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A microfluidic platform for fluorescence-based multi-target biochemical assays

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Abstract

A Lab-on-a-chip system capable of fully automated sample aliquoting and parallelisation, sequential fluidic control and highly sensitive real-time fluorescence detection is presented. The system, consisting of a disposable polymer microfluidic chip and a control instrument, is evaluated in terms of reliability and performance. The presented chip is designed to perform nucleic acid analysis using the isothermal method Nucleic Acid Sequence Based Amplification (NASBA) in eight parallel channels. However, the chip design may be readily adapted to other isothermal nucleic acid amplification technologies. A novel fluidic actuation method permits robust, simultaneous on-chip flow control of the parallel samples using a single chip-to-world interface. The method is easily scalable and increased parallelisation can be achieved without the need to modify the instrument hardware. The real-time fluorescence detection unit is based on an optical probe scanner with fiber optical coupling to stationary illumination and detection optics. The sensitivity of the unit is demonstrated during on-chip NASBA amplification of eight parallel 740nl samples. By integration of dried reagents on-board the chip, the automated system may be applied to perform a variety of multi-target, sequential biochemical assays.

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