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Dual-aptasensor array for osteopontin detection: Optimization of the aptamers immobilization

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Introduction

Cancer diseases are associated with the presence of several protein biomarkers. Aptasensor arrays allow early multiple-detection of these biomarkers which can hold significant improvements in the cancer patients lives. Clinical studies suggest that osteopontin, a protein that is overexpressed in tumor cells, may be potentially used as a diagnostic and prognostic biomarker for several cancers.

Objectives

The aim of this work is to optimize the experimental conditions to build a label-free voltammetric dual-aptasensor array for the detection of human osteopontin using a 2^k factorial experimental design.

Methodology

Cleaning working gold electrode surface → Homogenization of the working gold electrode → Immobilization of DNA and RNA aptamer → Electrochemical measurements by cyclic voltammetry (CV) and square wave voltammetry (SWV) → Osteopontin incubation → Electrochemical measurements (CV and SWV)

$$\Delta I\ (\%) = (I_0 - I_1)/I_0 \times 100$$

where ΔI is the relative current change (%), I_0 and I_1 represents the peak current before and after the sample incubation, respectively

Experimental setup

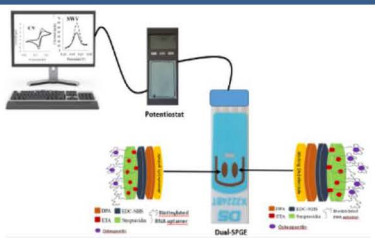

Fig. 1: Immobilization and electrochemical measurements

Results

Dual-aptasensor array response

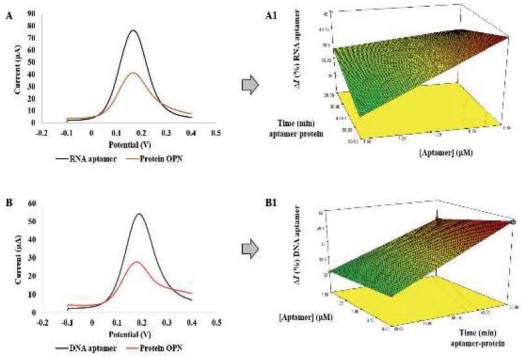

Fig.2 : SWV response for two aptamers with 200 nM of protein OPN (A and B) and optimal experimental immobilization conditions by 2^k factorial experimental design for (A1) RNA aptamer and (B1) DNA aptamer at 4°C and 30 min of aptamer incubation

Conclusions

Optimal experimental immobilization conditions

	RNA aptamer	DNA aptamer
Aptamer concentration (µM)	0.5	0.5
Time (min) aptamer immobilization into Dual-SPGE	**60**	**20**
Time (min) aptamer-protein interaction	30	30
Incubation temperature (°C)	4	4

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