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ABSTRACT

Polymerase Chain Reaction (PCR) is a powerful enzymatic reaction commonly used to amplify specific sequences of Deoxyribo Nucleic Acid (DNA). Since the introduction of the lab on a chip concept, numerous Continuous Flow PCR cyclers were realized with success at the micro scale. As reducing the reactor size and improving thermal management led to reduced sample volumes, results could be achieved much faster with these CF-PCR cyclers than with common commercial cycler. Furthermore, most of these demonstrated CF-PCRs are nowadays evolving towards high-throughput systems. However, most CF-PCR cyclers require complex manipulations and are not flexible (e.g. fixed number of cycles, and/or only usable for PCR …).

The concept of the electrophoretron cycler was introduced and demonstrated at the macro scale in 2001. The present work aims at using this electrokinetic cycler combining electroosmosis and electrophoresis in order to achieve cycling of the DNA species in a micro scale on-chip device, while applying only one potential difference. Even limited by polymers properties, appropriate design of the closed-loop microchannel allows the hydrodynamic effect resulting from mass conservation to drastically improve cycling time and species profile.

This result has been justified by appropriate theoretical analysis combined with numerical simulations, while polymers properties have been carefully characterized using experiments, resulting in the first micro scale electrophoretron prototype which has been tested in PCR like conditions.