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Polyaniline-based 3D network structure promotes entrapment and detection of drug-resistant bacteria

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Abstract

Sensitive and accurate capture, enrichment, and identification of drug-resistant bacteria on human skin are important for early-stage diagnosis and treatment of patients. Herein, we constructed a three-dimensional hierarchically structured polyaniline nanoweb (3D HPN) to capture, enrich, and detect drug-resistant bacteria on-site by rubbing infected skins. These unique hierarchical nanostructures enhance bacteria capture efficiency and help severely deform the surface of the bacteria entrapped on them. Therefore, 3D HPN significantly contributes to the effective and reliable recovery of drug-resistant bacteria from the infected skin and the prevention of potential secondary infection. The recovered bacteria were successfully identified by subsequent real-time polymerase chain reaction (PCR) analysis after the lysis process. The molecular analysis results based on a real-time PCR exhibit excellent sensitivity to detecting target bacteria of concentrations ranging from 10^2 to 10^7 CFU/mL without any fluorescent signal interruption. To confirm the field applicability of 3D HPN, it was tested with a drug-resistant model consisting of micropig skin similar to human skin and Klebsiella pneumoniae carbapenemase-producing carbapenem-resistant Enterobacteriaceae (KPC-CRE). The results show that the detection sensitivity of this assay is

10^2 CFU/mL. Therefore, 3D HPN can be extended to on-site pathogen detection systems, along with rapid molecular diagnostics through a simple method, to recover KPC-CRE from the skin.

논문정보

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