Ain Shams University
Faculty of Women's for Arts
Science and Education
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New Designs for Chemical Ion Sensors and Their Use in Environmental and Industrial Applications

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In
Inorganic and Analytical Chemistry

Submitted by

Samar Ezzat Mohamed Ouda
B.Sc. (2013)

Supervised by

Prof. Dr. Mona Abd El-Aziz Ahmed
Prof. of Analytical Chemistry, Chemistry Department
Faculty of Women of Arts, Science and Education, Ain Shams University

Prof. Dr. Ayman Helmy Kamel
Prof. of Analytical Chemistry, Chemistry Department
Faculty of Science, Ain Shams University

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Faculty of Women's for Arts
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Approval Sheet

New designs for Chemical Ion Sensors and Their Use in Environmental and Industrial Applications

Name of the candidate**:**

Samar Ezzat Mohamed Ouda

This thesis has been approved for submission by

Prof. Dr. Mona Abdel Aziz Ahmed ……

Prof. of Analytical Chemistry,
Faculty of Women of Arts, Science and Education, Ain Shams University

Prof. Dr. Ayman Helmy Kamel **……**

Prof. of Analytical Chemistry, Faculty of Science, Ain Shams University

Prof. Dr.Saad El-Sayed Mohamed Hassan **……**

Prof. of Analytical Chemistry, Faculty of Science, Ain Shams University

Prof. Dr. Taha Abdel Azem Mohamed El-Razak **……**

Prof. of Analytical and Environmental Chemistry, Institute of Environmental Studies and Research, Ain Shams University

Head of Chemistry Department

……..

Approval Stamp

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Approval of Faculty Council

/ /2020

Date of approval

/ /2020

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❖ Published papers extracted from the master thesis:

1. Single-Piece All-Solid-State Potential Ion Selective Electrodes Integrated with Molecularly Imprinted Polymers (MIPs) for Neutral 2,4-Dichlorophenol Assessment.

2. Modified potentiometric screen-printed electrodes based on imprinting character for bile acids determination: Application to Bovine human serum quantification

materials

MDPI

Article

Single-Piece All-Solid-State Potential Ion-Selective Electrodes Integrated with Molecularly Imprinted Polymers (MIPs) for Neutral 2,4-Dichlorophenol Assessment

Samar Ezzat [1,2], Mona A. Ahmed [2], Abd El-Galil E. Amr [3,4,*], Mohamed A. Al-Omar [3], Ayman H. Kamel [1] and Nagy M. Khalifa [3,4]

1 Department of Chemistry, Faculty of Science, Ain Shams University, 11566 Cairo, Egypt
2 Chemistry Department, College for Women, Ain Shams University, Heliopolis, 11751 Cairo, Egypt
3 Pharmaceutical Chemistry Department, Drug Exploration & Development Chair (DEDC), College of Pharmacy, King Saud University, Riyadh 11451, Saudi Arabia
4 Applied Organic Chemistry Department, National Research Center, 12622 Giza, Egypt
* Correspondence: aamr@ksu.edu.sa; Tel.: +966-565-148-750

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Abstract: A novel single-piece all-solid-state ion-selective electrode (SC/ISE) based on carbon-screen printed is introduced. Polyaniline (PANI) is dissolved in a membrane cocktail that contains the same components used for making a conventional ion-selective polyvinyl chloride (PVC) matrix membrane. The membrane, having the PANI, is directly drop-casted on a carbon substrate (screen-printed-carbon electrode). PANI was added to act as an intermediary between the substrate and the membrane for the charge transfer process. Under non-equilibrium sensing mechanism, the sensors revealed high sensitivity towards 2,4-dichlorophenol (DCP) over the linearity range 0.47 to 13 µM and a detection limit 0.13 µm. The selectivity was measured by the modified separate solution method (MSSM) and showed good selectivity towards 2,4-DCP over the most commonly studied ions. All measurements were done in 30 mm Tris buffer solution at a pH 5.0. Using constant-current chronopotentiometry, the potential drift for the proposed electrodes was checked. Improvement in the potential stability of the SPE was observed after the addition of PANI in the sensing membrane as compared to the corresponding coated-wire electrode (membrane without PANI). The applicability of the sensor has been checked by measuring 2,4-DCP in different water samples and the results were compared with the standard HPLC method.

Keywords: solid-contact ISEs; molecularly imprinted polymers (MIPs); chlorophenols; 2,4-dichlorophenol; neutral response mechanism.

1. Introduction

Chlorophenols, a class of organic pollutants, have recently drawn considerable attention. These organochlorine compounds have been classified as persistent organic pollutants (POPs) as well as endocrine disrupting compounds (EDCs) [1–3]. Due to their constancy in aquatic environments, they can be released to either surface or ground waters as good as bottom sediments. 2,4-DCP has been widely applied in the yield of various herbicides, pesticides, preservatives, and plant growth regulators [4]. Most of the chlorinated phenols can be found and are accumulated in the human body through the food cycle. They can cause felled effects such as faintness, itch, anemia, and cancer risk at extremely low concentration levels [3,5]. After inhalation of 2,4-DCP, the respiratory tract is irritated and this is harmful to the liver, kidneys and organs forming blood [6–9]. Long exposure to 2,4-DCP can

biomolecules

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Article

Modified Potentiometric Screen-Printed Electrodes Based on Imprinting Character for Sodium Deoxycholate Determination

Ayman H. Kamel[1,*], Samar Ezzat [1,2], Mona A. Ahmed[2], Abd El-Galil E. Amr[3,4,*], Abdulrahman A. Almehizia[3] and Mohamed A. Al-Omar[3]

[1] Department of Chemistry, Faculty of Science, Ain Shams University, 11566 Cairo, Egypt; s.ezzat.ouda@gmail.com

[2] Chemistry Department, College for Women, Ain Shams University, Heliopolis, 11751 Cairo, Egypt; abdelaziz.mona@gmail.com

[3] Pharmaceutical Chemistry Department, Drug Exploration & Development Chair (DEDC), College of Pharmacy, King Saud University, Riyadh 11451, Saudi Arabia; mehizia@ksu.edu.sa (A.A.A.); malomar1@ksu.edu.sa (M.A.A.-O.)

[4] Applied Organic Chemistry Department, National Research Center, 12622 Giza, Egypt

* Correspondence: abkamel76@sci.asu.edu.eg (A.H.K.); aamr@ksu.edu.sa (A.E.-G.E.A.); Tel.: +20-1000-361-328 (A.H.K.); +966-565-148-750 (A.E.-G.E.A.)

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Abstract: Potentiometric sensors have a great influence on the determination of most various compounds in their matrices. Therefore, efficient and new sensors were introduced to measure sodium Deoxycholate (NaDC) as a bile acid salt. These sensors are based on NaDC imprinted polymer (MIP) as sensory element. The MIP beads were synthesized using thermal polymerization pathway, in which acrylamide (AAm), ethylene glycol dimethacrylate (EGDMA), NaDC, and benzoyl peroxide (BPO) were used as the functional monomer, cross-linker, template, and initiator, respectively. The proposed sensors were fabricated using a coated screen-printed platform and the sensing membrane was modified by single-walled carbon nanotubes (SWCNTs) as an ion-to-electron transducer. The sensors exhibited high sensitivity that reached 4.7×10^{-5} M of near-Nernstian slope (−60.1 ± 0.9 mV/decade, $r^2 = 0.999$ (n= 5)). In addition, the sensors revealed high selectivity, long lifetime, high potential stability, and conductivity that ensure reproducible and accurate results over a long time. MIP characterization was performed using Fourier Transform-Infrared (FT-IR) and a scanning electron microscope (SEM). Regarding the interaction of NaDC with serum albumin (SA), albumin is determined in human serum samples as human serum albumin (HSA), which was collected from different volunteers of different ages and gender.

Keywords: sodium deoxycholate (NaDC); molecular imprinted polymer (MIP); screen-printed ion selective electrodes; single-walled carbon nanotubes (SWCNTs); human serum albumin (HSA)

1. Introduction

Sodium deoxycholate (NaDC) compound (Figure 1) is considered as one of the bile acid salts that biosynthesized in the liver of the human body from cholesterol moiety. These bile salts have a great biological role as an emulsifiers for different biological compounds in the body such as fat-soluble vitamins in the intestine, bilirubin, cholesterol, and lecithin [1,2]. NaDC has the steroidal skeleton with four rings containing hydroxyl groups and terminating in a carboxylic acid group. It is a water-soluble compound that has a good acceptability for pharmaceutical products and enhances

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