Multifunctional nanoparticles for rapid bacterial capture, detection and decontamination

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This research project aims at developing the magnetic fluorescent nanoparticles to quickly capture, detect, and kill bacteria. Engineered nanoparticles (NPs) with multifunctional properties may interact with eukaryotic cells as drug carriers or contrast agents. The interaction between multifunctional NPs and singled microorganisms, e.g. bacteria, however, remains unclear due to their special structure of cell wall. Here, we demonstrate that gentamicin (Gm)-bioconjugating fluorescent and magnetic NPs (FMNPs) capture gram-negative bacteria, e.g. Escherichia coli, E. coli, (1x10^7 CFU mL^-1 from 10 mL of solution) within 20 min. Our findings indicate: FMNPs (diameter = 65±8 nm) alone inert to E. coli, whereas Gm-FMNPs disrupt the cell wall of E. coli first through the ionic bonding between GM and lipopolysaccharide(LPS) on the outer membrane of E. coli; a low concentration of E. coli, ~1x10^3 CFU mL^-1, dramatically changes the fluorescent signal of Gm-FMNPs; the antimicrobial efficiency of Gm for E. coli is improved by ~20% through the conjugation with FMNPs. It indicates the Gm-conjugating FMNPs are able to be a multifunctional platform for bacterial capture, detection, and decontamination simultaneously.

Biography

Jin Zhang received her PhD from the National University of Singapore (NUS) in 2003. Dr. Zhang is now an Assistant Professor of the Department of Chemical and Biochemical Engineering (CBE) at the University of Western Ontario (Western), and an adjunct professor of the Schulich School of Medicine & Dentistry at Western. She has published 25 peer-reviewed journal papers and 14 peer-reviewed proceedings. She has co-authored a book chapter with the publisher Kluwer. As co-inventor, she has two filed patents and one-provisional patent application. Jin was recently recognized as the Grand Challenges Canada-Canadian Rising Stars in Global Health for her research work on “Non-invasive Diagnostic Tool for Diabetes”.

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