بسم الله الرحمن الرحيم

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تم رفع هذه الرسالة بواسطة / حسام الدين محمد مغربي

بقسم التوثيق الإلكتروني بمركز الشبكات وتكنولوجيا المعلومات دون أدنى مسئولية عن محتوى هذه الرسالة.

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كليه العلوم – قسم الكيمياء

New methods for the assessment of selenium in environmental samples

A Thesis
Submitted for the degree of Master of Science As a partial fulfilment for requirements of the master of Science

By

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B.Sc. (Chemistry)

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Heba Fawzy

Aim of the work

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The current research aims to use digital image-based analysis in conjunction with catalytic kinetic methods to assess ultra-trace quantities of tetravalent selenium in natural and heavily contaminated wastewater.

Summary

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Selenium is an essential element for the proper functioning of the human body. It plays a crucial role in metabolism and thyroid function and helps protect the body from oxidative stress damage. Therefore, the highly sensitive assessment of selenium in waters and food samples is of great importance for environmental, biochemical and health concerns. Selenium assessment based on its catalytic effect of the reduction of methylene blue by sulfide ion has been reported using the fixed time and induction period monitoring methods. However, the very poor precision and relatively limited sensitivity prompted us to develop a new highly sensitive, precise and validated initial rate kinetic method for selenium assessment based on the methylene blue- sulfide ion reaction. The progress of reaction was traced spectrophotometrically and with a digital camera. Various reaction variables affecting the methylene blue decolorization were thoroughly investigated, including: reagents concentrations, order of addition, mixing and standing times, pH, temperature, ionic strength, and the surfactant type and concentration. A mono-variate optimization procedure was followed for the optimization of reaction variables and the optimized conditions have been included in the recommended procedure. Cetyltrimethyl-ammonium bromide (CTAB) greatly enhanced the

selenohydrosulfide reduction of methylene blue near micellar concentrations, lowered the linear range of Se determination and boosted the analytical sensitivity of the developed method. The concentration effect of polysulfide or selenohydrosulfide on the micellar surface caused micellar catalysis, i.e., an increase in reaction rate. Procedures for dealing with various possible interfering species were investigated. The findings of this investigation allowed for a higher sensitivity, higher selectivity, lowered detection and quantification limits, and improved precision. The developed method has been successfully applied to natural, wastewaters, and food samples with excellent recovery results and excellent harmony with the standard AOAC method. Statistical treatment of analytical data showed the absence of any systematic errors and revealed the high accuracy and precision of the developed method.

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List of Abbreviations

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AOAC	Association of Official Analytical Chemists
APHA	American Public Health Association
ATSDR	Agency for Toxic Substances and Disease Registry
CCD	Charge Coupled Device
CMOS	Complementary metal oxide semiconductor
CMYK	Cyan, Magenta, Yellow, and Key Black model
CTAB	Cetyltrimethylammonium bromide
DIBA	Digital Image-based analysis
EDTA	Ethylenediaminetetraacetic acid
FDA	Food and Drug Administration office
HCHO	Formaldhyde
HCL	Hydrochloric acid
HG-AAS	Hydride generation atomic absorption spectrometry
HG-AFS	Hydride generation atomic fluorscence spectrometry
HS	Hydrosulfide
ICP-MS	Inductively coupled plasma-mass spectrometry
ICP-OES	Inductively coupled plasma-optical emission spectrometry