Graduate Student Research Seminar

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A study on the recirculation phenomenon and loss of biomass in microfluidic devices

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3:00 pm (EST) – 132 Fluor Daniel Building

Abstract

Candidemia is among the four most common bloodstream infections in U.S. hospitals with a mortality rate of 40 percent. In our study, we are focused on performing cell lysis of the Candida cells, extracting the DNA and feeding it to perform PCR (Polymeric Chain Reaction) to identify the type of the Candida strain to which the cells belong to. For this, are focus is to perform the efficient electrical cell lysis of the candida cells using microfluidic device. Here the challenge is that in a microchannel particles flow under the balance of shear-gradient lift force and wall effect lift force. Due to the sudden increase in the surface area, the wall effect lift force disappears on the particles, and the shear-gradient lift force leads the particles in the formation of recirculation. The size of the particles play an important role in the migration of them into and outside the recirculation region and trapping in the cavity (dead volume). However the formation of these recirculations is greatly dependent on the flow rate. In this study, our objectives are to find a relationship between the channel length and fluid flow stability inside the channel, optimizing the height and width of the microchannel, providing a stable flow along with increasing the flow rate inside the microchannel without the presence of recirculation, to optimize the process parameters like flow rate to avoid biomass loss using the simulation results, developing a relationship between the loss of biomass and recirculation occurring inside the channel, increasing the amount of biomass that can be processed without losses in the channel. This study has the potential to make the device more efficient in handling the biomass inserted in the microfluidic device by preventing biomass loss due to recirculation. Also our focus is towards increasing the amount of biomass processed (perform lysis of Candida cells) through the microfluidic device, by reducing their losses. Hence we attempt to determine the reasons for the loss of biomass in microfluidic devices.

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