MULTISPOT, LABEL-FREE BIODETECTION AT A PHANTOM PLASTIC–WATER INTERFACE

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Recognizing and quantifying specific biomolecules in aqueous samples are constantly needed in research and diagnostic laboratories. As the typical detection procedures are rather lengthy and involve the use of labeled secondary antibodies or other agents to provide a signal, efforts have been made over the last 10 years to develop alternative label-free methods that enable direct detection. We propose and demonstrate an extremely simple, lowcost, label-free biodetector based on measuring the intensity of light reflected by the interface between a fluid sample and an amorphous fluoropolymer substrate having a refractive index very close to that of water and hosting various antibodies immobilized in spots [1]. Under these index-matching conditions, the amount of light reflected by the interface allows straightforward quantification of the amount of antigen binding to each spot. Using antibodies targeting heterologous immunoglobulins and antigens commonly used as markers for diagnoses of hepatitis B and HIV, we demonstrate the limit of detection of a few picograms per square millimeter of surface-bound molecules. We also show that direct and real-time access to the amount of binding molecules allows the precise extrapolation of adhesion rates, from which the concentrations of antigens in solution can be estimated down to fractions of nanograms per milliliter. The intrinsic flexibility of the method is also demonstrated by using the flash LED and the photo camera of a smartphone to perform the measurement.

[1] F. Giavazzi, M. Salina, R. Cerbino, M. Bassi, D. Prosperi, E. Ceccarello, F. Damin, L. Sola, M. Rusnati, M. Chiari, B. Chini, T. Bellini, M. Buscaglia, Proc Natl Acad Sci USA (2013) www.pnas.org/cgi/doi/10.1073/pnas.1214589110.