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## Simple disposable microfluidic device for *Salmonella typhimurium* detection by magneto-immunoassay

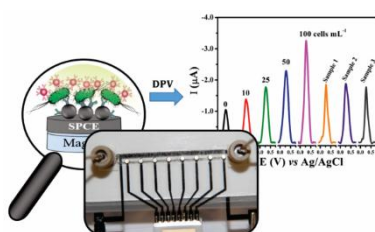
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Graphical Abstract



Highlights

- The construction of a simple and low-cost 8-electrode fully disposable microfluidic device was demonstrated.
- The device was successfully applied for ultrasensitive detection of *Salmonella typhimurium*.
- A single microfluidic device allows the simultaneous measurement of eight samples by magneto-immunoassay
- The magneto-immunoassay provides high sensitivity and fast response for *Salmonella* detection in milk samples.

### ABSTRACT

Herein, we describe the construction of a simple, low-cost, and fully disposable microfluidic device (D $\mu$ FD) for ultrasensitive *Salmonella typhimurium* (*S. typhi*) detection. The D $\mu$ FD is based on unmodified carbon electrode array for rapid detection of *S. typhi* in milk samples by magneto-immunoassay using gold nanoparticles (AuNPs) as a label. In the method proposed, *S. typhi* was magnetically captured and separated from samples using magnetic beads modified with a monoclonal anti-*Salmonella* antibody followed by the addition of polyclonal anti-*Salmonella* antibody labeling with AuNPs. The magneto-immunoconjugate formed was injected into the D $\mu$ FD and captured on the electrode surface by placing magnets behind the unmodified working electrodes. The *S. typhi* detection was carried out by the electrochemical response of the gold from AuNPs. A single D $\mu$ FD was used for rapid and full *S. typhi* analysis by measuring standards and samples simultaneously. A low limit of detection (LOD) of 7.7 cells mL<sup>-1</sup> for *S. typhi* in a linear range from 10.0 to 100.0 cells mL<sup>-1</sup> was obtained. The D $\mu$ FD proved to be fast, accurate, and inexpensive for *S. typhi* detection and has great potential to multiplex detection of different food contaminants.

**Keywords:** Microfluidic device; disposable; screen-printed electrode; magneto-immunoassay; *Salmonella*.

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