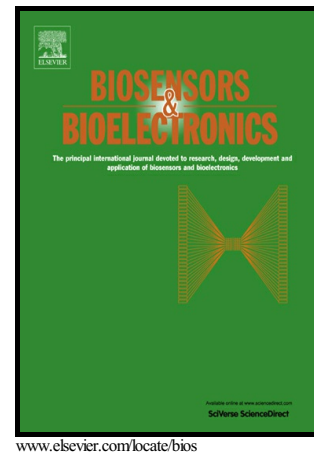


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A novel lab-on-chip platform with integrated solid phase PCR and supercritical angle fluorescence (SAF) microlens array for highly sensitive and multiplexed pathogen detection

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Abstract

Solid-phase PCR (SP-PCR) has become increasingly popular for molecular diagnosis and there have been a few attempts to incorporate SP-PCR into lab-on-a-chip (LOC) devices. However, their applicability for on-line diagnosis is hindered by the lack of sensitive and portable on-chip optical detection technology. In this paper, we addressed this challenge by combining the SP-PCR with supercritical angle fluorescence (SAF) microlens array embedded in a microchip. We fabricated miniaturized SAF microlens array as part of a microfluidic chamber in thermoplastic material and performed multiplexed SP-PCR directly on top of the SAF microlens array. Attribute to the high fluorescence collection efficiency of the SAF microlens array, the SP-PCR assay on the LOC platform demonstrated a high sensitivity of 1.6 copies/μl, comparable to off-chip detection using conventional laser scanner. The combination of SP-PCR and SAF microlens array allows for on-chip highly sensitive and multiplexed pathogen detection with low-cost and compact optical components. The LOC platform would be widely used as a high-throughput biosensor to analyze food, clinical and environmental samples.

Keywords: solid phase PCR, microlens array, supercritical angle fluorescence, high sensitivity, lab-on-a-chip

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