Design of a 3-D molecular imprinting biosensor with multi-scale roughness for the detection of fibrinogen
Vincent Ricotta\textsuperscript{a}, Yingjie Yu\textsuperscript{a}, Chung-Chueh Chang\textsuperscript{c}, Dennis K. Galanakis\textsuperscript{d}, Kalle Levon\textsuperscript{b}, Miriam Rafailovich\textsuperscript{a}
\textsuperscript{a} Stony Brook University College of Engineering and Applied Science, Stony Brook, NY, 11794-2275 USA.
\textsuperscript{b} Department of Chemical and Biomolecular Engineering, New York University Tandon School of Engineering, Brooklyn, NY, 11201, USA.
\textsuperscript{c} ThINC Facility, Advanced Energy Center, Stony Brook, NY 11794. USA.
\textsuperscript{d} Stony Brook University School of Medicine, Stony Brook, NY, 11794, USA.

We have developed a biosensor platform which can be applied to a broad range of biological molecules ranging in scale from nanometer to micron. The sensor is based on potentiometric detection which can be integrated into a portable, sensing device, such as an iphone or tablet, with wireless transmission of the data. The detection mechanism is based on molecular imprinting using self assembled monolayer (SAM) technology applied within a 3-D niche whose dimensions are matched to those of the analyte [Fig.1]. The sensitivity of this technique is comparable to ELISA, but can be deployed at bedside, using physiological fluids, and providing results within minutes. Furthermore, in addition to sensing differences in the molecular chemical sequence, the technique is also sensitive to morphology and can detect small changes in molecular conformation and complexation. Here we discuss the application of the technique to the discrimination between normal and genetically defective fibrinogen molecules [Fig. 1, insert]. Rapid detection of the latter is critical since it can inhibit fibrin polymerization and clot formation. The technique is also shown to detect soluble fibrin and fibrin/fibrinogen complexes which may be involved in non-thrombogenic clot formation on foreign surfaces.

\begin{figure}[h]
  \centering
  \includegraphics[width=\textwidth]{figure1.png}
  \caption{Dimensionality curve of analyte size and roughness of imprinted surfaces. Left insert: Top curve shows potentionmetric data obtained from a sensor imprinted for normal Fb and cross tested with abnormal Fb; Bottom curve was obtained by imprinting for the abnormal Fb and cross testing with normal Fb. Right insert: Description of imprinting process.}
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