

Abstract

Circular Microfluidic System for Electrochemical Continuous Monitoring of Biochemical Processes in Emulsion Droplets [†]

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Abstract: Droplet microfluidics has proved efficiency in simple manipulating of small volumes of liquid samples, especially in combination with electrochemical means of detection e.g., field-effect transistors, amperometric sensors, impedimetric sensors, and etc. The abovementioned combination has grown in a lab on a chip approach for the detection of various substances. However, the problem of precise droplet manipulation and long-term recirculation over individual sensors still present. Here we present a microfluidic design and the way of liquid control that enables recirculation real-time monitoring of hundreds of droplets with nanowire-based impedimetric sensors. The long-term recirculation of droplets over the nanowire area can be used for monitoring biochemical reactions whose real-time analysis of the kinetics can be advantageous for a more precise analysis. The combination of circular microfluidics and nanosensors allows long term recirculation of droplets over the sensor which can be used for monitoring of bio-chemical reactions within solutions or cell/bacteria cultures. The generation of hundreds of droplet reactors provides high reliability and throughput of the result due to statistical reasons, precise flow-rate manipulation allows viability of the assay and impedimetric way of monitoring provides an immersive analysis of the embedded compounds.

Keywords: silicon nanowire-based field-effect transistor; nanosensor; droplet-based microfluidics; point-of-care diagnostics; enzymatic reaction; recirculation; incubation; lab-on-a-chip