

Whole blood immunoassay and biochemistry analysis on a fully integrated research department.

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Abstract

We describe a fully integrated system that can run sandwich-style immunoassays and numerous biochemical analyses simultaneously on a disc. Whole blood is directly transferred to a disposable "lab-on-a-disc" that also contains various freeze-dried reagents for blood chemistry analysis and immunoassay reagents. The complete process of plasma separation, metering, mixing, incubation, cleaning, and detection is fully automated thanks to the ground-breaking laser-irradiated Ferro wax micro valves and centrifugal microfluidics. To support the many types of reaction procedures, the analyser has an optical detection module that can measure absorbance at ten distinct wavelengths.

Keywords: Biochemistry analysis, Point-of-care diagnostics, Ferro wax, Biochemistry analysis.

Introduction

"Lab-on-a-disc" can be a straightforward substitute because it just needs one motor to manage numerous fluidic transports. On a centrifugal microfluidic platform, a variety of biological experiments, including immunoassays, cell lysis and homogenization, DNA analysis, and sorting of bio particles, have been demonstrated [1]. The majority of centrifugal microfluidic platforms used passive hydrophobic valves-a hydrophobic surface inhibits additional liquid flow-or capillary valves-liquid stopped by a capillary pressure barrier at junctions when the channel diameter suddenly increases-to control fluidic transit. However, even on centrifugal microfluidic platforms, fully integrated point-of-care diagnostics systems that can handle unprocessed materials like whole blood have proven hard to come by [2].

Even in centrifugal microfluidic platforms, fully integrated point-of-care diagnostics solutions capable of processing raw materials like whole blood have been hard to come by. It is partially due to the passive type of valves' practical constraints. For instance, although though the blood separation stage is typically the first step and requires the maximum spin speed, the disc must be operated sequentially from low to high spin speed, not the other way around. In addition, precise control of the spin speed and the local surface characteristics of the micro channels were necessary for reliable valve control. Due to this, only a few diagnostic tests that don't call for complicated fluidic design have been created on [3]. We described a completely integrated pathogen specific DNA extraction from whole blood on a lab-on-a-disc using the ground-breaking LIFM in conjunction with the pathogen specific magnetic particles. We

have also shown that a sandwich type immunoassay starting with whole blood can be fully integrated within 30 minutes thanks to our innovative centrifugal microfluidic design.

Whole blood can perform many types of biochemical analyses simultaneously on a disc in addition to immunoassays. Testing the components of blood serum or plasma yields crucial information for illness diagnosis and therapy. Biochemical analysis is used to determine the concentrations of the most crucial substances, including proteins, lipids, electrolytes, and enzymes [4].

The immunoassay's fundamental workings are the same as those described in the prior study, with the exception that bigger silica beads are utilised in place of polystyrene particles. The larger silica beads are much easier to handle than the micron-sized polystyrene particles and are preloaded into the mixing chamber before the bonding stage. Additionally, the silica beads have a larger mass, making efficient mixing on a centrifugal microfluidic platform simple. Additionally, silica surfaces facilitated antibody covalent attachment more readily than polystyrene particles. The 3-aminopropyl triethoxy silane (APTES)-modified silica balls (Sigma Aldrich) with a 1 mm diameter were then treated with the CK-MB capture antibody. You can get more information on the bead-based immunoassay's precise experimental conditions elsewhere [5].

Conclusion

Utilizing the cutting-edge Ferro-wax valve and centrifugal microfluidics technology, we have created a blood analyser. To the best of our knowledge, it is the first small-sized apparatus

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capable of performing both immunoassays and blood chemistry analysis. In this, we show how to analyse six blood chemistry markers simultaneously utilising an immunoassay for CK-MB as a model system, including ALT, AST, CHOL, GLU, HDL, and TRIG. The "Lab-on-a-Disc" is better for point-of-care applications than traditional blood chemistry analysis performed in clinical laboratories because it uses less blood, takes less time, and doesn't need an expensive operator or specialised equipment.

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