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Simulation of Stretching and Fragmenting DNA by Microfluidic for Optimizing Microfluidic Devices

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Abstract : Stretching and snipping DNA molecule by microfluidic has important application value in gene analysis by lab on a chip. Movement, deformation and fragmenting of DNA in microfluidic are typical fluid-solid coupling problems. An efficient and common simulation system for researching the movement, deformation and fragmenting of DNA by microfluidic has not been well developed. In our study, Brownian dynamics-finite element method (BD-FEM) is used to simulate the dynamic process of stretching and fragmenting DNA by contraction flow. The shape and parameters of micro-channels are changed to optimize the stretching and fragmenting properties of DNA. Our results indicate that strain rate, resulting from contraction microchannel, is the main control parameter for stretching and fragmenting DNA. There is good consistency between the simulation data and previous experimental result about the single DNA molecule behavior and averaged fragmenting properties in this study. BD-FEM method is an efficient calculating tool to research stretching and fragmenting behavior of single DNA molecule and optimize microfluidic devices for manipulating, stretching and fragmenting DNA.

Keywords : fragmenting, DNA, microfluidic, optimize.
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