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ANCA: artificial nucleic acid circuit with argonaute protein for one-step isothermal detection of antibiotic-resistant bacteria

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Abstract

Endonucleases have recently widely used in molecular diagnostics. Here, we report a strategy to exploit the properties of Argonaute (Ago) proteins for molecular diagnostics by introducing an artificial nucleic

acid circuit with Ago protein (ANCA) method. The ANCA is designed to perform a continuous autocatalytic reaction through cross-catalytic cleavage of the Ago protein, enabling one-step, amplification-free, and isothermal DNA detection. Using the ANCA method, carbapenemase-producing *Klebsiella pneumoniae* (CPKP) are successfully detected without DNA extraction and amplification steps. In addition, we demonstrate the detection of carbapenem-resistant bacteria in human urine and blood samples using the method. We also demonstrate the direct identification of CPKP swabbed from surfaces using the ANCA method in conjunction with a three-dimensional nanopillar structure. Finally, the ANCA method is applied to detect CPKP in rectal swab specimens from infected patients, achieving sensitivity and specificity of 100% and 100%, respectively. The developed method can contribute to simple, rapid and accurate diagnosis of CPKP, which can help prevent nosocomial infections.

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목록

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