Design and fabrication of PDMS microfluidics device for rapid and label-free DNA detection

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Abstract - Microfluidics explores the manipulation of fluid in small volume, a multidisciplinary field is imperative for DNA extraction. This study offers a simple yet substantial methodology for the fabrication of microfluidics structure-based polydimethylsiloxane (PDMS) biopolymer on a glass substrate with SU-8 photoresist for label-free detection of pathogenic genomic DNA. Two microfluidics designs for DNA detection were based on AutoCAD software, both contain two inlets and one outlet, with dimensions of 28 mm wide, and 18 mm long, and total surface area of 504 mm2. The designs were patterned in such particular sizes and dimensions to test fluid delivery and enhancement in biochemical processes in DNA extraction, while maintaining economical values as a disposable chip. Both microfluidics devices showed no leakage during fluid delivery, have heights of 97.97 and 103.44 µm, and surface roughness of 0.15 and 0.07 µm, respectively. DNA extraction from pathogenic fungus Ganoderma boninense was run on PDMS microfluidic device and UV–Vis analysis confirmed successful extraction with peaks found at 260–280 nm. Current–voltage (I–V) measurement confirmed the accuracy of microfluidic device for the specific pathogen with both real and synthetic samples of G. boninense illustrating the similar graph values of only 0.000005 A difference at 1.0 V after hybridization.

Author keywords: biosensor, dna extraction, ganoderma boninense, lab-on-a-chip, microfluidics