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Zeolite-iron oxide integrated interdigitated electrode sensor for diagnosing cervical cancer

Abstract

Cervical cancer is caused by changes in the cervix that lead to precancerous cells and eventually progress to cancer. Human papillomavirus (HPV) infections are the primary cause of cervical cancer. Early detection of HPV is crucial in preventing cervical cancer, and regular screening for HPV infection can identify cell changes before they develop into cancer. While Pap smear tests are reliable for cervical cancer screening, they are critical, expensive, and labor-intensive. Therefore, researchers are focusing on identifying blood-based biomarkers using biosensors for cervical cancer screening. HPV strains 16, 45, and 18 are common culprits in cervical cancer. This study aimed to develop an HPV-16 DNA biosensor on a zeolite-iron oxide (zeolite-IO) modified interdigitated electrode (IDE) sensor. The DNA probe was immobilized on the IDE through amine-modified zeolite-IO, enhancing the hybridization of the target and DNA probe. The detection limit of the DNA-DNA duplex was found to be 7.5 pM with an R^2 value of 0.9868. Additionally, control experiments with single and triple mismatched sequences showed no increase in current responses, and the identification of target DNA in a serum-spiked sample indicated specific and selective target identification.

Keywords

Cervical cancer; DNA sensor; Interdigitated electrode; Nanomaterial