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On-Chip immunoassay of a Cardiac Biomarker in Serum Using a Polyester-Toner Microchip

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Abstract

An on-chip immunoassay to detect C-reactive protein (CRP) was performed using a polyester-toner (PT) microchip. CRP is a highly conserved plasma protein responding to inflammation and is used for clinical purposes to diagnose an inflammatory state. For rapid analysis and specific interactions in immunoassays, extensive studies using microfluidic chips have been carried out. Recently, a simple technique to fabricate a disposable PT microchip by a direct printing process was developed and several applications were introduced. One major drawback of the PT microchip, however, is the poor separation performance due to the quality of the microfluidic structures. This problem for a PT microchip can be overcome using a cleavable tag immunoassay, which requires minimal separation performance. After analytes are conjugated onto antibodies which are immobilized on the surface of microbeads placed on the PT microchip, a second group of fluorescently tagged antibodies is added and complexed with the analytes. The tag is then cleaved and the solution containing the cleaved tag is analyzed by electrophoresis. The time needed for the complete analysis to be carried out on a PT microchip was less than 35 min. The dynamic range of the CRP in 10-fold diluted serum was 0.3 to 100 mg/L and the limit of detection was 0.3 mg/L, which demonstrated the possibility of a quantitative analysis of CRP in serum in clinical trials.

Keywords: Polyester-toner microchip, microfluidic immunoassay, C-reactive protein, cleavable tag immunoassay