VOLTAMMETRIC GLUCOSE SENSOR USING POLY(2,5 DIMETHOXY ANILINE) AS A POLYMER SUPPORT

Authors: Prabhuraj Balakrishnan*, Sivakumar Chinnaiah**.

*PhD Student, School of Chemical Engineering and Analytical Science (CEAS), The University of Manchester, Manchester M13 9PL, UK. Email: prabhuraj.balakrishnan@postgrad.manchester.ac.uk

**Scientist, Electrodics and Electrocatalysis (EEC) Division, CSIR-Central Electrochemical Research Institute (CECRI), Karaikudi-630006. Tamilnadu, INDIA. Email id: ccsivakumar@cecri.res.in

Abstract: A glucometer is a medical device for measuring levels of glucose concentration in the blood, depending on the level, administration of a drug might be required for the patient. Test strips are used in glucometers to interact with a patient's drop of blood. This work mainly focuses on the synthesis and fabrication of sensor material used in the test strips of the glucometer.

A non-enzymatic voltammetric sensor has been constructed for the detection of glucose by using nanofibrillar morphology of MPBA-Au-PDMA matrix. This was achieved by simple three step process involving electrochemical processes namely voltammetric techniques. PDMA (Poly dimethoxy aniline) is exclusively fabricated as non-enzymatic glucose sensor platform because the presence of two methoxy groups in the PANI (Poly Aniline) backbone shows better support for immobilization of Au nanocatalyst followed by SAM (Self Assembled Monolayer) attachment of 4-Mercapto phenyl boronic acid (MPBA) groups. The sensor platform was characterized by Cyclic voltammetry and Scanning Electron Microscopy (SEM). The resulting biosensor platform shows good sensitivity with linearity for the detection of Glucose between 0.25 mM to 50 mM at a pH of 7.2 in Phosphate Buffer solution (PBS) similar to physiological conditions of blood.

Several samples were synthesized by changing the experimental parameters such as method of deposition of polymer film, concentration of Auric chloride [$HAuCl_4$] solution, concentration of MPBA [$(HO)_2$-B-C_6H_4-SH] solution and their immersion periods. These sensor materials were tested to find their use as one-time non reusable test strips for glucose meters. To be in an engineering point of view, cost for all samples were calculated. Finally optimization was carried out and the best material was identified. Hence a new sensor material has been fabricated.

Reference:

1. J. Liu, M. Agarwal *et al.,* "Glucose sensor based on organic thin film transistor using glucose oxidase and conducting polymer " J.Sensors and Actuators B: Chemical, Volume 135, Issue 1, 10 December 2008, Pages 195-199.

2. Min Pan *et al*.,"A novel glucose sensor system with Au nanoparticles based on microdialysis and coenzymes for continuous glucose monitoring" J. Sensors and Actuators A: Physical, Volume 108, Issues 1–3, 15 November 2003, Pages 258-262.

3. Gabriele Favero *et al*.,"Preparation and characterization of a chemically modified electrode based on ferrocene-tethered β-cyclodextrin self assembled monolayers" Microchemical Journal, Volume 76, Issues 1–2, February 2004, Pages 77-84.

4. Ping He *et al*.," ESR-electrochemistry in-situ studies on chemically modified electrodes" Journal of Electroanalytical Chemistry, Volume 405, Issues 1–2, 12 April 1996, Pages 217-22.

5. Xinjian Huang *et al*.,"Electrochemical characteristics of conductive carbon cement as matrix for chemically modified electrodes" J.Analytica Chimica Acta, Volume 300, Issues 1–3, 20 January 1995, Pages 5-14.

Figures:

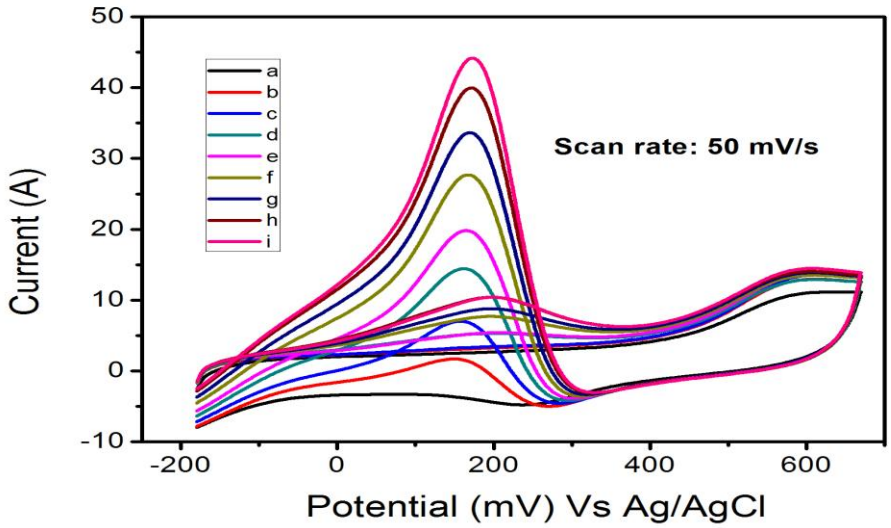

Fig.1. Cyclic voltammogram of MPBA-Au-PDMA film on GCE recorded in 0.1 M PBS (pH-7.2) for different additions of glucose (a) 0mM (b) 1mM (c) 2mM (d) 3mM (e) 4mM (f) 5mM (g) 6mM (h) 7mM (i) 8mM for one of the samples.

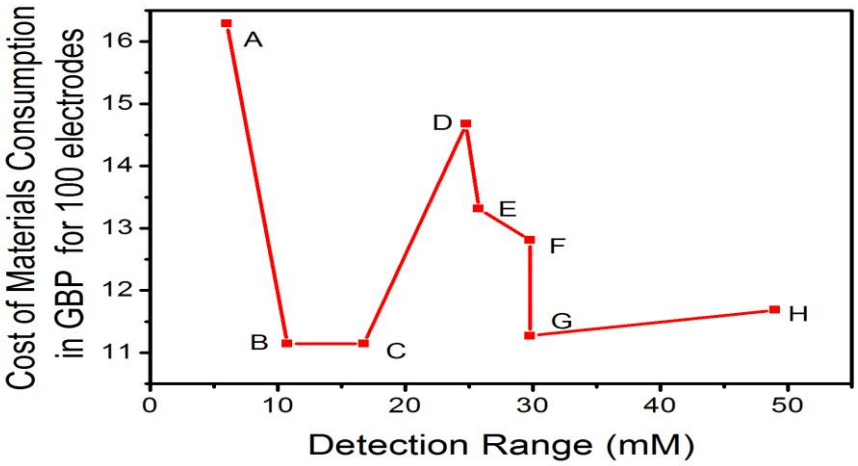

Fig 2.Optimisation graph of Detection Range (mM) Vs Cost of material for samples A to H