Fabrication of novel chemicaly modified carbon paste electrode for the selective nano-level determination of Cd^{2+} ions in real samples

Abbas Afkhami *, Tayyebeh Madrakian, Hosein khoshsafar , Mona kharazi

Faculty of Chemistry, Bu-Ali Sina University, Hamedan, Iran

This research introduces the design of a anodic stripping voltammetry (ASV) method for the cadmium(II) determination at a carbon paste electrode, chemically modified with multi-walled carbon nanotubes (MWCNTs), ionic liquid and also a new synthesized Schiff base. New Schiff base,(Z)-2-((1H-1,2,4-triazol-3-ylimino)methyl)phenol, was synthesized to apply as an efficient modifire in electrochemical responses of the ASV sensor for the determination of cadmium. The proposed method allows determination of cadmium(II) in the wide linear dynamic range of 0.2 to 23 μg L^{-1}. The Limit of detection (LOD) was noticed to be 0.08 μg L^{-1}.The prepared electrode was used for the cadmium determination in real samples and very good recovery results were obtained.

Keywords: Carbon paste electrode; ASV sensor; Cadmium; Multi-walled carbon nanotubes; ionic liquid.

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Conductometric study of complexation reaction between 4`-nitrobenzo-15-crown-5 and Mn^{+2},Co^{+2} ,Y^{+3} and ZrO^{+2} metal cations in pure and binary mixed organic solvents

Masomeh esmaeelporfarkhani , GholamhosseinRounaghi*,MohammadhosseinArbabZavar

Department of Chemistry,Faculty of Sciences,Ferdowsi University of Mashhad,Mashhad,Iran
Email:mh_es91@yahoo.com;ghrounaghi@yahoo.com;arbab@um.ac.ir

The complexation reaction between Mn^{2+},Co^{2+} ,Y^{3+} and ZrO^{2+} metal cations with the macrocyclic ligand, 4`-nitrobenz-15-crown-5 in pure acetonitrile, methanol and also acetonitrile-mathanol(AN-MeOH) binary mixtures have been studied at different temperatures using conductometry method. The values of formation constants of the complexes were obtained from fitting of molar conductivity curves using a computer program, GENPLOT [1,2]. The conductance data show that the stoichiometry of the complexes formed between 4`-NB15C5 with Mn^{+2},Co^{+2} ,Y^{+3} and ZrO^{+2} cations is 1:1[ML]. The values of the standard enthalpy changes (ΔH°_c) for complexation reactions were obtained from the slope of the v'ant Hoff plots and the changes in standard entropy ΔS°_c were calculated from the relationship $\Delta G^{\circ}_{C,298.15}=\Delta H^{\circ}_C-298.15\Delta S^{\circ}_C$[3]. In most cases, a non-linear relationship is observed between the stability constants of the complexes ($\log K_f$) and the composition of the AN-MeOH binary solution. The order of stability of the metal–ion complexes in pure AN at 25 °C was found to be:$(4`\text{-NB15C5.Y})^{3+}$ >$(4`\text{NB15C5.Mn})^{2+}$ >$(4`\text{-NB15C5.Co})^{2+}$>$(4`\text{-NB15C5.ZrO})^{2-}$ and in the case of pure MeOH at the same temperature, it changes to:$(4`\text{-NB15C5.Co})^{2-}$>$(4`\text{-NB15C5.Mn})^{2+}$>$(4`\text{-NB15C5.ZrO})^{2+}$>$(4`\text{-NB15C5.Y})^{3+}$. The results also show that the stability sequence of the complexes in binary solution of AN-MeOH (mol% MeOH =75) at 25°C varies in order: $(4`\text{-NB15C5.ZrO})^{2+}$>$(4`\text{-NB15C5.Co})^{2+}$>$(4`\text{-NB15C5.Y})^{3+}$>$(4`\text{NB15C5.Mn})^{2+}$ and in AN-MeOH binary solvent (mol % MeOH=50), it is: $(4`\text{NB15C5.Mn})^{2+}$ >$(4`\text{-NB15C5.ZrO})^{2+}$>$(4`\text{-NB15C5.Y})^{3+}$>$(4`\text{-NB15C5.Co})^{2+}$ and in the case of AN-DMF(mol%MeOH=25) at 25°C it changes to: $(4`\text{-NB15C5.Co})^{2+}$>$(4`\text{-NB15C5.ZrO})^{2+}\approx$ $(4`\text{-NB15C5.Y})^{3+}$>$(4`\text{NB15C5.Mn})^{2+}$. The experimental results show that depending on the nature and composition of the binary solvent systems, the selectivity of the ligands for the metal cations and thermodynamic of complexation processes may be changed[4,5].

Key word: conductometry, 4`-NB15C5, acetonitrile-mathanol ,Mn^{+2},Co^{+2} ,Y^{+3}, ZrO^{+2}

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Electrochemical sensors for selective determination of N-acetylcysteine in the presence of folic acid using a modified carbon carbon nanotube paste electrode

Fatemeh Mirrahimi*[a,b], Mohammad-Ali Taher[a], Hadi Beitollahi[c], Rahman Hosseinzadeh[d]

[a]*Department of Chemistry, Shahid Bahonar University of Kerman, P.O. Box 76175-133, Kerman, Iran*
[b]*Young Researchers Society, Shahid Bahonar University of Kerman, P.O. Box 76175-133, Kerman, Iran*
[c]*Environment Department, Research Institute of Environmental Sciences, International Center for Science, High Technology and Environmental Sciences, Kerman, Iran*
[d]*Department of Organic Chemistry, Faculty of Chemistry, University of Mazandaran, Babolsar, Iran*

In present paper, a novel (BF) modified carbon nanotube paste electrode (BFCNPE) was prepared. The modified electrode was further used for the successful determination of N-acetylcysteine (NAC). NAC is a pharmaceutical drug used primarily as a mucolytic agent since it is able to cleave disulfide bonds, converting them into two sulfhydryl groups. NAC can also be very effective as an antidote in cases of acetaminophen poisoning [1]. Folic acid (FA) is a significant component of the haematopoietic system and is the coenzyme that controls the generation of ferrohaeme [2]. The decrease in concentration of FA in our body fluids leads to several complications including gigantocytic anaemia, leucopoenia, devolution of mentality, psychosis and increasing possibility of heart attack and stroke [3].
BFCNPE showed an excellent electrocatalytic oxidation activity toward NAC with a lower overvoltage, pronounced current response, and good sensitivity. Under the optimized experimental conditions, the proposed electrochemical NAC sensor exhibited a linear calibration plot ranged from 3.0×10^{-7} to 7.0×10^{-4} M with a detection limit of 9.0×10^{-8} M. Also, Square wave voltammetry (SWV) was used for simultaneous determination of NAC and folic acid at the modified electrode. Finally, the proposed method was applied to the determination of NAC in NAC tablets.

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