

Integrated acoustic immunoaffinity-capture (IAI) platform for detection of PSA from whole blood samples.

ABSTRACT

On-chip detection of low abundant protein biomarkers is of interest to enable point-of-care diagnostics. Using a simple form of integration, we have realized an integrated microfluidic platform for the detection of prostate specific antigen (PSA), directly in anti-coagulated whole blood. We combine acoustophoresis-based separation of plasma from undiluted whole blood with a miniaturized immunoassay system in a polymer manifold, demonstrating improved assay speed on our Integrated Acoustic Immunoaffinity-capture (IAI) platform. The IAI platform separates plasma from undiluted whole blood by means of acoustophoresis and provides cell free plasma of clinical quality at a rate of 10 $\mu\text{L}/\text{min}$ for an online immunoaffinity-capture of PSA on a porous silicon antibody microarray. The whole blood input (hematocrit 38-40%) rate was 50 $\mu\text{l min}^{-1}$ giving a plasma volume fraction yield of $\approx 33\%$. PSA was immunoaffinity-captured directly from spiked female whole blood samples at clinically significant levels of 1.7-100 ng ml^{-1} within 15 min and was subsequently detected via fluorescence readout, showing a linear response over the entire range with a coefficient of variation of 13%.

Keyword: Point-of-care diagnostics; Immunoaffinity; PSA; Microfluidic; Acoustic.