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Abstract

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

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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 is believed 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 a new method that offers the advantages of a fast, not expensive, in situ, and accurate analysis. For this purpose, bismuth oxide-screen-printed electrodes (SPEs) and graphene-modified SPEs were used with a very small amount of dimethylglyoxime and amino acid L-histidine that were deposited. A potentiostat that displays the response in the form of a cyclic voltammogram was used to study the electrochemical properties of nickel standard solution with different concentrations. The results were compared and the most sensitive sensor proved to be bismuth oxide-SPEs with dimethylglyoxime (Bi_2O_3/C-dmgH_2) 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 Bi_2O_3/C-dmgH_2 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

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