Investigation of analyte induced particle aggregation using tunable pores

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The move towards rapid and sensitive diagnostic platforms as close as possible to the patient (point-of-care testing, POCT) has delivered a range of new assay formats. Omic technologies and the continuous monitoring or biomarkers offer the ability to provide a detailed readout of the patient that can be tailored for individual treatment. Significant research programmes are currently underway around the world to identify new biomarkers and it's clear that as advances are made in this field, new diagnostic devices that can simultaneously measure multiple biomarkers from complex biological media without complicated or time consuming sample preparation and equipment will be required.

When compared to rival technologies, superparamagnetic beads (SPMs) offer a simple, inexpensive and fast way of separating and purifying the target analytes prior to detection. If the particle is designed so that its surface is modified with a capture probe capable of capturing an analyte, either via the use of an antibody, aptamer of chemical bond. The particle can quickly bind to the analyte in solution, further because of their superparamagnetic properties; they along with any bound analyte can be extracted from the solution quickly, with nothing more complex than a hand held magnet. Quantification of the analyte can then be performed directly on the beads surface by monitoring the physical properties of the beads upon binding to the anayte. By monitoring changes in surface charge and/or aggregation we can monitor the amount of analyte captured.

Here we demonstrate some key aspects of the assay design and their impact upon sensitivities. We will also discuss recent work using multicomponent cylindrical particles (Rods) and their benefits for multiplexed assays. The rods are functionalised with a protective polyethylene glycol, PEG, to prevent non-specific adsorption of serum proteins and target analytes and functionalised with an aptamer capable of capturing the cancer biomarker Platelet derived growth factor, PDGF.

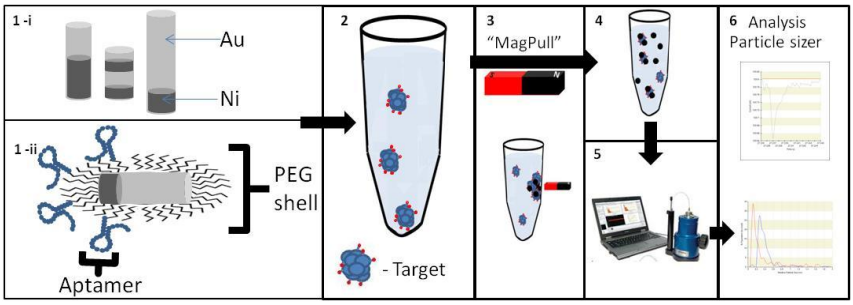

Figure 1. Schematic of the assay. 1i – Schematic of Rods created via template deposition, each rod contains a Ni segment and Au segment to make each rod contain a magnetic functionality and be visually unique . 1ii – Rods are coated with protective PEG layer and aptamer sequence. 2 - Rods are incubated with target. 3 i - Aggregation of the beads is aided via the use of an external magnetic field. 4 – During the "magpull" stage the beads may be washed. 5 – Beads are resuspended before analysis using a coulter counter technology.