Full Paper

Electrochemical Detection of Abasic Site-Containing DNA

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Received: September 22, 2005
Accepted: November 3, 2005

Abstract
A simple and rapid approach for detecting apurinic (AP) sites in DNA, based on direct stripping chronopotentiometric measurements of the adenine and guanine nucleobases at a graphite electrode is described. Tetrahydrofuranyl residues, lacking a nucleobase moiety, were utilized for designing the AP sites and were incorporated in 19-mer oligonucleotides. The change of adenine-to-guanine response ratio (A/G) in one-, two- or three-substituted adenosine residues for stable analogs of AP sites was exploited for electrochemical measurements of the adenine loss. The resulting A/G response ratio decreases linearly upon increasing the number of AP sites in the oligonucleotides; the values of A/G electrochemical signals were slightly enhanced when compared to the actual purine content. HPLC analysis of the released nucleobases confirmed that the sulfuric acid-induced oligonucleotide cleavage provides complete apurination and dissolution of the released nucleobases in aqueous solution. Additional experiments with mixtures of free nucleobases and purine nucleosides reveal that the larger A/G ratio observed in the electrochemical analysis of AP-site-containing oligomers is attributed to the influence of the acid and/or thermal decomposition products (particularly the sugar fragments). This study represents the first step in developing a simple and direct electrochemical assay of AP sites in single-stranded DNA.

Keywords: DNA damage, Abasic site-containing DNA, Electrochemical detection, Guanine, Adenine

DOI: 10.1002/elan.200503428

Dedicated to Professor Petr Zuman on the Occasion of His 80th Birthday