IMMUNOELECTROCHEMICAL METHODS OF HORMONE ANALYSIS

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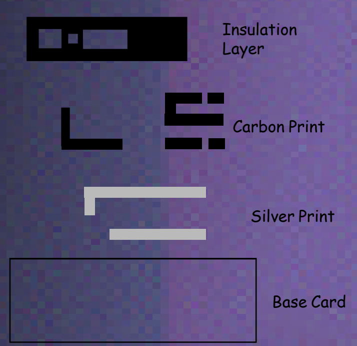
Abstract

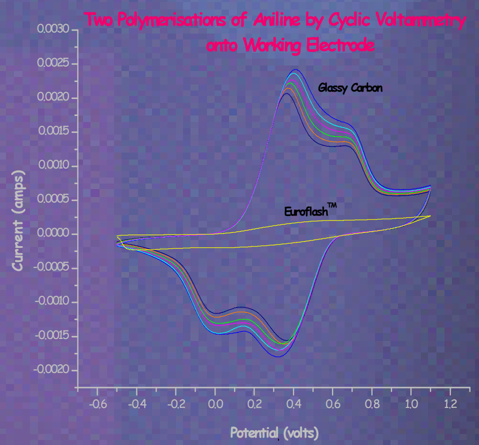
Over the last decade, there has been considerable interest in the development of immunoelectrochemical assays, mainly due to the advantages offered by the combination of the selectivity of immunoassays with the great sensitivity and simplicity of modern electroanalytical techniques. However, immunoelectrochemical assays have not yet been exploited commercially, as transitions from the laboratory bench to large-scale manufacturing has proved difficult.

The system described is an amperometric peroxide biosensor prepared by electrochemical deposition of horseradish peroxidase on an electroactive polymer, polyaniline. Polyaniline brings about mediatorless redox coupling between the electrode and biomolecular components attached to the surface. This assay will be the stepping-stone to developing an immunoelectrochemical method for the analysis of human chorionic gonadotropin (hCG), and other female hormones. The assay initially utilises glassy carbon electrodes for preliminary data, before being replaced with a commercially available electrode Euroflash™, produced by Inverness Medical Limited™. This electrode was utilised with a view to producing an electrochemical assay that complies with manufacturing requirements.

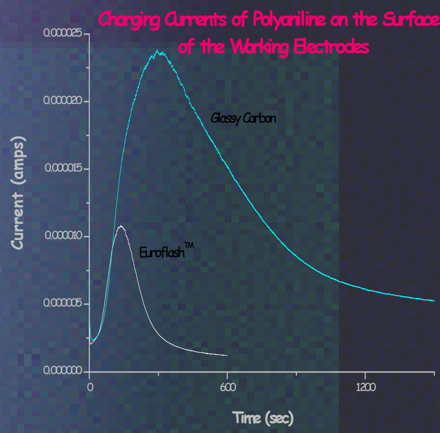
Euroflash™ Two Electrode System



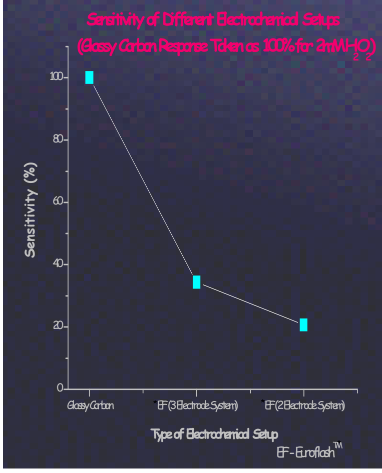
Euroflash™ electrodes are fabricated using a screen-printing technique and composed of an Ag/AgCl reference and a carbon working electrode. Electrode areas are defined by an insulating layer.



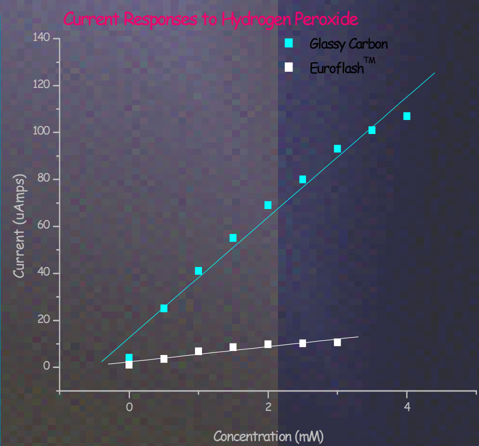
The two different carbon surfaces yield very different cyclic voltamograms after the same number of cycles. The very small amount of current passed for the Euroflash™ compared to the glassy carbon demonstrates a high charge transfer resistance for the manufactured strip.



The graph shows the different charging currents of the polyaniline demonstrating the reduced deposition of the polymer on the Euroflash™ electrode.



The low sensitivity of the Euroflash™ is due to high charge transfer resistance, which is diminished even further when the electrode strip is used independently, i.e. using the inbuilt reference in two electrode mode.



This feasibility study has demonstrated that although the HRP peroxide biosensor works, it is only at its optimum when using a glassy carbon electrode. The next step is to design an electrode strip that meets manufacturing requirements, and that has minimum charge transfer resistance, in order to boost sensitivity.