Multi-chamber PCR chip with simple liquid introduction utilizing the gas permeability of polydimethylsiloxane

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Abstract: On-chip polymerase chain reaction (PCR) is beginning to provide a viable alternative to conventional genetic profiling and amplification devices through minimal reagent use, short time, high detection resolution and potential high-throughput parallel testing of genetic materials. Despite the advantages, there are many challenges to overcome in accurate control and manipulation of fluid, circumventing bubble formation and inhibiting sample loss during PCR thermal cycling for successful PCR. In this research, gas permeability of polydimethylsiloxane (PDMS) was employed for liquid sample introduction into PDMS multi-chamber PCR chip, avoiding trapped bubbles in the reaction chambers. This method is simpler and more reliable compared to the other reported methods where integration of many complicated components, such as micropumps and micromixers on the chip for both sample loading and mixing are necessary. The sample evaporation and bubble formation on chip were controlled by using glycerol as a vapor pressure modifier. With this device, successful amplification of human β-Actin gene was demonstrated. This approach will be applicable in developing chip devices for multi-target sample amplification for diagnostic purposes.
Author Keywords: Bubble elimination; Evaporation suppression; Fluid manipulation; PCR in chip; PDMS gas permeability
Index Keywords: Bubble elimination; Chip devices; Genetic materials; High-throughput; In-chip; Liquid sample; Micro pump; Micromixers; Multi-chamber; Multitarget; On chips; Parallel testing; PCR chips; PCR in chip; Polydimethylsiloxane PDMS; Reaction chambers; Simple liquids; Trapped bubble; Amplification; Bubble formation; Evaporation; Glycerol; Liquids; Materials testing; Microchannels; Microlenses; Polymerase chain reaction; Pumps; Silicones; Gas permeability

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