

Abstract

Sensing of Nickel(II) Ions by Immobilizing Ligands and Using Different SPEs †

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† Presented at the 8th International Symposium on Sensor Science, 17–26 May 2021; Available online:

<https://i3s2021dresden.sciforum.net/>.

Published: date

Abstract: The aim of this paper is the development of a sensor for the quantification of nickel ions in food raw materials and foods. It seems that about 15% of the human population suffers from nickel allergy. In addition to digestive manifestations, food intolerance to nickel may also have systemic manifestations, such as: diffuse dermatitis, diffuse itching, fever, rhinitis, headache, altered general condition. Therefore, it is necessary to control this content of nickel ions for the health of the human population by developing this new method that brings advantages such as: it is fast, not expensive, in situ and provides accurate analysis. For this purpose, bismuth oxide –SPEs (screen-printed electrodes) and graphene modified SPEs were used with very small amount of dimethylglyoxime and amino acid L-histidine which were deposited. A potentiostat which displays the response in the form of a cyclic voltammogram was used to study the electrochemical properties of nickel standard solution with different concentration. The results were compared and the most sensitive sensor proved to be bismuth oxide –SPEs with dimethylglyoxime (Bi₂O₃/C - dmGH₂) with a linear response over a wide range (0.1–10 ppm) of nickel concentrations. Furthermore, the sensor shows excellent selectivity in the presence of common interfering species. The Bi₂O₃/C - dmGH₂ sensor showed good viability for nickel analysis in food samples (cocoa, spinach, cabbage and red wine) and demonstrated significant advancement in sensor technology for practical applications.

Keywords: bismuth (III) oxide; cyclic voltammetry; nickel sensor; screen-printed electrodes