L-IV10

DETERMINATION OF MERCURY BY THE GOLD FILM MERCURY ANALYZER M-511 AT MANOGRAM LEVELS

M. SKREBLIN[(1)], M. HORVAT[(2)] and P. STEGNAR[(2)]

(1) Center for Marine Research, Institute R. Boskovic, Rovinj (Yugoslavia)
(2) "J. Stefan" Institute, "E. Kardelj" University, Ljubljana (Yugoslavia)

INTRODUCTION

Among the many techniques for determination of mercury in environmental samples[1] there is the Gold Film Mercury Analyzer,Model 511,developed by the Jerome Instrument Corporation.The purpose of this study was to evaluate the M-511 with respect to its precision and accuracy,interferences and applicability.

MATERIALS AND METHODS

All reagents were analytical grade (Merck).Stock mercury solution:1 mg Hg^{2+}/l in 5 % HNO_3.Working mercury standards were prepared daily.Stannous chloride solution 10 % in 3 M H_2SO_4.Preacidified unfiltered sea water was analysed directly by reduction-aeration or by double amalgamation technique.[2]Biological samples were wet digested using HNO_3 or $HNO_3/HClO_4$ in PTFE vessels or in sealed glass tubes.

The apparatus consists of the Gold Film Mercury Analyzer, M-511,and a reaction vessel.The modified method with a preamalgamation step is schematicaly shown (Fig.1).

RESULTS AND DISCUSSION

The instrument was calibrated using both reduction-aeration and the vapour-injection method[3](Fig.2).Excellent linearity was obtained for the range examined (2-50 ng Hg). A two-fold increase in sensitivity was found using the modified method.

Working with wet digested biological samples serious interferences (probably caused by acidic fumes)were observed when the measurements were made by the direct method. Using a preamalgamation step these interferences were successfuly overcome.Table 1. shows the results of trace mercury analysis for various samples.

The precision of both method is 10 - 12 %.

CONCLUSION

Model 511 shows the good characteristics with respect to its linearity and reproducibility when working with pure standard solutions of mercury.Detection limits of 2-3 ng Hg,linearity up to 50 ng Hg and a precision of 11% were determined.Interferences coming from wet digested natural samples can be eliminated by using a simple preamalgamation step which also increases sensitivity and makes the instrument suitable for analysis of a wide variety of samples.

Table 1: Comparison of analysis of various samples obtained with M-511 Mercury Analyzer and the LDC-UV monitor

Sample type	M-511 direct mean value	M-511 preamalgamation mean value	LDC-UV mean value	Notes
Polluted sea water (ngHg/l) (three different samples)	1040 (2) 500 (2) 870 (1)		1080 (2) 520 (2) 900 (2)	Influenced by chlor-alkali industry
Coastal sea water (ngHg/l)		6 (2)	5.4±2.4(4)	
Tuna homogenate (ngHg/ml)	16 (2)	8 (2)	9.0 (2)	
Hair (two different samples) (ngHg/ml)		9 (1) 9 (2)	8.5 (2) 7.8 (2)	Comparative results are from same digest
NBS Oyster tissue (ngHg/g)		61±7 (10)		Ref.material 57 ngHg/g

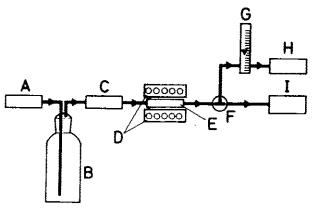


Fig.1. Diagram of apparatus for determination of mercury by preamalgamation step

(A) activated carbon trap, (B) reduction vessel, (C) acidic gas filter, (D) furnace, (E) gold trap, (F) threeout tap, (G) flow meter, (H) water pump, (I) M-511

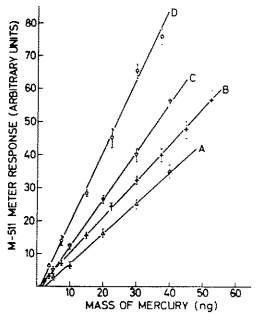


Fig.2. Comparison of calibration curves for M-511

(A) direct: reduction-aeration method
r = 0.999 y = 0.93x - 2.4
(B) direct: vapour-injection method
r = 0.999 y = 1.09 - 0.7
(C) preamalgamation: reduction-aeration
r = 0.999 y = 1.42x - 2.5
(D) preamalgamation: vapour-injection
r = 0.998 y = 2.19 - 2.8

LITERATURE

1) S.Chilov, Talanta (1975) 22, 205-232.

2) M.Horvat, M.Škreblin, T.Zvonarić and P.Stegnar (in press).

3) R.Dumarey, E.Temmerman, R.Dams and J.Hoste, Anal.Chim.Acta (1985) 170, 337-340.

L-IV11

MERCURY-BINDING PROTEINS IN CYTOSOL OF THE GILLS AND DIGESTIVE GLAND OF MYTILUS GALLOPROVINCIALIS

M. TUŠEK-ŽNIDARIČ[(1)], M. ŠKREBLIN[(2)], I. KREGAR[(1)], P. STEGNAR[(1)] and A. PROSENC[(1)]

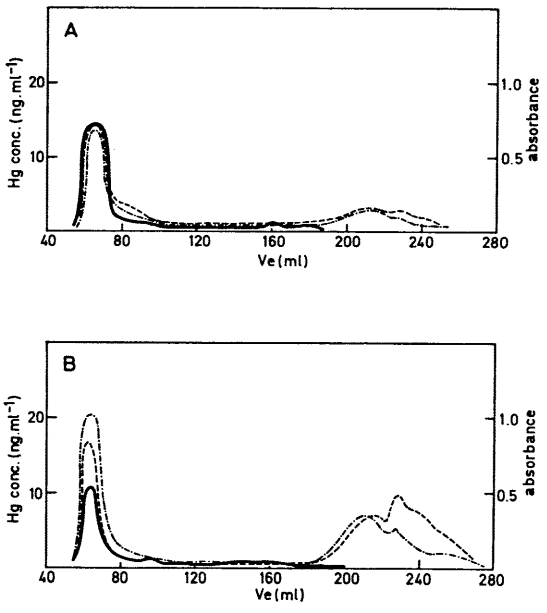
(1) "J. Stefan" Institute, "E. Kardelj" University, Ljubljana (Yugoslavia)
(2) Center for Marine Research, R. Boskovic Institute, Rovinj (Yugoslavia)

It is well known that among marine animals mussels are good accumulators of heavy metals, and are therefore suitable test organism for indicating metal pollution. In our experiment, mussels (Mytilus galloprovincialis) were exposed to mercury (2.5 $\mu g.l^{-1}$ of $HgCl_2$) using an open, continous-flow sea water system. Our previous results showed that in the gills and the digestive glands mercury was mostly associated with subcellular particles[(1)].

The present work was designed to determine the major mercury binding component in cytosol. The gill and digestive glands tissues were homogenized (10% homogenate) and ultracentrifuged at 36000 rpm for 70 minutes at 4°C. Supernatants, which contained 7-10% of total tissue mercury, was ultrafiltered and chromatographed on a Sephadex G-75 column. The absorbance of the fractions was measured at 280 nm and 254 nm, and mercury was determined by neutron activation analysis[(2)].

It was found that more than 70 % of total supernatant mercury from the digestive gland and more than 85 % of total supernatant mercury from the gills was associated with high molecular weight proteins. The rest of mercury was distributed between other fractions from gel filtration. This means that mercury entering the cell is bound mostly to cell structures. After 4 days of exposure there was no evidence of induction of metallothionein-like proteins in the cell cytosol.

FIG. 1: Sephadex G-75 chromatograms of supernatants of mussel gills (A) and digestive glands (B). In 5-7 ml fractions total mercury (——), absorbance at 280 nm (-·-·-) and 254 nm (---) were measured.



References:

1) M.Tusek-Znidarič, M.Skreblin, J.Pavičić, I.Kregar, P.Stegnar. Cellular distribution of Hg in selected organs of the marine mussels, Mytilus galloprovincialis, 5th International Conference Heavy Metals in the Environment, Athens,1985.

2) A.R.Byrne, L.Kosta: Simultaneous neutron activation determination of selenium and mercury in biological samples by volatilization. Talanta 21, 1083-1090, 1974.