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Clustered Regularly Interspaced Short Palindromic Repeats-Mediated Surface-Enhanced Raman Scattering Assay for Multidrug-Resistant Bacteria

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Abstract

Antimicrobial resistance and multidrug resistance are slower-moving pandemics than the fast-spreading coronavirus disease 2019; however, they have potential to cause a much greater threat to global health. Here, we report a clustered regularly interspaced short palindromic repeats (CRISPR)-mediated surface-enhanced Raman scattering (SERS) assay for multidrug-resistant (MDR) bacteria. This assay was developed via a synergistic combination of the specific gene-recognition ability of the CRISPR system, superb sensitivity of SERS, and simple separation property of magnetic nanoparticles. This assay detects three multidrug-resistant (MDR) bacteria, species Staphylococcus aureus, Acinetobacter baumannii, and Klebsiella pneumoniae, without purification or gene amplification steps. Furthermore, MDR A. baumannii-infected mice were successfully diagnosed using the assay. Finally, we demonstrate the on-site capture and detection of MDR bacteria through a combination of the three-dimensional nanopillar array swab and CRISPR-mediated SERS assay. This method may prove effective for the accurate diagnosis of MDR bacterial pathogens, thus preventing severe infection by ensuring appropriate antibiotic treatment.

KEYWORDS:CRISPR/dCas9, surface-enhanced Raman scattering, antimicrobial-resistance, bacteria, nanoparticle

논문정보

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