proceedings

Abstract

Sensors for the Determination of Organic Load (Chemical Oxygen Demand) Utilizing Copper/Copper Oxide Nanoparticle Electrodes †

Qing Wang * and Manel del Valle *

Group of Sensors and Biosensors, Department of Chemistry, Universitat Autònoma de Barcelona, 08193 Bellaterra, Barcelona, Spain

* Correspondence: arieswq@163.com (Q.W.); manel.delvalle@gmail.com (M.d.V.)

† Presented at the 6th International Electronic Conference on Sensors and Applications, 15–30 November 2019; Available online: https://ecsa-6.sciforum.net/.

Published: 14 November 2019

Abstract: Chemical oxygen demand (COD) is a widely used parameter in analyzing and controlling the degree of pollution in water. Methods of analysis based on electrochemical sensors are increasingly being used for COD quantitation because they could be simple, accurate, sensitive and environmentally friendly. Electro-oxidizing the organic contaminants to completely transform them into CO_2 and H_2O is considered the best method for COD estimation using sensors. In this sense, copper electrodes have been reported based on the fact that copper in alkaline media acts as a powerful electrocatalyst for oxidation of aminoacids and carbohydrates, which are believed to be the major culprits of organic pollution. In this work, three kinds of copper/copper oxide electrodes were studied that employed the cyclic voltammetry technique: electrodeposited copper nanoparticle electrode, copper nanoparticle–graphite composite electrode and copper oxide nanoparticle–graphite composite electrode. Actual COD estimations are based on the measurements of oxidation currents of organic compounds. Glucose, potassium hydrogen phthalate and ethylene glycol were chosen to be the standard substances to observe the responses, and to correlate the current intensity vs. the COD values. The performed calibrations showed that glucose and ethylene glycol can be oxidized by these three electrodes, as the current intensity increased along with increasing concentrations. However, only the electrodeposited copper nanoparticle electrode showed the ability to oxidize potassium hydrogen phthalate. Besides, the obtained voltammetric profiles presented different shapes with the tested organic compounds, suggesting this can be used as a potential fingerprint for distinguishing the organic compounds. Ongoing work is focused on optimizing measuring conditions and detecting the COD values of real samples.

Keywords: voltammetry; copper nanoparticles; organic load; chemical oxygen demand

© 2019 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (http://creativecommons.org/licenses/by/4.0/).