the need for an impendence circuit and redox mediator, making the handheld devices simpler to fabricate and operate. All the sensor surfaces are engineered to achieve maximum current responses and catalytic activity to detect the analytes in biological samples, which can be further utilized to develop a miniaturized handheld point of care devices for onsite diagnosis.