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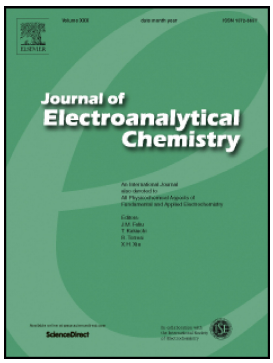

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PII: S1572-6657(17)30803-2
DOI: doi:10.1016/j.jelechem.2017.11.025
Reference: JEAC 3655

To appear in: *Journal of Electroanalytical Chemistry*

Received date: 5 July 2017
Revised date: 3 November 2017
Accepted date: 7 November 2017

Please cite this article as: Nihal Ermiş, Lokman Uzun, Adil Denizli , Preparation of molecularly imprinted electrochemical sensor for l-phenylalanine detection and its application. The address for the corresponding author was captured as affiliation for all authors. Please check if appropriate. Jeac(2017), doi:10.1016/j.jelechem.2017.11.025

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ACCEPTED MANUSCRIPT

Preparation of Molecularly Imprinted Electrochemical Sensor For L-Phenylalanine Detection and its Application

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Abstract

For selective and sensitive determination of L-phenylalanine (L-Phe) a novel and reliable electrochemical sensor has been developed based on molecular imprinting technique. Thiophen-3-carbonyl tryptophan (TP3C-Trp) has been synthesized and used as a novel monomer. L-Phe was used as template molecule and imprinted in presence of thiophen and thiophen-3-carbonyl tryptophan (TP3C-Trp), used as functional monomers. As a comparison a non-modified polymer surface was also prepared under same circumstances without template molecule, L-Phe. The characterization studies of both non-imprinted (NIP) and L-Phenylalanine imprinted (MIP) electrochemical sensor surfaces were made by using atomic force microscopy (AFM), Fourier transform infrared spectroscopy (FTIR), ellipsometry and contact angle measurements. The electrochemical characterization analysis were made via square wave and cyclic voltammetry. The linearity range and the detection limit of the developed sensor were obtained as $1.0x10^{-8}$–$1.0x10^{-7}$ M and $1.0x10^{-9}$ M, respectively.

1. Introduction

Phenylalanine (Phe) is an essential non-polar amino acid and shows hydrophobic feature because of its aromatic group. It is also metabolic precursor of non-essential amino acid tyrosine and derivatives. It is used in pharmaceutical industry, to fabricate some antibiotics like bacitracin, gramicidin, tirocidin and in food industry used as sweetener, aspartame [1,2]. It is converted to tyrosine (Tyr) in presence of phenylalanine hydroxylase enzyme (PAH). Tyrosine is the precursor of monoamine neurotransmitters, such as dopamine, epinephrine and norepinephrine which are associated with depression and lack of motivation. Therefore Phe is important to maintain adequate levels of monoamine neurotransmitters in the brain. When L-phenylalanine crosses into the brain in the presence of PAH, it is converted to L-tyrosine and then to L-dopa which is further converted into the three neurotransmitters mentioned above. Adrenaline and noradrenaline are synthesised from dopamine, which is itself made from the amino acid phenylalanine via tyrosine. It is well known that

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