

# STRUCTURE OF CHEMICAL COMPOUNDS, METHODS OF ANALYSIS AND PROCESS CONTROL

## SELECTIVE VOLTAMMETRIC DETERMINATION OF SULFUR-CONTAINING AMINO ACIDS IN DRUGS AND VITAMIN COMPLEXES ON AN ELECTRODE MODIFIED BY A RUTHENIUM-HEXACHLOROPLATINATE FILM

L. G. Shaidarova,<sup>1,\*</sup> A. V. Gedmina,<sup>1</sup> É. R. Zhaldak,<sup>1</sup> I. A. Chelnokova,<sup>1</sup>  
V. D. Demina,<sup>1</sup> and G. K. Budnikov<sup>1</sup>

Translated from *Khimiko-Farmatsevticheskiy Zhurnal*, Vol. 52, No. 2, pp. 34 – 39, February, 2018.

*Original article submitted April 18, 2016.*

An inorganic film of ruthenium hexachloroplatinate (RuPtCl<sub>6</sub>) deposited on the surface of a glassy-carbon electrode exhibited catalytic activity for oxidation of S-containing amino acids. Catalytic electrochemical oxidation of cysteine, cystine, and methionine occurred at various potentials. The optimum conditions for producing a RuPtCl<sub>6</sub> film that gave the greatest catalytic effect were found. A method for selective voltammetric determination of cysteine, methionine, and cystine at an RuPtCl<sub>6</sub>-film electrode was developed. The lower limit of quantitation of cysteine and cystine was  $5 \times 10^{-6}$  M; of methionine,  $5 \times 10^{-7}$  M. The proposed voltammetric method was used to determine cysteine, cystine, and methionine in drugs and vitamin complexes.

**Keywords:** analysis of drugs and vitamin complexes, electrocatalysis, amino acids, ruthenium hexachloroplatinate.

S-containing amino acids fulfill various and very important functions in the human body and are involved in ion exchange driving the calcium—sodium pump in cell membranes, formation of skin tissues, and activation of leukocytes and lymphocytes [1, 2]. Cystine and cysteine are used as drug components for complex therapy of heavy-metal intoxication, atherosclerosis, lung emphysema, tuberculosis, rheumatoid arthritis, recovery after operations and burns, chemotherapy, and radiotherapy. Methionine is indicated for treating and preventing diseases and toxic damage of the liver (cirrhosis, chronic hepatitis) and pancreas (chronic pancreatitis, diabetes mellitus).

Recently, S-containing amino acids have been broadly used in cosmetics, in particular, to prevent premature skin

aging, hair damage, alopecia, frailty, nail disintegration, etc. Therefore, the examined S-containing amino acids are included in not only various drugs but also vitamin complexes [1, 2].

HPLC with a mass-spectrometric detector [3] and spectroscopic [4] and electrochemical methods [5] have been used to detect and determine S-containing amino acids in complicated medical and biological matrices. Chromatographic and spectroscopic methods require the use of expensive equipment and preliminary derivatization based on reducing the amino acids to thiols followed by reacting them with chromophores and fluorophores. This increases the cost and time for the analysis itself.

Voltammetric methods differ from the above methods by high sensitivity, simple experimental setup, rapidity, and low cost. Metal, carbon, and chemically modified electrodes (CMEs) are used as working electrodes in voltammetric analytical methods [5 – 7]. The sensitivity and selectivity for de-

<sup>1</sup> A. M. Butlerov Chemical Institute, Kazan Federal University, 18 Kremlevskaya St., Kazan, Tatarstan, 420008 Russia.

\* e-mail: LarisaShaidarova@mail.ru