Name(s)

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Project Number

S0321

Project Title

An Economical Microfabrication Process for the Production of a Microfluidic Device to Isolate Volvox aureus

Abstract

Objectives

Microfluidic devices made of elastomer poly(dimethylsiloxane)(PDMS) using multilayer soft lithography are used for single cell bioanalysis. My goal is to utilize a novel economical process to fabricate PDMS microfluidic device to isolate a single cell colony of Volvox aureus(green algae).

Methods

Variations in microfabrication and operational processes were done across trials to achieve optimal procedures. As a result of the combination testing, final procedures for fabrication of the PDMS microfluidic device required 6mm thickness of PDMS, clear nail lacquer photoresist, T-junction AutoCAD design, polyjet 3-D printing for the wafer, thermal bond of 80 degree Celsius, 1000 micron microfluidic channel width, 3000 micron channel inlet width, emulsification agent was vegetable oil, and utilizing vacuum desiccator. Different concentrations of water:algae, 1:1, 1:2, 2:1, were used. The number of a droplet with zero colonies, one colony, and more than one colony were recorded across five trials.

Results

The variations in the microfabrication and operational processes to achieve optimal procedures utilized different trial combinations. The standard utilized to determine the best method was if the combination produced a droplet. The best combination was used to produce a microfluidic device. The total cost of the PDMS microfluidic device utilizing the optimal procedure was $275. The 1:2 concentration water:algae produced average of 1.62 cell colonies in one droplet, while 2:1 concentration produced average of .32 algae colony in a droplet. A concentration of 1:1, water:algae, isolated one algae colony in 15/20 droplet

Conclusions

The data consistently supports the hypothesis. By using a 1:1,water:algae, in the PDMS microfluidic device, I was successful in isolating a single cell colony of Volvox aureus 75% of trials. The purpose of this experiment was to exemplify the capability of my novel process to produce a PDMS microfluidic device that could successfully isolate a cell. The variations of materials and methods used in the fabrication of the PDMS microfluidic device led me to engineer a new economical fabrication process to produce a microfluidic device that is 10% of the cost of Professional Institution microfluidic device. Not only have I been able to make a more economical device, but also proved that it functions reliably to isolate a cell colony. This novel methodology can be extended to any cells. The economical microfluidic device allows for greater access to this technology and will result in the development of advanced applications.

Summary Statement

A novel, economical process for the production of PDMS microfluidic device to isolate a single cell colony of Volvox aureus in a droplet..

Help Received

I worked independently on this project, utilizing only the laboratory space at Epinex Diagnostics.