An integrated lab-on-a-disc approach to detect inflammatory biomarkers from whole blood

Uddin, Rokon; Donolato, Marco; Fock, Jeppe; Hansen, Mikkel Foug; Hwu, En-Te; Boisen, Anja

Publication date:
2017

Document Version
Peer reviewed version

Link back to DTU Orbit

Citation (APA):

General rights
Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.
An integrated lab-on-a-disc approach to detect inflammatory biomarkers from whole blood

Rokon Uddin, Marco Donolato, Jeppe Fock, Mikkel F. Hansen, En-Te Hwu, and Anja Boisen

Department of Micro- and Nanotechnology, DTU Nanotech, Technical University of Denmark, BluSense Diagnostics, Copenhagen, Denmark, Institute of Physics, Academia Sinica, Taiwan

We demonstrate a novel integrated assay from a whole blood (WB) sample to detect the two most common inflammation biomarkers, C-reactive protein (CRP) and white blood cell (WBC) count on a low-cost centrifugal microfluidic disc. CRP detection is performed using a magnetic nanobead (MNB)-based agglutination assay and a Blu-ray based optomagnetic reader unit [1], whereas the WBC count is obtained using an optical imaging unit (oCelloScope). Both detection units are integrated with the centrifugal microfluidics platform and are performed on a single disc ensuring automation and reliability of the assay (Fig. 1a). In-house fabricated microfluidic discs (Fig. 1b) were used for sample processing and detection using both readout methods. First, 35 µl of PBS-diluted human WB (EDTA-treated) was loaded into the disc. High speed centrifugation (45 Hz) with a low acceleration (2.5 Hz) first caused the blood to overlay on a pre-loaded density gradient medium (DGM) followed by stratification into plasma, WBC layer and red blood cells. The blood plasma and the WBC were then transferred to different microfluidic chambers using centrifugo-pneumatic valving [3]. CRP antibody-functionalized MNBs were mixed on-disc with different amounts of plasma resulting in MNB agglutination as detected optomagnetically in the 2nd harmonic component of the transmitted light as function of an applied oscillating magnetic field at low frequency (Fig. 1d) [2]. The WBCs were counted on-disc by scanning the WBC chamber using the oCelloScope followed by quantification using the instrumental software Uniexplorer 8.0 [4] (Fig. 1c). Current work aims to test the efficacy of the method with blood samples from multiple subjects and compare the efficiency of the WBC count with that of a hemocytometer.

References