

MERCURY IN SEA-FOOD FROM THE COAST OFF BOMBAY

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ABSTRACT

Concentrations of mercury in sea food collected from coastal waters off Bombay are reported. Measurements were made by a sensitive method comprising of neutron activation and beta-gamma coincidence counting.

All the analysed samples, except one, show a mercury concentration of about 100 ppb on a fresh weight basis; this is well below the limits allowed (somewhat arbitrarily) for human consumption in Sweden and United States. The measured concentrations are believed to indicate the natural levels of mercury in these samples.

INTRODUCTION

OF all the pollutants released into the environment, mercury and DDT are believed to be most hazardous¹. Recent estimates have shown that the amount of mercury released into the environment by the combustion of fossil fuels² is much larger compared to its introduction by natural processes such as weathering¹ and volcanic emanations³. Several disturbing reports from abroad regarding mercury poisoning of humans and other animals through the consumed food materials^{1,4,5} led us to investigate whether there is any serious problem in this regard in our coastal waters.

Like most other pollutants, mercury will have its final resting place in the sea. Due to its long residence time, $\sim 10^4$ yrs⁶, its concentration in the world oceans should be gradually increasing as a result of continuing man-made input. The areas expected to be contaminated worst are the coastal waters which, ironically, provide most of the sea-food, particularly in countries not equipped for deep-sea fishing.

Waters in India, in general, can be expected to be less contaminated than those in the highly industrialised countries. However, it is advisable to check our coastal waters, in particular, that of Bay of Bengal which receives most of the drainage that brings with it the pollution products. Arabian Sea, on the other hand, should be relatively cleaner though samples from the coast off Bombay might have been polluted by the local industries.

As a first step to keep watch on possible mercury pollution of marine environment, we have analyzed the Hg contents of fish and

other sea-foods collected from Bombay coast. A sensitive technique consisting of neutron activation of the fresh samples followed by some simple chemistry and beta-gamma coincidence counting is employed. The method of analysis, the first batch of results and their implications are briefly described here.

METHODOLOGY

Specimens of common sea-food, lobster, pomfret, Bombay duck, prawns, etc., (see Table I) were freshly caught and stored in clean polybags. Weighed amounts of the edible portions of the organisms (about 1 gm) were transferred into clean poly-vials which were then carefully heat sealed. These vials, along with suitable blanks and standards, were irradiated in a thermal neutron flux of about 10^{12} n/cm² sec. for about four hours at Bhabha Atomic Research Centre, Trombay. The irradiated samples were cooled for a period of 10-15 days to decay away the sodium-24 activity (half-life = 15 hr) produced from the sodium present in the samples.

The irradiated samples were opened in conical flasks containing concentrated hydrochloric and nitric acid mixtures after addition of stable mercury carrier. After oxidising organic matter, mercuric sulphide was precipitated, the precipitate was filtered through millipore (0.45 micron size) filter-paper, washed and assayed for the isotope Hg²⁰³ ($E_{\max.} \beta^- = 0.214$ mev and $E\gamma = 0.278$ mev) of 46.9 days half-life⁷ using a beta-gamma coincidence spectrometer⁸.

The method is essentially identical to that employed earlier for the determination of low concentrations of mercury (for example in

meteorites and natural waters) by various workers⁹⁻¹².

RESULTS AND DISCUSSION

Concentrations of mercury in seven analysed sea-food samples are given in Table I. Six

TABLE I

Mercury concentrations of sea-food from the Bombay coast

Specimen		Concentration of mercury in ppb (on a fresh weight basis)*
Commercial Name	Scientific Name	
Lobster	<i>Panularis polyphagus</i>	100 ± 15
Pomfret (fish)	<i>Pampus argentinus</i>	90 ± 13
Bombay Duck (fish)	<i>Horpodon nheaus</i>	62 ± 11
Dhoma (fish)	<i>Sciaemids</i>	109 ± 9
Salmon (Tail portion) (fish)	<i>Polynemus tetradactylus</i>	470 ± 40
Pathanchi (fish)	—†	108 ± 8
Red prawn	<i>Metapaenous affinis</i>	130 ± 10
Distilled water	..	19 ± 6

* Errors quoted are due to counting statistics only.

† Not identified.

of these range from 62–130 ppb (parts per billion) on a fresh weight basis: whereas one sample, the Salmon has 470 ppb (Table I). These values are about 5 to 20 times higher than the blank (distilled water) irradiated along with the samples and run through the same procedure. Also, the values presented here are in the same range, 30–130 ppb, reported for mollusk *Mercaneria mercaneria*¹² in areas free from contamination. On the other hand mercury concentrations of some fishes from one of the polluted areas, i.e., the Baltic Sea go as high as 5200 ppb⁴ (Table II); and are

TABLE II

Mercury concentrations of some fish from the Baltic Sea

Specimen	Hg concentration (ppb)	
	Range	Mean
Pike	150–5200	1090
Pike-perch	170–2500	1000
Vendele	122–1400	360

on the average about ten times higher than those in the coastal catch off Bombay.

An arbitrary upper limit of 1000 ppb mercury in Sweden and 500 ppb in U.S.A., both

on a fresh weight basis, are set up for fish considered safe for human consumption. The concentrations reported here are well under these limits. The tail part of Salmon appears to have the mercury content close to the limit set in U.S.A. It may be emphasized that although the first batch of results give no cause for alarm, numerous analyses of this type need to be carried out on natural waters and organisms before a real evaluation of the countrywide situation can be made. The purpose of such a study will be to take regulatory measures if high concentrations of mercury are found. On the other hand it would be a boon to the fishing industry if the Hg concentrations are real low (which appears to be the case), since the catch can be sold at premium in the world market. One may require to label the consignment appropriately, indicating the low mercury content of the material.

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