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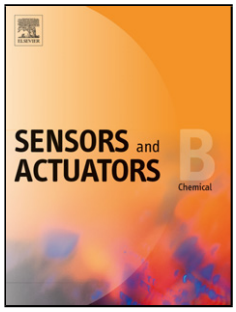

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Porous silicon microcavities redefine colorimetric ELISA sensitivity for ultrasensitive detection of autoimmune antibodies

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Higlights

- A cost-effective and simple to use colorimetric sensing protocol is proposed.
- No need for special light sources, neither costly microscopes or plate readers.
- Porous silicon microcavities are used to detect 10 fg ml^{-1} anti-histones in serum.
- The RGB analysis of the color formed in diffuse light enables to quantify molecules.
- Use of photonic substrates amplify 100x detection sensitivity compared to ELISA.

Abstract

Cost-effective health care technologies for detection of disease biomarkers at ultralow concentrations can significantly improve the quality of life in resource-constrained countries. However, current techniques require expensive instruments, complex conjugation protocols and tedious laboratory procedures that may not be affordable for the major part of the world population. Here, we propose to sidestep the problem by establishing a simple, relatively inexpensive sensing method employing a photonic substrate, a material affinity peptide, and a smart phone CCD detector to achieve detection of clinically relevant proteins in serum at concentrations much lower than standard enzyme-linked immunosorbent assay (ELISA). Easy to process porous silicon (PSi) microcavities were employed as substrates that provide a three-dimensionality, large surface area, and convenient light enhancement properties for molecular detection. Anti-histone H2B antibodies and biomarkers of severe illnesses are detected in whole serum at concentrations as low as 10 fg mL^{-1} by using the proposed PSi- ELISA protocol. Due to its easy use, cost effectiveness and high sensitivity, the proposed method has potential