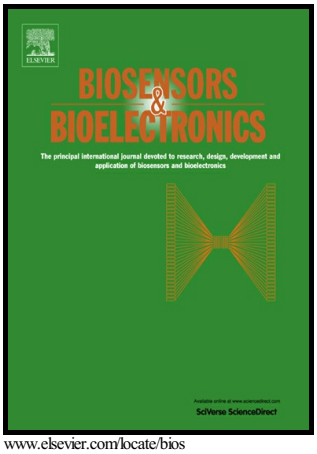


www.elsevier.com/locate/bios

# 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

Tran Quang Hung, Wai Hoe Chin, Yi Sun, Anders Wolff, Dang Duong Bang

PII: S0956-5663(16)31168-X
DOI: http://dx.doi.org/10.1016/j.bios.2016.11.028
Reference: BIOS9349

To appear in: *Biosensors and Bioelectronic*

Cite this article as: Tran Quang Hung, Wai Hoe Chin, Yi Sun, Anders Wolff and Dang Duong Bang, 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, *Biosensors and Bioelectronic* http://dx.doi.org/10.1016/j.bios.2016.11.028

# 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

Tran Quang Hung[a†‡], Wai Hoe Chin[a‡], Yi Sun[b,*], Anders Wolff[b] and Dang Duong Bang[a]

[a]Laboratory of Applied Micro and Nanotechnology (LAMINATE) National Food Institute, Technical University of Denmark (DTU-Food), Denmark.

[b]BioLabChip group, Department of Micro- and Nanotechnology, Technical University of Denmark, Ørsteds Plads, DK-2800 Kgs. Lyngby, Denmark.

[†]Current affiliation: Institut Charles Gerhardt UMR 5253 CNRS-UM, Université de Montpellier, Montpellier 34000, France.

[‡] These authors contribute equally to this work.

[*]Corresponding author. E-mail address: sun.yi@nanotech.dtu.dk

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 super critical 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