
ELECTROCHEMILUMINESCENCE IN TRYPTOPHAN / TETRAPHENYLBORATE SYSTEM FOR BIOSAMPLES ASSAY

Yuriy Zholudov*^{†1,2}, Natalia Lysak^{1,3}, and Guobao Xu^{‡2}

¹Kharkiv National University of Radio Electronics (NURE) – 14 Nauka Ave., Kharkiv, 61166, Ukraine

²State Key Laboratory of Electroanalytical Chemistry, Changchun Institute of Applied Chemistry
(SKLEAC) – 5625 Renmin Street, Changchun, Jilin 130022, China

³V.N. Karazin Kharkiv National University (KhNU) – 4 Svobody Sq., Kharkiv, 61022, Ukraine

Abstract

L-tryptophan is one of the most important essential amino acids which role in the human body is invaluable. It participates in maintaining of nitrogen balance in metabolism, in the synthesis of muscle proteins, enzymes, antibodies of the immune system and other biologically active substances. Thus the development of reliable methods for quantitative determination of this compound in biosamples, foods and medicines is an actual task for today.

Electrogenerated chemiluminescence (ECL) is a kind of non-optically excited luminescence in solutions during electrolysis. Due to high selectivity, sensitivity and a low detection limit it is a powerful analytical tool in biology, medicine, ecology and other areas. It combines the advantages of chemiluminescent and electrochemical detection techniques and eliminates their drawbacks.

Tryptophan belongs to the class of luminescent amino acids. In this work it was used as an electrochemiluminophore in ECL reaction with sodium tetraphenylborate (TPB) coreactant. Excitation of ECL was done using pulse amperometry method. It was found that ECL spectrum of tryptophan/TPB system does not coincide with the fluorescence spectrum of amino acid (peak of ECL at 505 nm, peak of PL at 350 nm). Thus we believe that the emission is associated with the product of tryptophan oxidation.

During this study the optimal conditions for tryptophan detection were established, namely applied oxidation potential, concentration of coreactant, time of deoxygenation and voltage pulse parameters. Under the optimized conditions the limit of tryptophan detection was 0.2 μM with the linearity range of 0.3 - 300 μM . It has an application potential in a number of areas including biological samples assay, pharmacy and foods industry.

The work was supported by President's International Fellowship Initiative for visiting scientists of the Chinese Academy of Sciences and Projects for young scientists of the Ministry of Education and Science of Ukraine.

Keywords: ECL, tryptophan, coreactant, assay

*Speaker

[†]Corresponding author: yurets.zh@gmail.com

[‡]Corresponding author: guobaoyu@ciac.ac.cn