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Nanopore biosensor for sensitive and label-free nucleic acid detection based on hybridization chain reaction amplification

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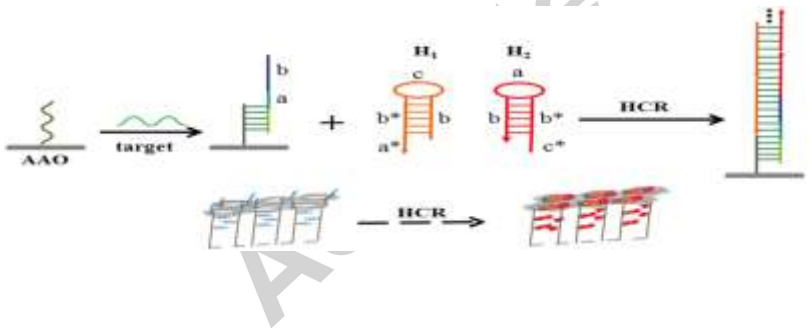
Abstract

A label-free nanopore biosensor for detection of DNA target is proposed utilizing hybridization chain reaction (HCR) strategy for signal amplification. The DNA target triggered HCR to form large DNA nanostructure inside the naopore and out the nanopore membrane, which inducing the ionic current decrease effectively due to the blockage of the nanopore. The developed method achieves a desirable sensitivity of 30 fM with a wide linear dynamic range from 0.1 to 10 pM and demonstrated good application for real sample analysis. This work has great potential to be applied in the early diagnosis of gene-related diseases and provide a new paradigm for label-free nucleic acid amplification strategy in ultrasensitive nanopore biosensor.

Graphical abstract

A label-free nanopore biosensor has been developed for the detection of DNA target with high sensitivity and specificity utilizing hybridization chain reaction as signal amplification strategy.



Keywords

Nanopore biosensor; hybridization chain reaction; label-free; DNA detection

1. Introduction

Nanopores have drawn increasing interest for constructing label-free biosensors in recent years [1-4].The sensing principle with nanopore is simple and straightforward, which is based on changes in ionic current when molecules pass or interact with the nanopore. One approach is to

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