A Portable Device for Probiotic Counting and Viability Assessment Based on Microfluidic Chip and Image Recognition

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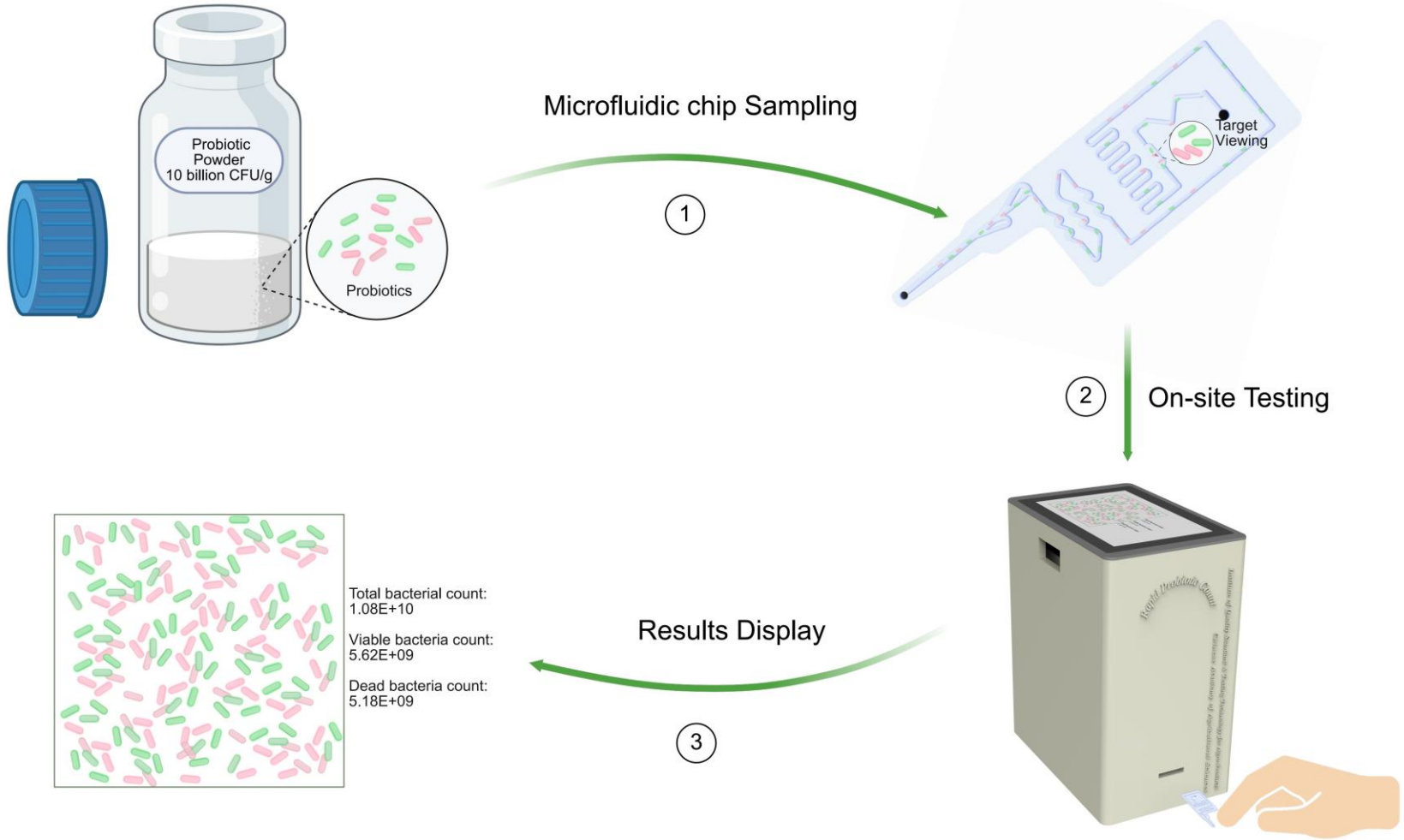
Introduction

Development of a Portable Device for Probiotic Counting and Viability Assessment Based on Microfluidic Chip and Image Recognition Technology



- A novel platform was developed for rapid probiotic viability assessment.
- Microfluidic chip and image recognition ensured accurate probiotic quantification.
- Results were delivered in 3 minutes at a low cost of $2 per test.
- Viable but non-culturable (VBNC) cell detection was achieved, surpassing conventional plate counting.
- A broad quantification range (10^7–10^{11} colony-forming units (CFU) mL^{-1}) was demonstrated for practical use.

Portable probiotic quantitative analyzer & Microfluidic chip

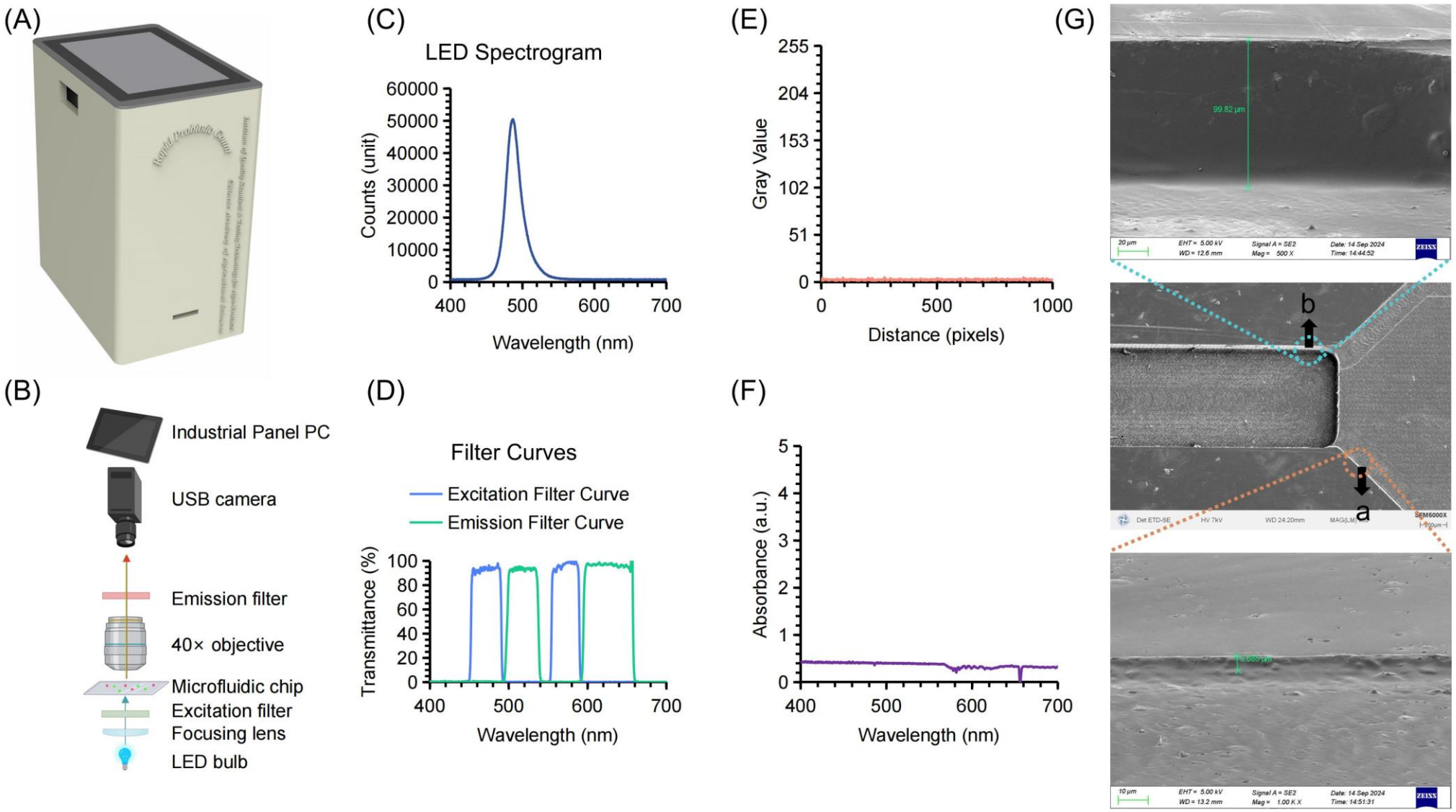


Figure 1 Structural and optical features of the portable probiotic quantitative analyzer and the microfluidic chip

Microfluidic chip and dye concentration optimization

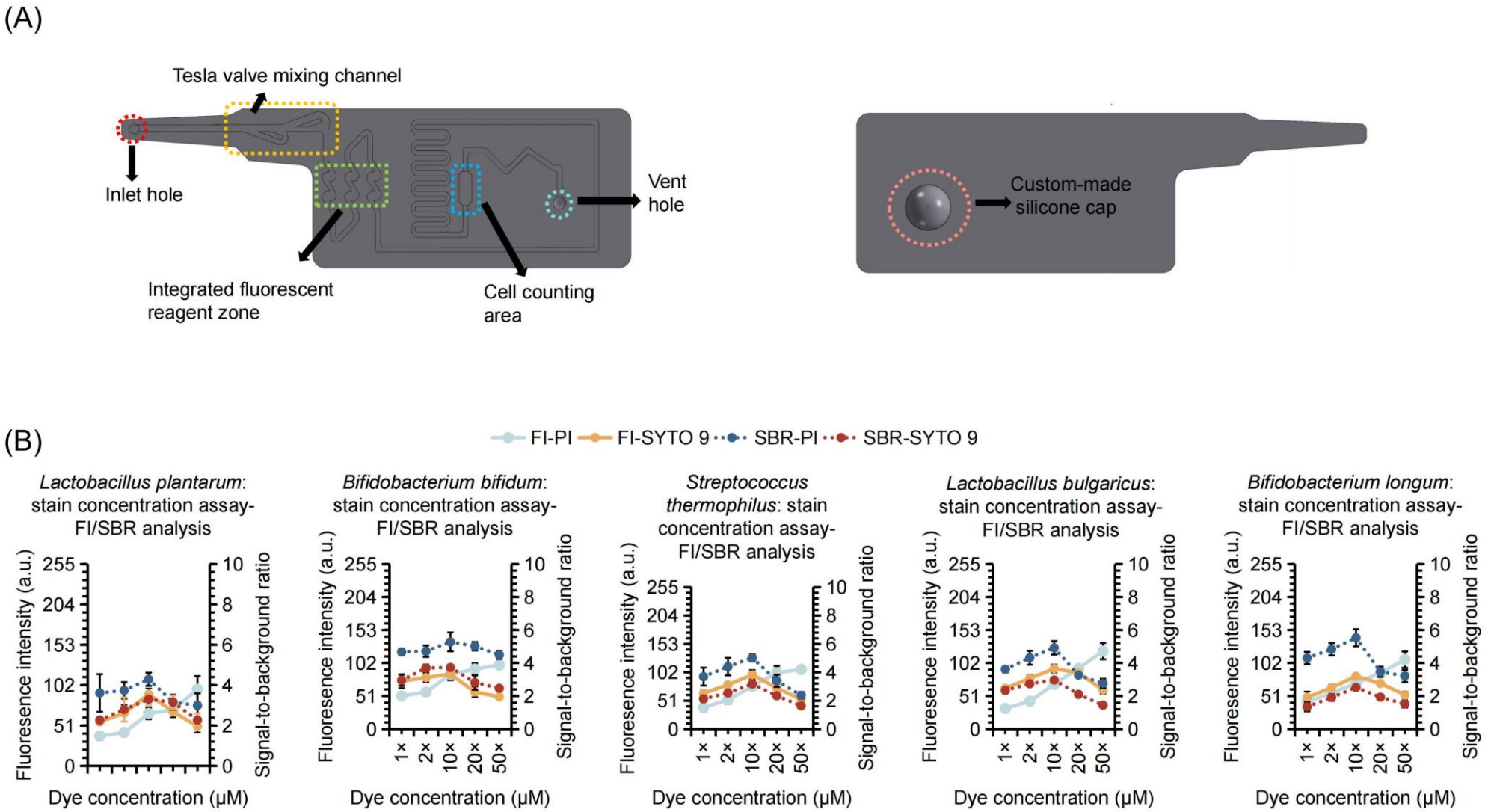


Figure 2 Schematic diagram of the microfluidic chip and dye concentration optimization for probiotic staining

Portable counter characterization

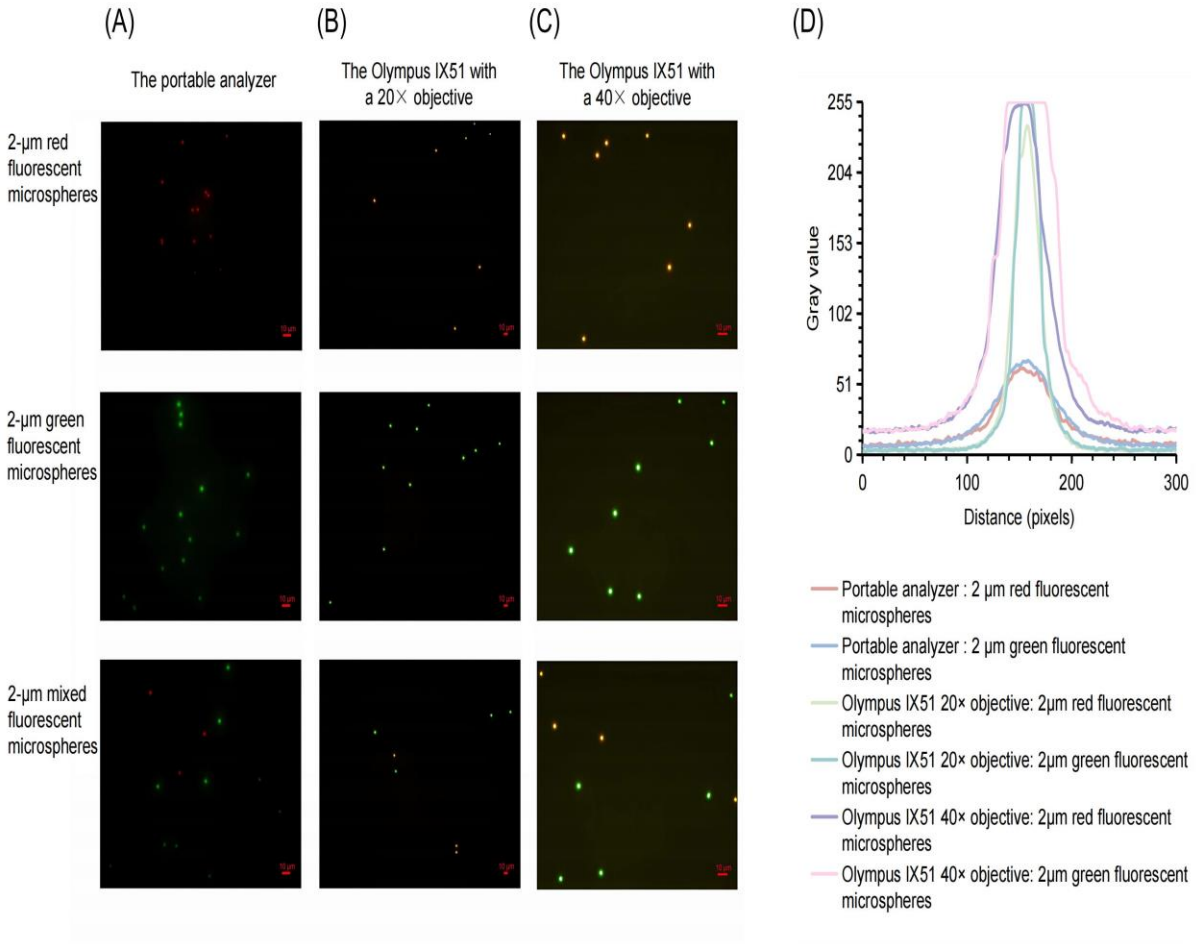


Figure 3 Evaluation of fluorescence imaging performance between the portable analyzer and the commercial Olympus IX51 microscope

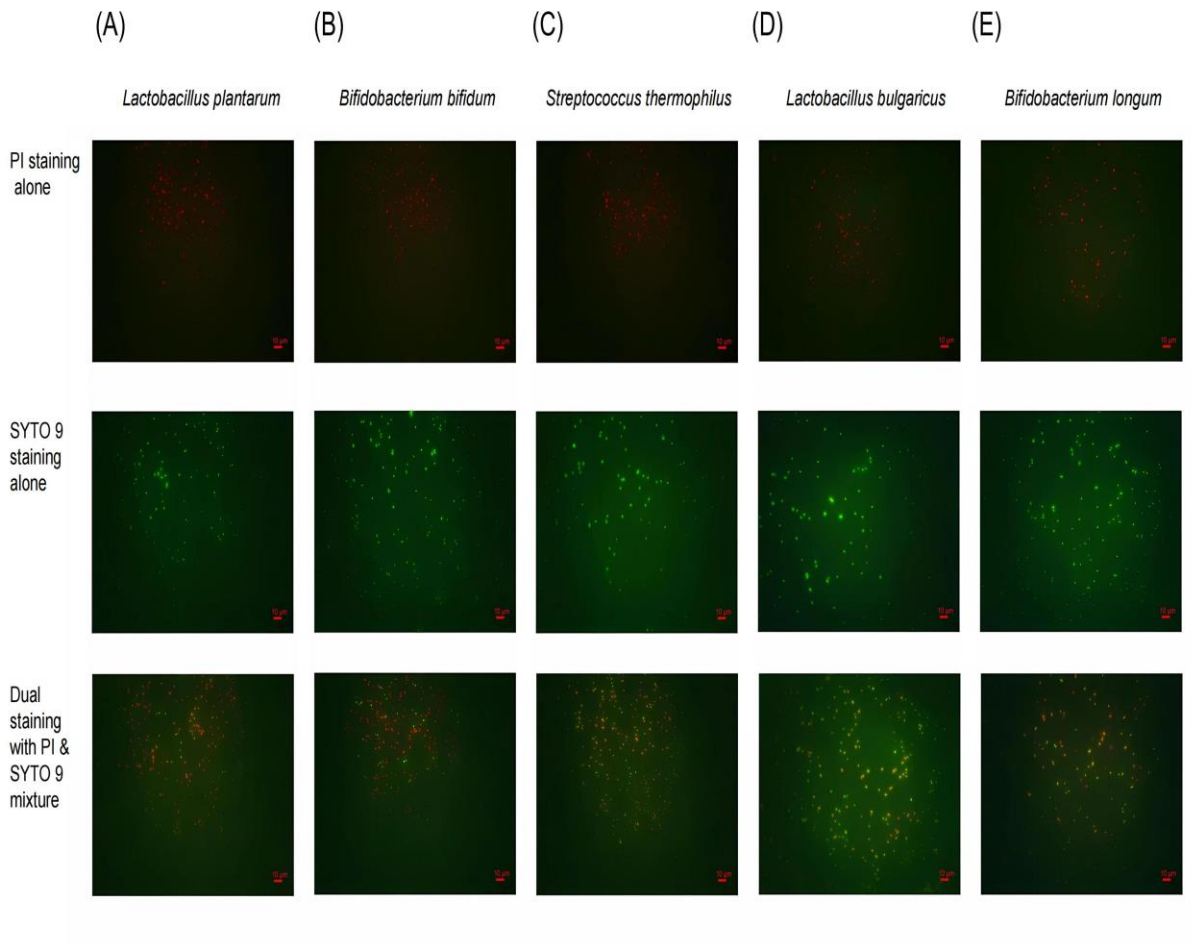


Figure 4 Fluorescence images of probiotic strains

Counting software development (ProBioCount)

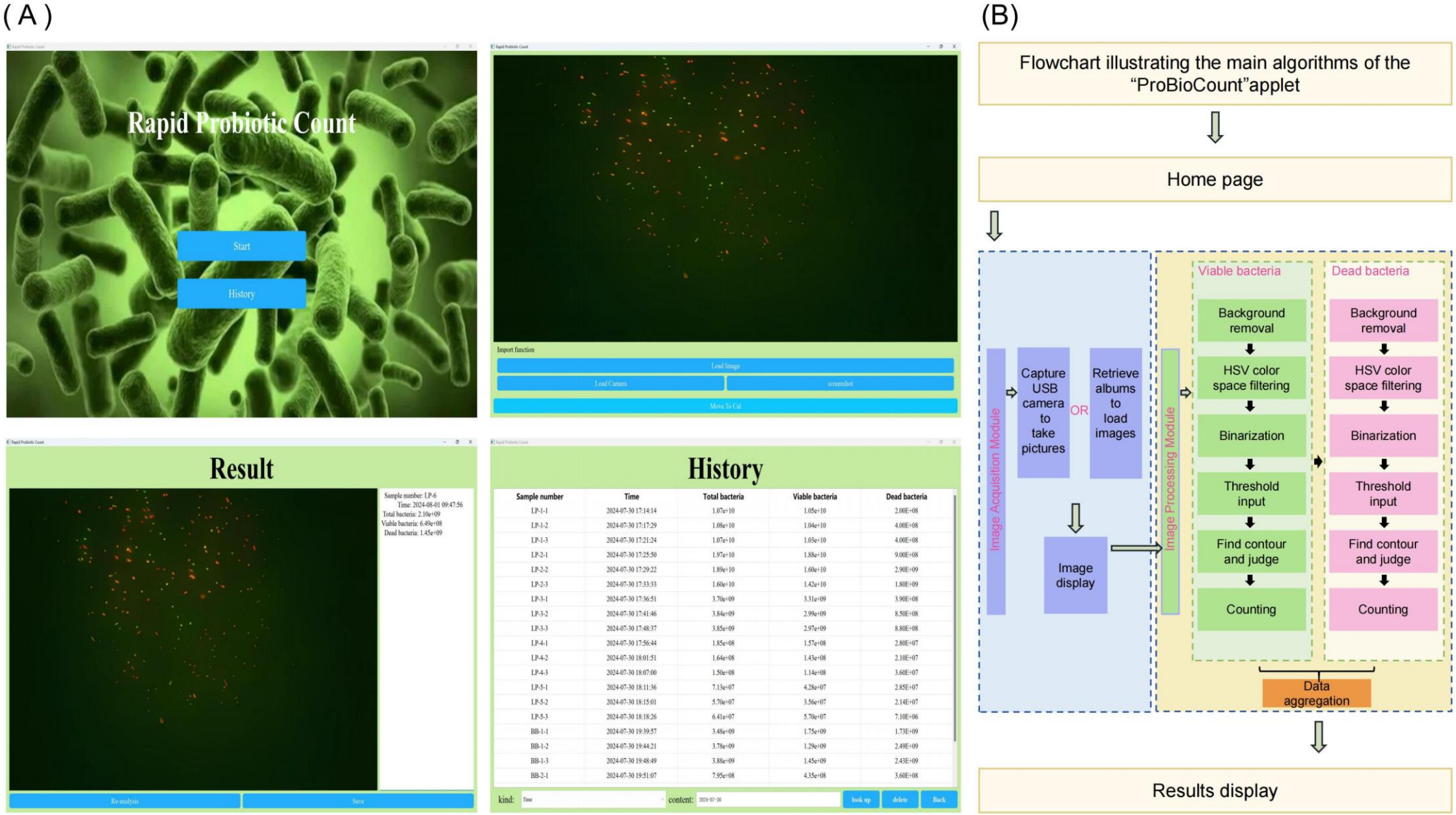


Figure 5 ProBioCount software interface and algorithm workflow.

Real samples verification

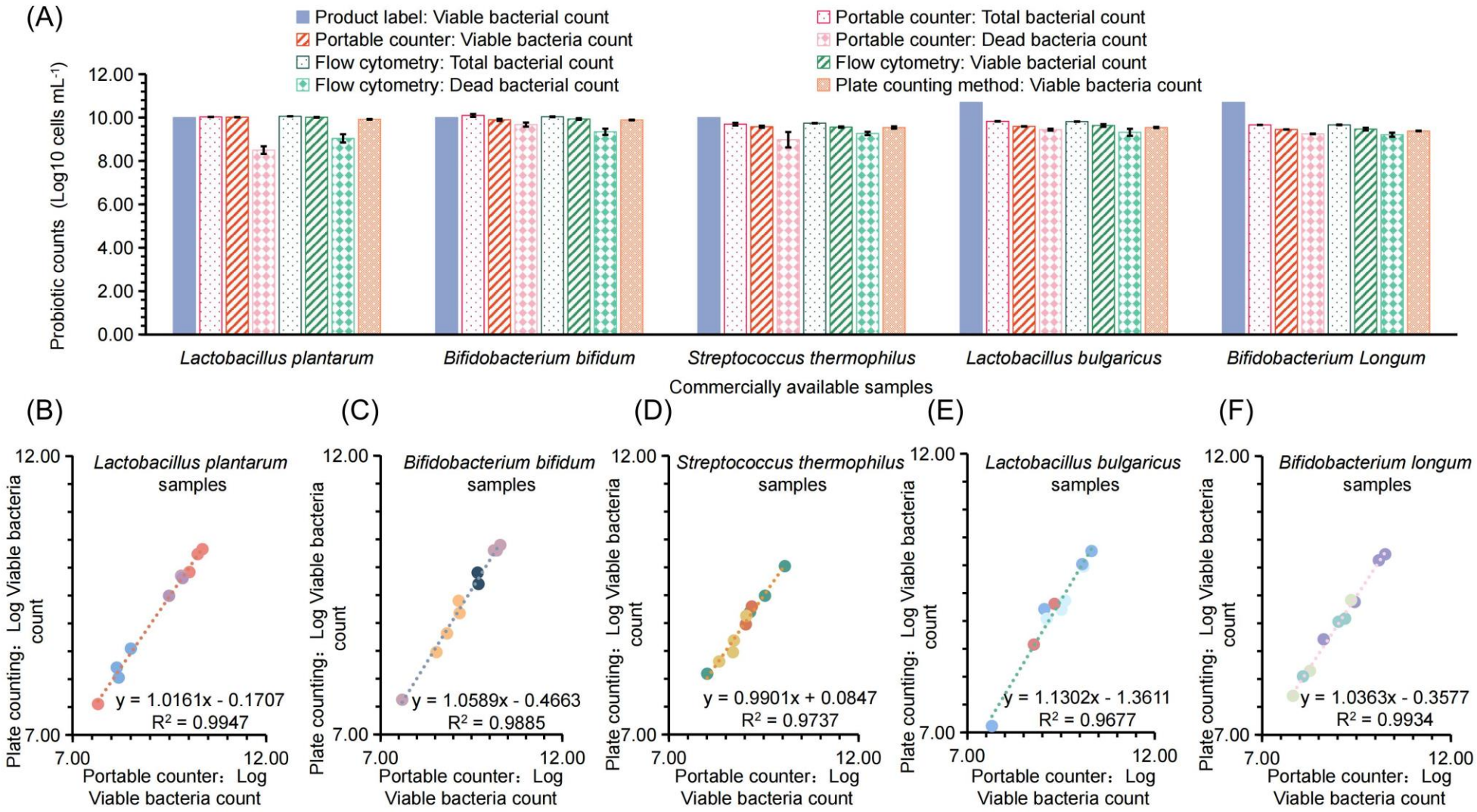


Figure 6 Probiotic counts of commercial samples and comparison with the standard methods

Summary

- This study developed and validated a portable probiotic quantification system.
- The system offers advantages such as compact size, low cost, high accuracy, and rapid detection. Comparison with flow cytometry and plate counting confirmed its accuracy and reliability.
- The platform provides an efficient solution for on-site probiotic viability assessment and holds strong application potential in fields such as food safety, health management, and clinical research.

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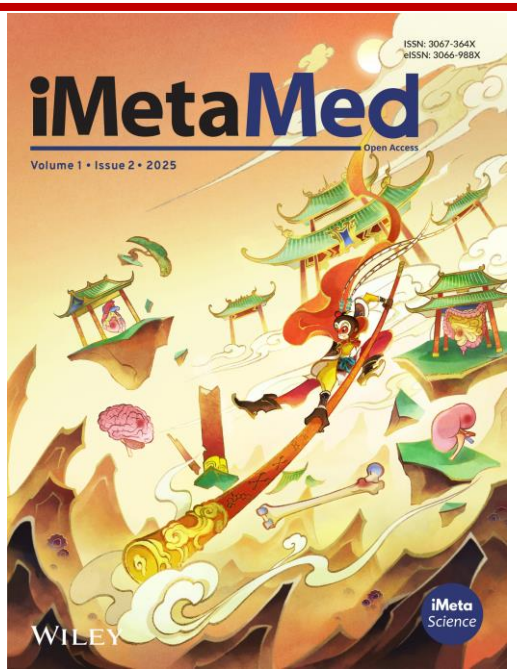

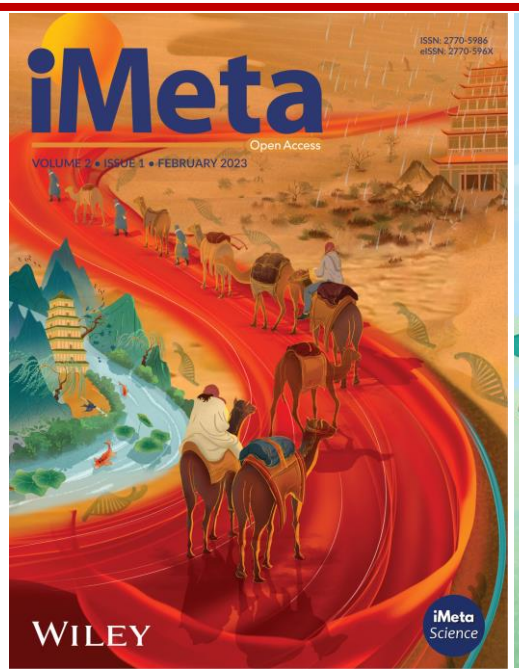

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