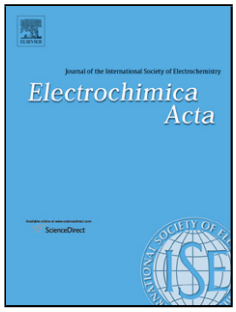

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PII: S0013-4686(15)00573-3
DOI: http://dx.doi.org/doi:10.1016/j.electacta.2015.03.003
Reference: EA 24517

To appear in: *Electrochimica Acta*

Received date: 8-12-2014
Revised date: 1-3-2015
Accepted date: 1-3-2015

Please cite this article as: Abigail Asha Abraham, Majid Rezayi, Ninie S.A.Manan, Leila Narimani, Ahmad Nazmi Bin Rosli, Yatimah Alias, A Novel Potentiometric Sensor Based on 1,2-Bis(N'-benzoylthioureido)benzene and Reduced Graphene Oxide for Determination of Lead (II) Cation in Raw Milk, Electrochimica Acta http://dx.doi.org/10.1016/j.electacta.2015.03.003

A Novel Potentiometric Sensor Based on 1,2-Bis(N'-benzoylthioureido)benzene and Reduced Graphene Oxide for Determination of Lead (II) Cation in Raw Milk

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Abstract:

We have developed a highly sensitive and selective potentiometric PVC-membrane sensor for lead (II) cation. A glassy carbon electrode (GCE) was modified with synthesized 1,2-Bis(N'-benzoylthioureido)benzene (BBTB) as an ionophore and reduced graphene oxide (RGO), and this material was characterized by scanning electron microscopy. The sensor shows sensitive and highly selective response to Pb(II) ion with a linear range from 6.31×10^{-8} to 3.98×10^{-2}M, Nernstian slope of 30.37±0.62 mV per decade and a detection limit of 2.51×10^{-8}M. The proposed sensor could be used in a pH range of 4.0-8.0. Selectivity coefficients were determined for known common cations by applying the match potential method (MPM). The sensor was successfully applied to monitor Pb(II) in raw milk and in potentiometric titration of Pb^{2+} ions. The structure of BBTB ligand and its complexation with some common cations were investigated by using quantum mechanical DFT calculations. Lead (II) cation showed prominent affinity to the BBTB carrier.

Keywords: Potentiometric sensor; lead (II) cation; 1,2-Bis(N'-benzoylthioureido)benzene; Reduced graphene oxide; raw milk.

Introduction

Many researchers have shown great interest in the past decade in the development and application of lead ion selective electrode [1]. New ionophores in construction of ion selective electrodes have been extensively studied [2-4]. During the last decade, the potentiometric and voltammetric sensors based on ionophores with high selectivity for specific metal ions have been developed to detect respective metal ions [5-11]. Heavy metal ions with consanguineous attraction connection and soft coordination center such as N, S, Se, and P have been reported; therefore, the functional groups containing N, S, Se, and P atoms in thioether, thiaayloxy, arylthiaalkoxy, pyridyl and benzothiazoyl groups would significantly improve the selectivity of ionophore to the heavy metal ion [12-17].