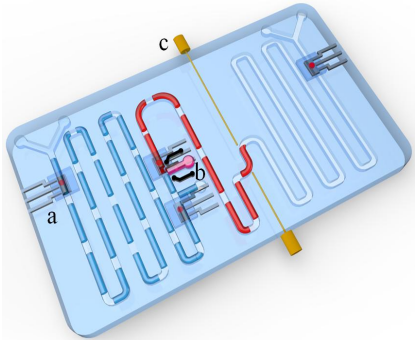
Bacterial Cell Incubation and Detection in Automation Microdroplet System

Dr. Qiang Cai
Professor
Analysis & Measurement Center
Yangtze River Delta Regional Institute of Tsinghua University,China
Email: caiq@tsinghua.edu.cn; Tel.: +86-13216388068

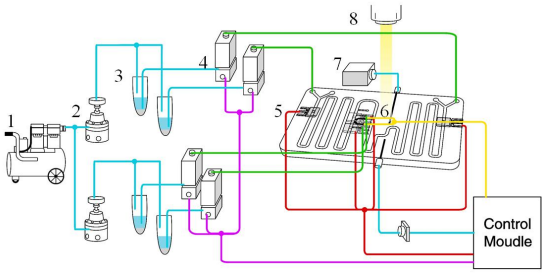
Biography

Qiang Cai received BEng degree in Biomedical Engineering Deparment from the Zhejiang University in 1996, and Ph.D. degree from the Biomedical Engineering Department, Zhejiang University in 2002. He is currently a research fellow in Analysis & Measurement Center, Yangtze River Delta Regional Institute of Tsinghua University. He has published more than 100 journal papers. His research interests cover mainly advance analytical instrument for environment monitoring and food safety.

We report an automated microdroplet platform for chemostat culture of bacterial cell, and continuous detection of optical density of microdroplet. The microdroplets, divided by air bubbles, are continuously injected into PMMA micro-fluidic chip using injection pump controlled by PC. Microdroplets are divided or merged via microchannels on the chip. On the top side of michochannels, optical detector is applied to acquire optical density of luminescent light. This platform is used to study chemostat continuous culture Escherichia coli on the chip, while concentration of bacterial cell can be online detected after tracer solution is merged into microdroplet. This system has several key characteristics: small (<100 μL, typically 2 μL) samples of liquids and suspensions of bacteria that are introduced directly into the chip; a sequence of droplets with compositions can controlled by injection speed and time; dividing and merging procedures can be easily programmed by user according experimental requirement; the droplets are detected with an in-line homemade optic spectrophotometer that measures cell growth, which detection limit reach 0.01 in 637nm wavelength. The E. coli detection experiment for water sanitary is on the way, while positive result can be expected.

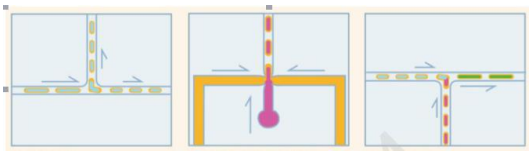


A a:Photoelectric converter b:electrode c:Fiber optic spectrometer



B 1:Air supply 2:Precision pressure regulating valve 3:The sample pool 4: Solenoid valve 5:The photoelectric converter 6:electrode 7: The light spectrometer

Fig.1 Cultivate chip structure



b1 *b2* *b3*

b1:Droplet partition

b1:Generate fresh medium droplets

b1:Droplet fusion

Fig.2 Droplet division and integration

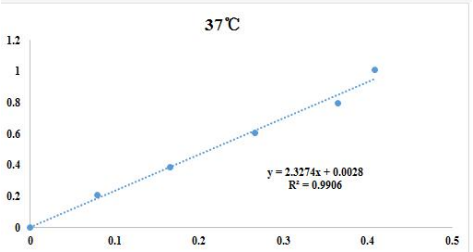


Fig.3 Droplets chemostat test report

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