Concentrating and labeling genomic DNA in a nanofluidic array

Nucleotide incorporation by DNA polymerase forms the basis of DNA sequencing-by-synthesis. In current platforms, either the single-stranded DNA or the enzyme is immobilized on a solid surface to locate the incorporation of individual nucleotides in space and/or time. Solid-phase reactions may, however, hinder the polymerase activity. We demonstrate a device and a protocol for the enzymatic labeling of genomic DNA arranged in a dense array of single molecules without attaching the enzyme or the DNA to a surface. DNA molecules accumulate in a dense array of pits embedded within a nanoslit due to entropic trapping. We then perform ϕ29 polymerase extension from single-strand nicks created on the trapped molecules to incorporate fluorescent nucleotides into the DNA. The array of entropic traps can be loaded with λ-DNA molecules to more than 90% of capacity at a flow rate of 10 pL min\(^{-1}\). The final concentration can reach up to 100 μg mL\(^{-1}\), and the DNA is eluted from the array by increasing the flow rate. The device may be an important preparative module for carrying out enzymatic processing on DNA extracted from single-cells in a microfluidic chip.

General information
Publication status: Published
Organisations: Department of Micro- and Nanotechnology, Stochastic Systems and Signals, Optofluidics, XGenomes, NIL Technology ApS
Corresponding author: Marie, R.
Contributors: Marie, R., Pedersen, J. N., Mir, K. U., Bilenberg, B., Kristensen, A.
Pages: 1376-1382
Publication date: 2018
Peer-reviewed: Yes

Publication information
Journal: Nanoscale
Volume: 10
ISSN (Print): 2040-3364
Ratings:
BFI (2018): BFI-level 2
Scopus rating (2018): CiteScore 7.17 SJR 2.396 SNIP 1.338
Web of Science (2018): Impact factor 6.97
Web of Science (2018): Indexed yes
Original language: English
Electronic versions:
Untitled_2.pdf
DOIs:
10.1039/c7nr06016e
Source: FindIt
Source ID: 2395095663
Research output: Contribution to journal › Journal article – Annual report year: 2018 › Research › peer-review