DETERMINATION OF MERCURY IN SEAWATER BY COLD-VAPOUR ATOMIC ABSORPTION SPECTROPHOTOMETRY

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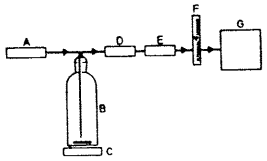
ABSTRACT

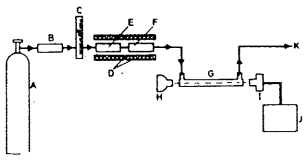
For the rapid and precise determination of low mercury levels in natural samples by cold vapour atomic absorption spectrophotometry, a concentration step is needed. This paper describes in detail a closed aeration technique coupled with a double amalgamation stage on a gold absorber, which is used for the determination of mercury in seawater samples from some different parts of the open and coastal Adriatic Sea.

Mercury analysis was conducted using a LDC-UV monitor (model 1225) equipped with a Hewlett Packard integrator (HP3390A). The preacidified unfiltered seawater sample was digested with 20 ml "sub-boiling" HNO_3 by heating for two hours at 60°C, followed by total mercury analysis. After the reduction-amalgamation step (Fig.1),the loaded gold absorber (E) was connected to a second permanent absorber (F) (Fig.2), and these two adsorbers were consecutively desorbed by heating at 650°C (D). Mercury released was swept into the optical cell (G) of the LDC-UV monitor (= 254 nm). The output signals from this apparatus were fed to an HP-integrator (I) for peak-area measurement.



(A) Activated carbon trap
(B) reduction vessel
(C) magnetic stirrer
(D) $Mg(ClO_4)_2$
(E) gold trap
(F) flow-meter
(G) pump (30 l h^{-1})

FIG.1: Diagram of the reduction amalgamation step



(A) nitrogen, (B) activated carbon trap, (C) flow-meter, (D) furnaces, (E) loaded gold trap, (F) permanent gold trap, (G) optical cell, (H) light source, (I) detector, (J) integrator, (K) $KMnO_4/H_2SO_4$ trap

FIG.2: Diagram of apparatus for determination of mercury

The double-amalgamation stage offers more advantages: the elimination of interferences due to organics or Cl_2 and measurement from the same gold trap which is well characterized. The precision of the method was investigated by determination of total mercury in surface water samples from some different parts of the Adriatic (Table 1).

Table 1: Concentration of total Hg in seawater from different parts of the Adriatic

Sampling area		Total Hg concentration ng/l	Notes
Open sea (North Adriatic)	surface	0.9 ± 0.4 (8)	
	bottom	1.4 ± 0.6 (8)	
Coastal water (North Adriatic Rovinj)	surface	5.4 ± 2.4 (4)	
Coastal water (Central Adriatic (Kaštela Bay)	surface 200m from the shore	32.0 ± 3 (6)	Industrial influence
Harbour mouth (Split)	surface	21 ± 2 (5)	Influenced by municipal sewage effluents
Coastal water (near Split)	surface	15 ± 2 (4)	Fresh water influence

The reproducibility was tested by 10 fold measurement of 2 ng Hg^{2+} spikes. The mean value was 1.9 ± 0.4 ng l^{-1}. The detection limit was found to be 0.5 ng l^{-1}.

LITERATURE

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ACCUMULATION OF MERCURY AND ITS DISTRIBUTION IN VARIOUS ORGANS OF THE WHITE BREAM DIPLODUS SARGUS

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ABSTRACT

Total mercury concentrations in various organs of the sparid, Diplodus sargus, were determined in specimens obtained from polluted (Haifa Bay and Akko) and unpolluted (Zarqa) areas along the Mediterranean coastline of Israel. D. sargus is a commercially important inshore species. It is most abundant at depths of 5-20 m, its migratory habits are limited, and its prey habitat is benthic.

In 10 different tissues and organs of D. sargus, mercury concentrations were higher in specimens from the polluted area than in those from the unpolluted one. Mercury concentrations in the muscle tissue ranged from 0.072 to 1.020 µg/g wet wt. (mean: 0.531) in the former area and from 0.059 to 0.212 µg/g (mean: 0.123) in the latter. Highest mercury levels were found in the liver: up to 3.527 µg/g (mean: 1.052) in specimens from Haifa Bay and Akko and up to 0.269 µg/g (mean: 0.161) in specimens from Zarqa. The mean mercury concentration in food found in the intestines of specimens from Haifa Bay and Akko was about 8 times higher than the corresponding value for specimens from Zarqa. The patterns of the distribution of mean mercury concentrations in the tissues and organs examined are similar for the two populations (Fig. 1). However, for the specimens of the polluted area, significant linear correlations (at the <1% and <5% levels) were found between the mercury content of almost all tissues and organs and total body weights and lengths; in specimens from the unpolluted area only the mercury content of the muscle tissue correlated significantly with the body size (Fig. 2a,b).

The results indicate that mercury accumulation by D. sargus is associated with its feeding habits - the levels of mercury in its organs depend on the mercury content of its food. This study is part of a comprehensive study on mercury accumulation in inshore fish which is carried out within the framework of the MED POL Phase II program and supported by the Mediterranean Trust Fund.

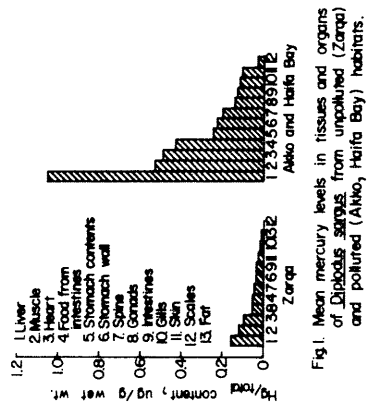

Fig.1. Mean mercury levels in tissues and organs of Diplodus sargus from unpolluted (Zarqa) and polluted (Akko, Haifa Bay) habitats.

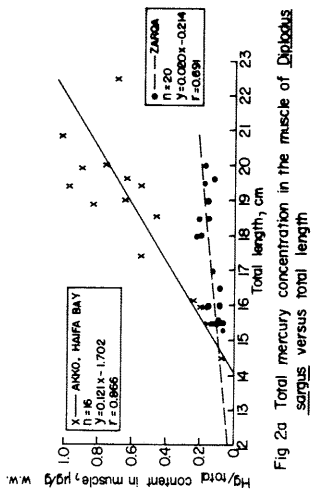

Fig 2a Total mercury concentration in the muscle of Diplodus sargus versus total length

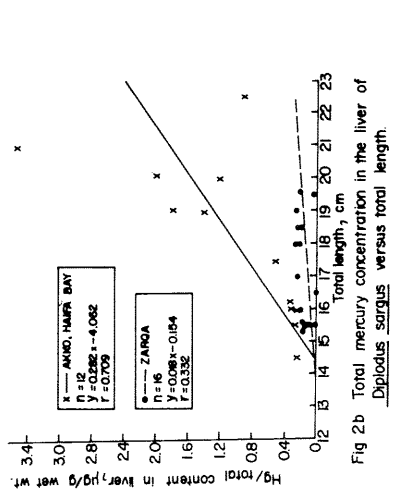

Fig 2b Total mercury concentration in the liver of Diplodus sargus versus total length