ЭЛЕКТРОХИМИЯ, 2022, том 58, № 7, с. 423–424

ABSTRACTS

QUANTITATIVE EVALUATION OF GENERIC GLYPHOSATE USING CARBON PASTE ELECTRODE ELECTROCHEMICALLY MODIFIED WITH COPPER IONS

© 2022 Youssef Ibrahim Moharram[a], *, Ibrahim Shibl El-Hallag[a], **, *, and Sameh Mahmoud Selim[b], ******

[a] *Analytical and Electrochemistry Research Unit, Chemistry Department, Faculty of Science, Tanta Univeristy, Tanta, 31111 Egypt*

[b] *Microanalysis Laboratory, Kz Corporation for Pesticides and Chemicals, Nubaria, Egypt*

**e-mail: yimoharram@hotmail.com*

***e-mail: sameh_selim2015@yahoo.com*

****e-mail: i.elhallag@yahoo.com*

*****e-mail: samehselim3@gmail.com*

Received December 4, 2019; revised March 3, 2020; accepted May 15, 2020

Generic products are not identical to their branded equivalents. They are typically off-patent. Therefore, this paper suggests a selective, reliable, and accurate electrochemical method for quantifying the original and generic glyphosate from Monsanto Roundup®, USA and Rotam Agrochemicals, Hong Kong. The reliability of the suggested electroanalytical method was assured. An electrochemically modified carbon paste electrode was used as a working electrode. This working electrode was constructed by depositing a copper layer electrochemically using chronoamperometry under continuous stirring. The copper deposition was conducted for 180 s at the potential of –0.8 V from an aqueous solution of copper sulphate pentahydrate at pH 6.5. Adjust by adding phosphate buffer. Cyclic voltammograms for electrochemically modified CPE versus Ag/AgCl were recorded between (–0.8 : 1.4 V) at a scan rate of 0.1 V s^{-1} in solutions with and without glyphosate. The results showed an enhancing in the oxidation peak current of the copper previously deposited on CPE by the addition of glyphosate. This enhancing in copper oxidation peak may be attributed to glyphosate adsorption on the surface of the electrode and formation of a complex. SW-ASV method was used as an efficient electroanalytical technique for glyphosate quantification. The operating parameters such as accumulation potential and accumulation time were optimized to give maximum oxidation peak current of copper. Calibration curves were constructed in a concentration range (2×10^{-6} : 2×10^{-4} mol L^{-1}) for generic, original and standard glyphosate. Calibration curve method was adopted in a comparison. It was observed that there are very minor differences in the slopes of generic, original, and standard glyphosate (0.2982–0.2993–0.2957 μA/μM) respectively.

Keywords: generic glyphosate, square-wave anodic stripping voltammetry, electrodeposited copper layer, electrochemically modified CPE, chronoamperometry

DOI: 10.31857/S0424857022040119

CONCLUSIONS

This paper has introduced an easy, fast and effective method to quantify glyphosate in its generic form from (Rotam Agrochemicals, Hong-Kong) and original form from (Monsanto-Roundup, USA) as commercial formulations and compare them using the certified reference material of glyphosate from (LGC, Germany). This was done through two steps: the first one was the preparing of electrochemically modified carbon paste electrode and evaluation of its effectiveness using cyclic voltammetric technique under previously optimized conditions. These conditions include scan rate at 100 mV s^{-1}, phosphate buffer at pH 6.5, 1 mM $CuSO_4 \cdot 5H_2O$ as deposition solution. The second step was to use the more sensitive SW-ASV technique to quantify glyphosate under previously optimized conditions including accumulation potential at –0.8 V, accumulation time at 120 s, phosphate buffer at pH 6.5, and various concentrations of glyphosate. By using CRM of glyphosate, the results showed that there was a well fitted linear relationship between the net signal value of the peak current i_p (μA) corresponding to glyphosate concentrations c (μM) in the range of concentrations 2 : 200 μM. depending on this linear relationship a reliable calibration curve was successfully built. Further by constructing calibration

curves for the generic and original glyphosate, the results showed that there were insignificant differences in the slopes corresponding to generic glyphosate from (Rotam), original glyphosate from (Monsanto), and standard glyphosate from (LGC-Germany). These slopes have values of (0.2982–0.2993–0.2957 μA/μM) respectively. Based on these results, glyphosate can be quantified in quality control samples in its commercial form, whether generic or original using previously mentioned method.

This is an excerpt of the article "Quantitative Evaluation of Generic Glyphosate Using Carbon Paste Electrode Electrochemically Modified with Copper Ions."

Full text of the paper is published in Russian J. Electrochemistry, 2021, vol. 57, p. 644.