

249b Determination of Optimum Reagent Replacement Strategy in Microfluidic Channels/Reactors by Numerical Simulation of Flow and Diffusion

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The conventional DNA or oligonucleotide in-situ synthesis is composed of cycles of reaction steps; detritylation, coupling, oxidation and capping. In addition, the synthesis cycle consists of intermediate washing steps to remove excess reactants and by-products. However, the amount of solvent needed and the time that a feed is required to displace the former fluid are unknown. Because flow in microarray is always in laminar region in which surface velocity is very small, total fluid replacement becomes hard to achieve. Furthermore, in this laminar layer, the mixing is limited by diffusion such that it is a well-known problem in microscale devices. Therefore, in order to ensure that all the excess reactants are removed, the solvent volume used to wash the microfluidic platform is more than 100 times of the microarray volume itself. Moreover, as previously mentioned, a great number of washing steps is needed over the cycles of synthesis reaction. Consequently, an entire bottle of solvent is required just for the purpose of washing a small microchip. The propose of this study is to suggest a washing method in our microarray for reducing the solvent amount needed. Also, we investigate the effects of flow rate, diffusion coefficient, and feeding characteristics to the fluid replacement result. The feeding styles include continuous and pulse with various pulsing sizes.