Abstract

Diabetes has become a serious global health threat and glucose test is very important for diabetic patients on a daily basis. Traditional blood glucose test uses a lancet device to prick the patient's finger to get a drop of blood sample for testing. This invasive test causes pain to patient and increases the risk of cross-infection of blood-transmitted diseases. Non-invasive glucose monitoring has become very attractive alternative to blood glucose test. Research has found that other biological samples (e.g. saliva, tears, sweat, urine) also contains trace amount of glucose molecules and they may be used for diabetes diagnosis. However, glucose level in such biological samples is generally very low and many other ingredients in saliva may interfere with the measurement. To overcome this issue, graphene offers the opportunity to alternative saliva for non-invasive painless glucose sensing due to their extremely large surface area and improved catalytic activities.

Preparation and Evaluation of the Cu-Graphene Glassy Carbon Electrode

The preparation and evaluation of the Cu-Graphene Glassy Carbon (GC) Electrode includes three steps: firstly, prepare Glass Carbon (GC) electrode; secondly, prepare of Graphene electrode; thirdly, prepare of Cu-Graphene electrode. In addition, Cyclic Voltammetry (CV) is selected electrochemical technique which measures the current that develops in an electrochemical cell under conditions where voltage is in excess of that predicted by the Nerst equation. CV is performed by cycling the potential of a working electrode, and measuring the resulting current. A cyclic voltammogram is obtained by measuring the current at the working electrode during the potential scans. It shows a cyclic voltammogram resulting from a single electron reduction and oxidation, and measuring the resulting current.

Design and Working Principle

The proposed lab-on-a-chip with graphene-based nanosensor for non-invasive glucose sensing is shown in Figure 1. It consists of three functional stages: sample preparation, electrochemical sensing chamber, and waste disposal. The aimed device does not cause any wound to patient's body and avoids cross-infection of blood-transmitted diseases during the testing. It may allow continuous monitoring of glucose level, which is very important for diabetes patients in their disease management. With the measurement of glucose level, diabetic patients can adjust their medication intake or insulin injection to achieve healthy control of the disease.

Conclusions and Further Work

In the poster, the architecture design of a lab-on-a-chip with graphene-based nanosensor for non-invasive glucose sensing is proposed. So far, the Cu-Graphene electrode has been modified. The cyclic voltamgraph of the electrode by different modified methods and different Cu deposition time in various concentration of Glucose are obtained. The linear relationship between the concentration and the peak current is studied. However, graphene sheets on surface of the electrode modified by graphene powder are loose and can be easily peeled off. Thus, it results in a poor reproducibility. In addition, increasing the deposition time can increase the peak current. In each case, the peak current value increases regularly when the concentration of glucose increases. The relationship between the Cu-Graphene electrode and peak current is shown in Figure 3. The result will guide us in designing the detection system.