A temperature control method for shortening thermal cycling time to achieve rapid polymerase chain reaction (PCR) in a disposable polymer microfluidic device

We present a temperature control method capable of effectively shortening the thermal cycling time of polymerase chain reaction (PCR) in a disposable polymer microfluidic device with an external heater and a temperature sensor. The method employs optimized temperature overshooting and undershooting steps to achieve a rapid ramping between the temperature steps for DNA denaturation, annealing and extension. The temperature dynamics within the microfluidic PCR chamber was characterized and the overshooting and undershooting parameters were optimized using the temperature-dependent fluorescence signal from Rhodamine B. The method was validated with the PCR amplification of mecA gene (162 bp) from methicillin-resistant Staphylococcus aureus bacterium (MRSA), where the time for 30 cycles was reduced from 50 min (without over- and undershooting) to 20 min.

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