Chlorogenic acid as an electroactive indicator for detection of target DNA sequence and single-base mismatch related to Helicobacter pylori

Amineh Asadzadeh-Firouzabadi *, Hamid R. Zare *, Navid Nasirizadeh b
a Department of Chemistry, Yazd University, Yazd, 89195-741, Iran, hrzare@yazd.ac.ir
b Department of Chemistry, Yazd Branch, Islamic Azad University, Yazd, Iran

Background: A biosensor is an analytical device which converts a biological response into an electrical signal. It comprises a biorecognition molecule immobilized over a transducer [1]. The basis for DNA hybridization biosensors is the DNA base pairing, namely, the strong interaction between the immobilized probe and the sample target [2]. The detection techniques employed in DNA hybridization biosensors can be optical, electrochemical or mass-based [3, 4]. This research is concerned with the electrochemical detection of DNA hybridization of helicobacter pylori cagE gene using chlorogenic acid (CGA) as an electroactive indicator.

Methods: The surface of a gold electrode, AuE, was hand-polished with 0.05 µm alumina-water slurry using a polishing cloth. The electrode was cleaned by cycling between the potentials -0.3 and +1.5 V versus saturated calomel electrode (SCE) in a 0.1 M H₂SO₄ solution at a scan rate of 100 mV s⁻¹ until reproducible cyclic voltammograms were recorded. The differential pulse voltammetric response of the accumulated CGA on different electrode surfaces was used to assess the DNA hybridization.

Results: The results indicate that CGA has a higher affinity for dsDNA than for ssDNA. Also, complete hybridization is not accomplished with a one-base mismatch sequence and, therefore, the proposed biosensor can be used for detection of a one-base mismatch sequence from a complementary sequence. In order to enhance the selectivity and sensitivity of the proposed biosensor, some experimental factors were optimized. Under optimum conditions, the signal of the indicator for complementary DNA demonstrated a linear relationship within the concentration range of 20.0 to 410.0 nM (R=0.9987) as well as a detection limit of 7.2 nM.

Conclusion: Chlorogenic acid, CGA, was used as an electroactive indicator to assess the hybridization process. The proposed biosensor can be used for detection of a one-base mismatch sequence from a complementary sequence.

Keywords: Chlorogenic acid, DNA biosensor, Hybridization process, Helicobacter pylori.

References