Accepted Manuscript

A conductometric creatinine biosensor prepared through contact printing of polyvinyl alcohol/polyethyleneimine based enzymatic membrane

Mohamed Braiek, Mohamed Amine Djebbi, Jean-François Chateaux, Anne Bonhomme, Roberto Vargiolu, François Bessueille, Nicole Jaffrezic-Renault

PII: S0167-9317(17)30394-5
DOI: doi:10.1016/j.mee.2017.11.018
Reference: MEE 10669

To appear in: *Microelectronic Engineering*

Received date: 16 August 2017
Revised date: 12 November 2017
Accepted date: 28 November 2017

Please cite this article as: Mohamed Braiek, Mohamed Amine Djebbi, Jean-François Chateaux, Anne Bonhomme, Roberto Vargiolu, François Bessueille, Nicole Jaffrezic-Renault , A conductometric creatinine biosensor prepared through contact printing of polyvinyl alcohol/polyethyleneimine based enzymatic membrane. The address for the corresponding author was captured as affiliation for all authors. Please check if appropriate. Mee(2017), doi:10.1016/j.mee.2017.11.018

A conductometric creatinine biosensor prepared through contact printing of polyvinyl alcohol/polyethyleneimine based enzymatic membrane.

Mohamed Braiek[a], Mohamed Amine Djebbi[a], Jean-François Chateaux[b], Anne Bonhomme[a], Roberto Vargiolu[c], François Bessueille[a], Nicole Jaffrezic-Renault[a*]

[a]University of Lyon, Institute of Analytical Sciences, UMR-CNRS 5280, 5, La Doua Street, Villeurbanne 69100, France
[b]University of Lyon, Institute of Nanotechnology, UMR-CNRS 5270, 43 Boulevard 11 November 1918, 69622 Villeurbanne Cedex, France
[c]University of Lyon, Laboratory of Tribology and Dynamic of Systems, UMR-CNRS 5513, ENISE–ECL, 36 Avenue Guy de Collongue, 69131 Ecully, France

*Corresponding author: email address: nicole.jaffrezic@univ-lyon1.fr. Full postal address: Institute of Analytical Sciences, UMR-CNRS 5280, 5, La Doua Street, Villeurbanne 69100, France

Abstract

A conductometric creatinine biosensor was prepared through creatinine deaminase entrapped into a polyvinyl alcohol/polyethyleneimine/gold nanoparticles composite film, previously deposited on the surface of a PDMS stamp and then, after glutaraldehyde coupling, transferred on interdigitated microelectrodes by contact printing method. The detection of creatinine in a sucrose background solution, revealed a wide linear calibration plot (10–600 µM creatinine concentration range), with a limit of detection of 2 µM (S/N = 3), a good repeatability. The resulting creatinine biosensor exhibits a drastic increase of detection range compared to that of the biosensor prepared by simple dropping: 10–300 µM creatinine concentration range. The developed biosensor was validated by determining creatinine in spiked artificial blood serum.

1. Introduction

Creatinine, (2-amino-1-methyl-imidazolin-4-one) is the final product of creatine metabolism in mammals, which ocurs in skeletal muscles to release energy. It is extracted from the blood through renal function. Kidney problems, thyroid malfunction and muscular disorder lead to increase of creatinine concentration in blood, therefore measuring creatinine concentration in blood or in serum leads to diagnose those disorders. Its concentration in serum can arise from 35 – 140 µM to 1 mM during kidney malfunction. However, it can fall below 40 µM due to decreasing of muscle mass [1]. It is usually determined by a spectrophotometric method based on the Jaffe's reaction, despite the high volume of sample required and the poor selectivity of