Microfluidic ELISA on non-passivated PDMS chip using magnetic bead transfer inside dual networks of channels

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Abstract: Achieving efficient passivation of micro-channels against non-specific adsorption of biomolecules is a critical aspect in the development of microfluidic ELISA systems. Usual surface treatments such as pre-coating of the channels with serum albumin, exposure to oxygen plasma, polyethylene glycol grafting however exhibit a lack of long-term stability, with procedures that can be time-consuming, complex or associated with costly materials and instruments. In this paper, we present a new fluidic design combined with an original strategy of manipulating magnetic beads in order to reduce assay noise in bead-based microfluidic ELISA without the need for prior channel pre-treatment. The novelty of the system relies on the physical separation of the immune complex formation phase and the enzymatic reaction phase into two independent networks of channels. These networks are linked by fluidic bridges, whose openings are controlled by pressure valves, and through which the beads are magnetically transferred. A standard curve for the quantification of a model antibody was obtained within 30 minutes. A detection limit of 100 pg mL -1 (660 fM) and good linearity of the signal up to 4 ng mL -1 were observed. © The Royal Society of Chemistry.

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