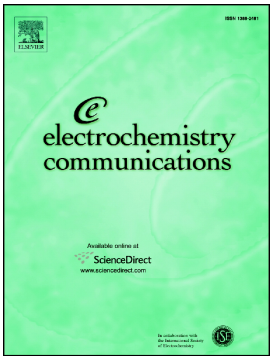

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Detection of abasic DNA by means of impedance spectroscopy

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Abstract

Abasic sites can occur in DNA for different reasons, and thus the detection of this special molecular structure has turned into the focus of research. Here we have investigated the hybridization of abasic ssDNA to immobilized ssDNA probes by impedance spectroscopy. For this purpose three different abasic 25mer ssDNA (abasic site near the electrode; in the middle and near the solution) are studied in comparison to fully complementary 25mer ssDNA. For all abasic strands the surface binding can be followed concentration dependent via impedance spectroscopy; however, the concentration range and the maximum impedance change are found to be different compared to fullmatch ssDNA. Here, the position of the abasic site within the DNA strand significantly determines the signal behavior, and thus even allows a partial discrimination between the different abasic DNA strands. By investigating the binding in parallel by SPR, only slightly smaller surface concentrations are detected for the abasic strands in comparison to the fullmatch strand. This points to the formation of different DNA structures when abasic sites are contained.

Key words:
Abasic DNA, biosensor, impedance spectroscopy, SPR, DNA structure

1. Introduction

Abasic DNA denotes to DNA in which one or more bases are missing. The formation of abasic sites (a-sites) is triggered by hydrolytic cleavage of glycosidic bonds leaving behind deoxyribose residues in the DNA strand. Reasons are various and range from radiation [1–3], genotoxic agents [1,2], intermediate base deletion due to DNA repair mechanism [1] up to spontaneous deletion, such as DNA-breathing [2]. If not fixed, a-sites have mutagenic effects or lethal consequences for the organism [4]. Therefore, interest has turned to the development of reliable and fast detection methods.

Classical methods have used alkaline degradation to detect a-sites by inducing a strand breakage [4,5]. This process can be followed by sedimentation in a sucrose gradient or alkaline elution.