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Culture-free, highly sensitive, quantitative detection of bacteria from minimally processed samples using fluorescence imaging by smartphone

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Abstract

A critical unmet need in the diagnosis of bacterial infections, which remain a major cause of human morbidity and mortality, is the detection of scarce bacterial pathogens in a variety of samples in a rapid and quantitative manner. Herein, we demonstrate smartphone-based detection of *Staphylococcus aureus* in a culture-free, rapid, quantitative manner from minimally processed liquid samples using aptamer-functionalized fluorescent magnetic nanoparticles. The tagged *S. aureus* cells were magnetically captured in a detection cassette, and then fluorescence was imaged using a smartphone camera with a light-emitting diode as the excitation source. Our results showed quantitative detection capability with a minimum detectable concentration as low as 10 cfu/ml by counting individual bacteria cells, efficiently capturing *S. aureus* cells directly from a peanut milk sample within 10 min. When the selectivity of detection was investigated using samples spiked with other pathogenic bacteria, no significant non-specific detection

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