A lab-on-a-chip platform for quantitative detection of foodborne bacteria using immunomagnetic separation, enzymatic catalysis and distance indication

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ABSTARCT

In this study, a simple, disposable and equipment-free lab-on-a-chip platform for quantitative detection of foodborne bacteria using immunomagnetic separation, enzymatic catalysis and distance indication was developed. This method was demonstrated to be able to detect *Salmonella typhimurium* as low as 10^2 CFU/mL in 1 h without cumbersome equipment and the recovery of *Salmonella typhimurium* in chicken samples ranged from 82% to 118%.

HIGHLIGHTS

- Naked eye detection
- Simple and rapid mixing
- In-field and low-cost application

PRINCIPLE

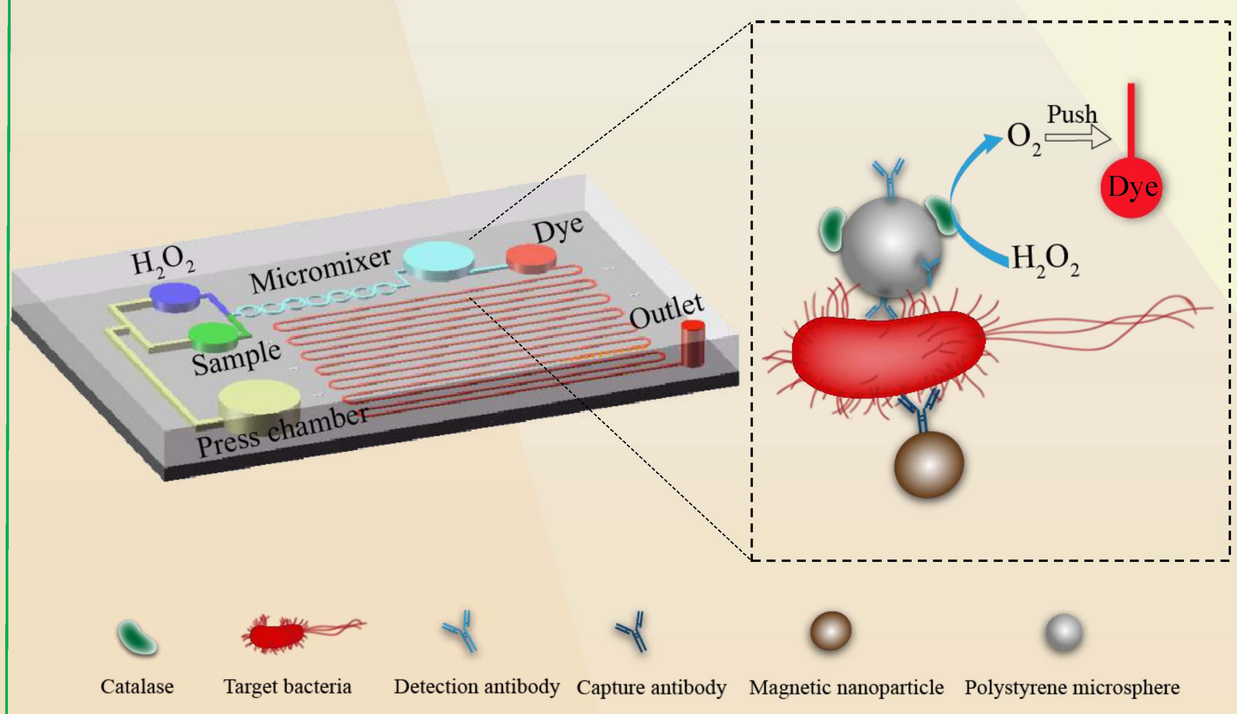

Fig. 1. Schematic of equipment-free lab-on-a-chip platform for quantitative detection of *Salmonella.*

RESULTS AND DISCUSSION

1. Micromixer simulation

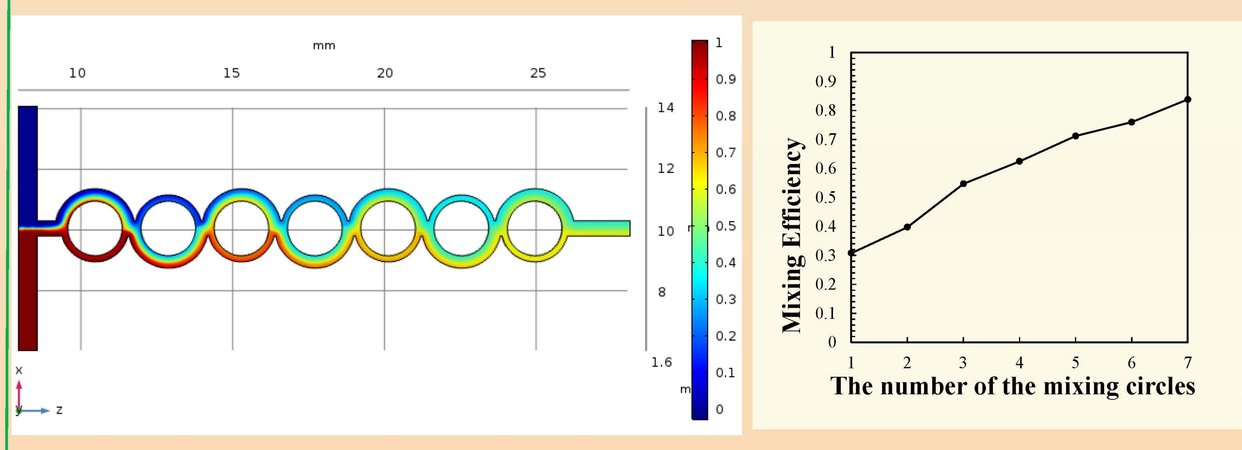

Fig. 2. Simulation of the micromixer.

2. Parameter optimization

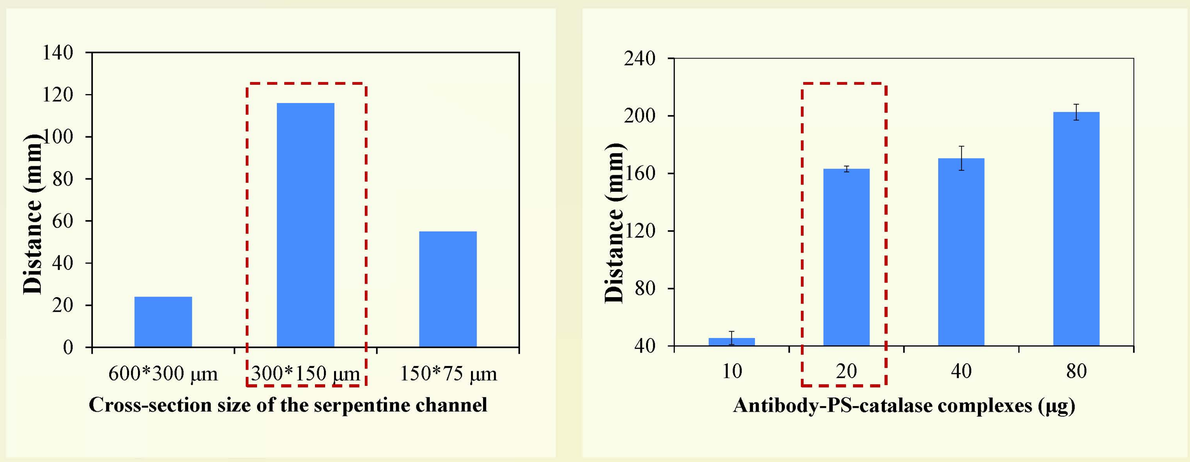

Fig. 3. Optimization of the serpentine channel and the antibody-PS-catalase complexes.

3. TEM imaging

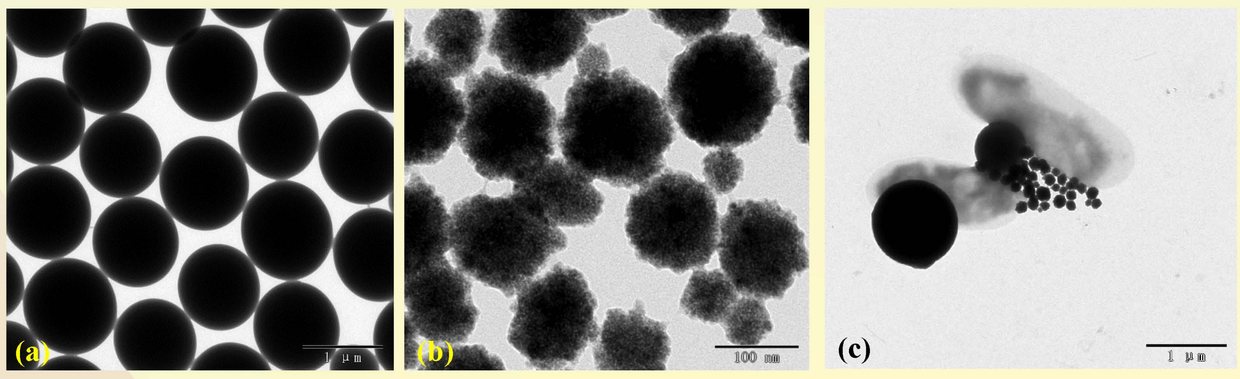

Fig. 4. TEM image of the (a) polystyrene microsphere(PS), (b) magnetic nanoparticles(MNPs), and (c) MNPs-*Salmonella*-PS complexes.

4. Bacteria detection

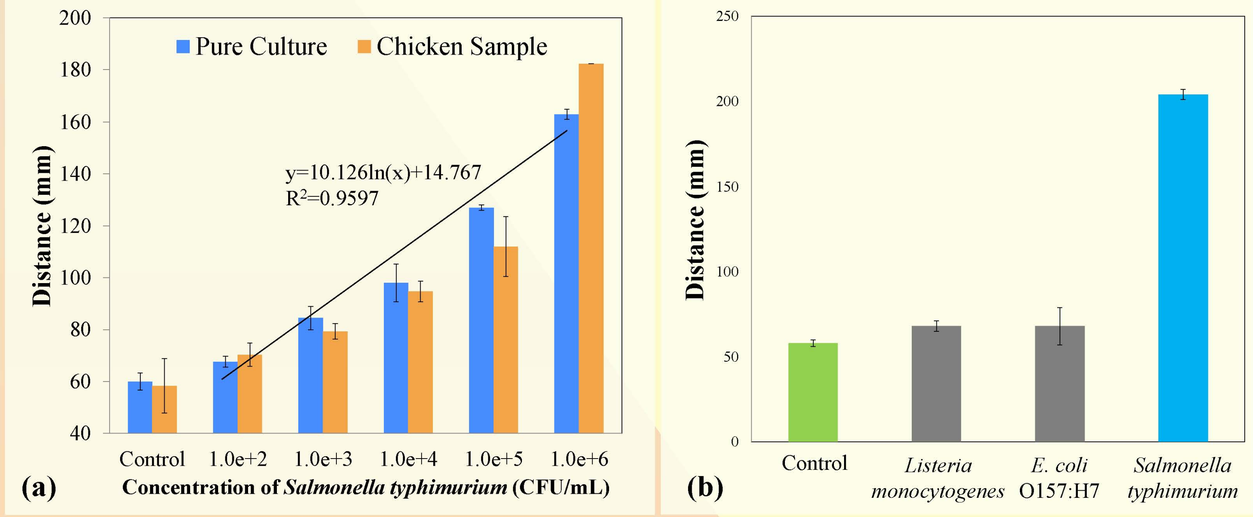

Fig. 5. (a) Detection of different concentrations of *Salmonella* in pure culture and chicken samples; (b) The specificity of the lab-on-a-chip platform.

CONCLUSIONS

This proposed platform was able to detect *Salmonella typhimurium* in 1 h with the mean recovery of 97.7%. It could be further improved by using a smaller indication channel to obtain a higher sensitivity, and has the potential to develop a low-cost, simple and quantitative method for in-field monitoring of bacteria in food supply chains.

ACKNOWLEDGMENT

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