

Development Zinc-selective membrane potentiometric sensor based on crown ether.

By
Zeina Mohammed Kadhum Al-Mossawy

Kerbalaa University /Science college/Chemistry department

الخلاصة//

لقد حُضر قطب انتقائي سائل جديد لايون الزنك المعتمد على الايثر التاجي DB18C6 والمذيب الملدن Di-n-octyl phenyl phosphonate (DOPP) وقد حقق القطب الحساس إستجابة نيرنستية لايونات الزنك لمدى $1.7 \times 10^{-2} - 3.1 \times 10^{-4}$ وحدة فعالية وبميل نيرنستي $27.00 \frac{mV}{decade}$. وحده كشف 3.9×10^{-4} وحدة فعالية. وكان زمن الاستجابة حوالي (30 s) ويمكن ان يستعمل لفترة (60 days) على الاقل بدقة قياسات ثابتة. واستعمل القطب بنجاح في تقدير أيونات الزنك مباشرة في المحلول .

Abstract//

A new liquid selective electrode for Zinc ions based on Di-benzo-18-crown-6 as membrane carrier with plasteicezer (DOPP) was prepared. The sensor exhibits a nernstian response for Zn^{2+} range $1.7 \times 10^{-2} - 3.1 \times 10^{-4}$ with nernstian slope $27.00 \frac{mV}{decade}$, and detection limit of (3.9×10^{-4}) activity unit. It has a response time of a bout (30 s) and can be used for at least (60 days) without any divergence. The proposed membrane sensor revealed good selectivity for Zn^{2+} over variety of other metal ions and could be used in pH range of (3-7). It was successfully used for direct determination of Zn^{2+} in solution.

Introduction

The use of ion selective electrodes has gained importance because of their selectivities on specific ions.

After numerous attempts to design a membrane electrode based on various crystalline materials, Pungor and hallos –succeeded in preparing the first workable ion-selective electrode ⁽¹⁾. Then the fields of ion selective electrodes of membrane biochemistry and of electrochemistry are progressing rapidly ⁽²⁾.

Silver salts of spare solubility are used mostly for their preparation. It was found that solid state electrodes prepared from silver halogenides were sensitive to halogenide however these electrodes could also be used for the determination of some cat ions such as mercury^(3,4) in directly.

It was found that the electrodes made from two sulfide salts such as Ag₂S-PbS. And Ag₂S-CdS were sensitive to lead and cadmium ions respectively⁽⁵⁾.

The correlation found between the crystalline structure of the sensing material and the potentiometric response made possible the controlled preparation of several precipitate based electrodes such as cadmium, lead and copper selective electrodes.

⁽⁶⁻⁸⁾.Also there is lithium-selective electrodes based on a new series of neutral carriers ^(9,10). We have reported zinc-selective electrodes based on a new series of neutral carriers which exhibit satisfactory selectivity to zinc which the mineral is present in every part of the body and has a wide range of functions. It helps with the healing of wounds and is a vital component of many enzyme reactions⁽¹¹⁾. Zinc is vital for the healthy working of many of the body's systems. It is particularly important for healthy skin and is essential for a healthy immune system and resistance to infection.

Our body contain a bout (2-3)g of zinc and so a regular supply in diet is required⁽¹²⁾.

While the neutral carriers as in Fig (1) which one of these was used in this work ,named the crown ethers are among the first synthetic complexing agents introduced to bind strongly and selectively to alkali metal ions ^(13,14),they have been used as suitable neutral carriers for the selective transport of alkali metal cat ions throw liquid membrane^(15,16).

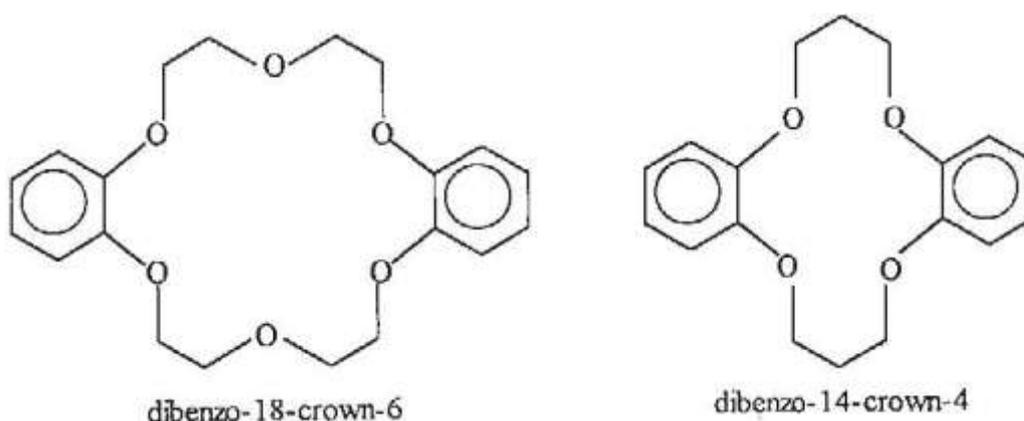


Fig (1) Some types from Crown ethers compounds.

2- Experimental

2-1 Apparatus and reagents

****Apparatus:-**

pH meter Knick-Digital pH, EmV-meter, Shaker, Wrist Action, Burell Corporation. Model 75, PA., U.S.A., Magnatic stirrer Gallinkamp-England, Calomel Reference Electrode, Gallinkamp(USA)., Sensitive balance, W.Germany, sartoris, pH Electrode, Orion Research (USA)., Silver-Silver chloride Electrode.

****Reagents:-**

Most reagents used were of analytical reagent grade (Merck):

Dibenzo-18-crown-6 (DB18C6),

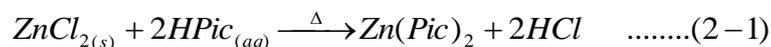
Tetrahydrofuran (THF), others were used of analytical reagent grade (Aldrich): Zinc chloride ($ZnCl_2$), Di-n-octyl phenyl phosphonate (DOPP) . Poly (vinyl chloride) (PVC) from (Fluka), others were used of analytical reagent grade (British Drug Housees) Hydrochloric acid, Sodium chloride.

2-2 Proceder//

Stock solution of (0.1M) of the cat ions were prepared, other standard solution were prepared by subsequent dilution of the stock solution.

A- Preparation of complex:

The picrate salt of Zn^{2+} was prepared by stirring mixture of aqueous solution containing the metal oxide and picric acid at $75^\circ C$. The excess picric acid was removed by extraction several times with benzene. The solid salts were obtained by evaporating the aqueous solution ⁽¹⁷⁾.



Then the solution of the metal picrate was mixed with the solution of the crown ether at $60^\circ C$ for 15 minutes. the complex obtained by cooling the mixture to $0^\circ C$ ⁽¹⁸⁻¹⁹⁾. The equation of this reaction as below:-
(20)



which is : L= ligand , A= crown ether

