High-Sensitivity Molecularly Imprinted Polymer Based Glucose Sensor

IITM Technology Available for Licensing

PROBLEM STATEMENT

- Present need is to develop a glucose diagnostic tool which is pain free, non-invasive, user-friendly, reliable & accurate monitoring of glucose levels. There are various biological fluids other than blood is being explored such as sweat, tears, saliva, urine, & tissue/interstitial fluids.
- To detect glucose in the human sweat requires a **powerful sensing technique.** As sweat is a complex physiological mixture, the selectivity detection of glucose is a **difficult task,** due to **major drawbacks** includes costlier procedures, shelf life & cumbersome immobilization procedures. Hence, there is a need to address the issues.

INTELLECTUAL PROPERTY

IITM IDF Ref. 2534; IN Patent No:473848

TECHNOLOGY CATEGORY/ MARKET

Technology: MIP Based Glucose Sensor;
Industry & Application: Bio medical Engineering, Medical Device, Bio-Electronics;
Market: The global glucose sensor market is projected to grow at a **CAGR** of **8.6%** during **2024-2032.**

TRL (TECHNOLOGY READINESS LEVEL)

TRL-4, Proof of Concept ready, tested in lab.

TECHNOLOGY

- The present invention describes a **molecular imprinted polymer biosensor device** for sensitive detection of glucose from sweat present on skin.
- Said biosensor device comprising a **paper substrate**, a working **electrode**, a **counter electrode** and a **reference electrode of carbon** formed on the paper substrate, a **molecular imprinted polypyrrole polymer sensing portion** coated onto the working electrode.

IMAGE

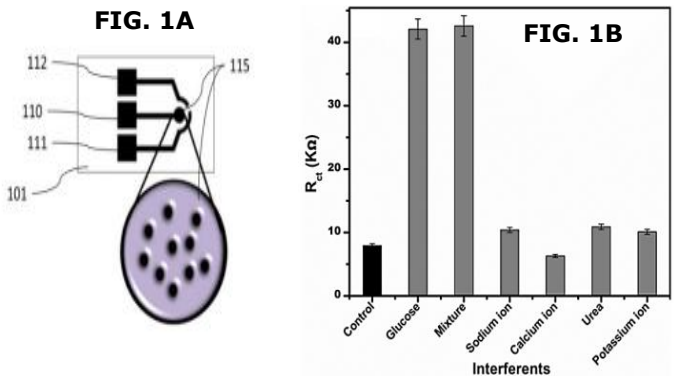

FIG.1A: Illustrate schematic diagram of claimed device; Fig. 1B: shows various interferents during sensing of glucose in a common mixture;

- Herein the **polypyrrole** is imprinted for **detection of glucose**.
- Further, the device is configured for **measurement of glucose concentration** using **electrochemical impedance spectroscopy (EIS).**
- Further, the present invention is directed to a **method for preparing polypyrrole molecular imprinted polymer** (MIP) **sensor** for glucose detection.
- In this instance, the method discloses a few steps including the **coating of the sensing portion.**
- **Coating the sensing portion** includes **dispersing 1mg of synthesized molecular imprinted polymer (MIP)** in **1mL water** and **coating the sensing portion of the working electrode**, followed by **drying at 60°C for 30 minutes.**

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KEY FEATURES / VALUE PROPOSITION

❖ *Technical Perspective:*

- The device is configured to have

a) a **linear detection** range between **3nM to 1.8mM,**

b) Sensitivity of **2.41KΩ/μm^{-1}/mm^{-2} or higher** or a **detection limit** of **4.8nM or lower**.

- The **sensor** is **stable** when stored under **indoor storage conditions for 80 days or more.**
- Further present invention discussed about the method for preparing **polypyrrole molecular imprinted polymer (MIP) sensor** for glucose detection.
- The method for **obtaining the MIP** in **pellet form** comprises repeatedly washing and centrifuging the pellet 3 or more times to remove the template molecule, followed by **drying the washed pellet in a hot air oven at 120°C for 12 hours.**

❖ *Industrial Perspective:*

- The claimed device is advantages such as **high selectivity, high sensitivity, high signal to noise ratio, & rapid response time.**
- Provides **cost-effective compact device.**
- Facilitates **Pain free, non-invasive, user friendly, reliable & accurate glucose detecting device.**

Sample Result

Electrode/Material	Transduction Technique	Linear Detection Range	LoD	Real Life Sample
Paper based carbon SPE/Polypyrrole based MIP (Present Work)	EIS	3 nM to 1.8 mM	4.8 nM	Artificial sweat

Table 1: Analytic sensing performance of claimed sensing device;

IMAGE

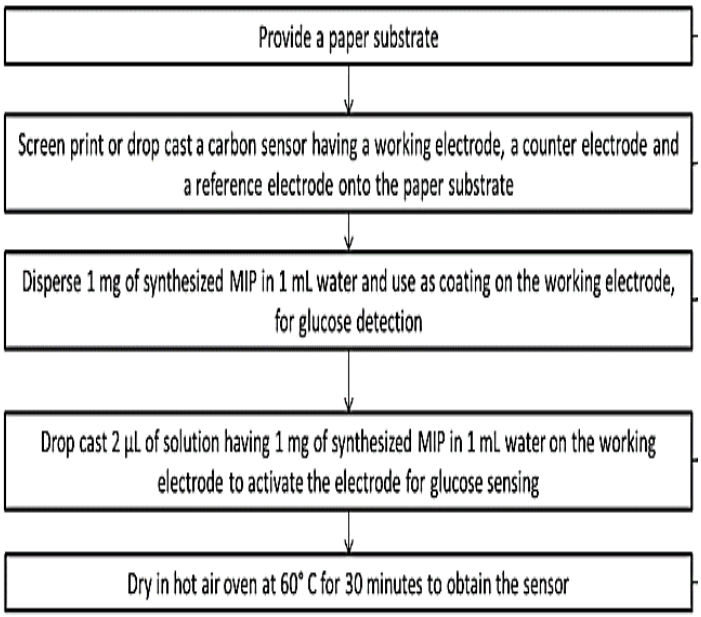


Fig. 2(Above): Depicts the method of preparing glucose sensor using polypyrrole-MIP;

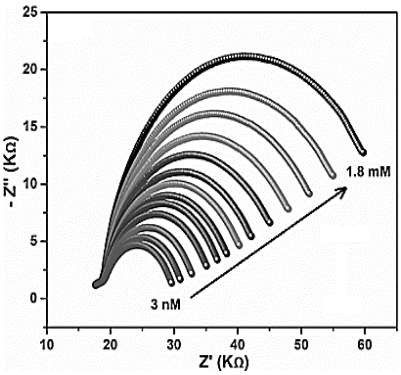
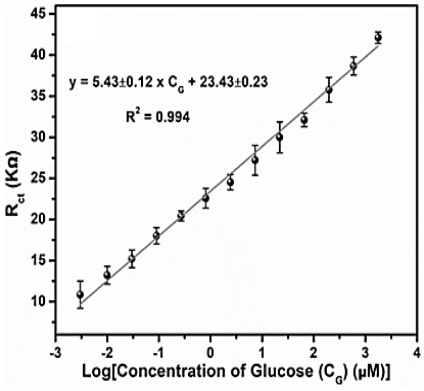


FIG.3(Left): Illustrates Nyquist plot at different glucose concentrations (3nM to 1.8mM) measured in the presence of redox probe.

FIG.4 (Right): Illustrates the calibration plot of the fabricated sensor at different glucose concentrations.



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