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A Case Study :

Mercury contamination due to thermometer glass solid waste dumping - A preliminary report

K. PARVATHI, K.JAYAPRAKASH AND N.SIVAKUMAR

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See end of the article for authors' affiliations

Correspondence to:

K. PARVATHI
Department of Chemistry,
L.R.G. Government Arts College for Women,
TIRUPUR (T.N.) INDIA

ABSTRACT

There is a report on the Hg contamination due to the waste glass coated with mercury dumped by a thermometer factory at Kodaikanal, Tamil Nadu. Water samples from various zones of the lake located at Kodaikanal were subjected for the spectrophotometric method of Hg content. The results have disclosed that there is an elevated level of Hg. The data was analysed statistically and discussed with relation to the contamination of Hg.

Key words : Hg contamination, Hg Pollution from thermometer factory, Environmental Hg in water analysis

Mercury (Herein quoted as Hg) pollution in water is emerging as an alarming situation due to discharge of elemental mercury spills, industrial effluents containing mercury salts and solid waste such as mercury coated glass waste (Clarkson, 1994; Jayaprakash, 2009). It is known that Hg in water bodies due to industrial effluent ranges from 0.058 to 0.268 mg./L against the normal safe limit of 0.001 mg./L (WHO, 1980; ATSDR, 1999). It has been worked out by many authors that Hg concentration is higher in water bodies closer to industries using elemental mercury or mercury based raw materials. It is established that the Hg level is as high as 0.176 mg./L in water samples analysed from in and around chlorine industrial areas (Rudd, 1995).

Similarly, the Tamil Nadu Pollution Control Board (TNPCB) has confirmed that Hg contaminated glass pieces were dumped at various locations in Kodaikannal by a thermometer factory of Unilever Ltd., The waste described as scrapyard contains more than 50 mg/kg (Report of Human Right, 2003). It has been suggested that because of above Hg discharge, the water available in and around Kodaikannal lake may be polluted Hg pollution. Although the factory was closed because of the legal dispute, still there has been a controversy over this hypothesis and the level of Hg concentration in water as well as soil (Sharma, 2003; Rajagopal, 2003).

By holding the above hypothesis, a preliminary attempt has been made in the present study to ascertain the Hg concentration levels in water samples collected from various zones of Kodaikannal lake, Kodaikannal, Tamil Nadu.

MATERIALS AND METHODS

The spectrophotometric method using 2-acetylthiophene benzoyl hydrazone (ATBH) as adopted by Saleem Basha *et al.* (2009) was employed for the determination of Hg in water samples collected from various zones of Kodaikannal area during the period between January 2010 to March 2010.

250 ml of each water sample was filtered with whatman No. 40 and added with conc.HNO_3. Then the samples were digested by potassium permanganate solution as suggested by Fifield and Haines (2000). The reagent (ATBH) was prepaed by mixing 1 mole of 2-acetylthiophene and 1 mole of benzoyl hydrazide in a 250 ml flask. The shiny yellow crystals were filtered and dried in vaccum. To get 90% yield, the solution was refiltered again and again.

The Hg compound was determined by UV spectral analysis. The standard Hg solution ($1x10^{-2}$M) was prepared by $HgCl_2$ in acetate buffer at pH 4-6. The absorbance was measured at 350-600nm range against blank.

In each case 10 samples were analysed and mean was calculated. The data on Hg values for different zones (A, B, C, D, E, and F) were compared with Hg level obtained for unpolluted water, which was maintained as control unit. The data were analysed statistically and student 't' test was employed to know the significance at 95% confidence level ($P<0.05$).

RESULTS AND DISCUSSION

The results of Hg analysis of control water (unpolluted ground water) as well as six different water

Table 1 : Mean levels of Hg in water samples

Sr. No.	Area	Mean Hg concentration * (mg./L)	Test of significance @
1.	Control	0.0023 ± 0.006	NS
2.	Zone – A (ground water)	0.074 ± 0.008	S
3.	Zone – B	0.029 ± 0.002	S
4.	Zone – C	0.016 ± 0.007	S
5.	Zone – D	0.011 ± 0.004	S
6.	Zone – E	0.009 ± 0.003	NS
7.	Zone – F	0.012 ± 0.006	S

* Values are mean with S.E.
@ Student 't' test was applied for significance ($P < 0.05$).
NS- Not significant; S – Significant

samples collected from various random areas of Kodaikannal Lake water under investigation are presented in Table 1. There was a very low level of dissolved Hg (0.0023 ± 0.0006 mg./L) that was observed in unpolluted control water sample collected from ground source about 50 kms away from the thermometer glass waste dumping area.

On the other hand, water samples which were collected from six different areas of lake water under study (A, B, C, D, E and F zones) have shown variations in the content of Hg estimated by spectrophotometric method. The water of A zone had an elevated level of Hg, the mean unit was recorded as 0.074 ± 0.008 mg./L). There were 0.029 ± 0.002 mg./L; 0.016 ± 0.007 mg./L; 0.011 ± 0.004 mg./L; 0.009 ± 0.003 mg./L and 0.012 ± 0.006 mg./L mean values of Hg, respectively for the collection zones of B, C, D, E and F (Table 1).

The comparative statistical interpretation yielded that mean Hg levels on the samples of A, B, C, D and F zones are significant, as in these cases, the null hypothesis (m) was rejected ($P < 0.005$).

From the above results, it would be presumed that the lake water, which is nearer to the thermometer industrial waste solid glass pieces dumping scrapyard (zone A) area shows an elevated level of Hg than the recommended safety concentration of 0.001 mg./L. Besides, the water samples from other zones have less Hg contamination when compared with the result of A zone. This is reasonable to suggest that there is a discharge of Hg in the lake water body under study.

Mercury is a potentially elemental toxic substance. With environmental Hg concentration posing a health threat, this is a subject of concern for many environmental research workers. Several studies are available on the contamination of Hg in eco-system and their effect on biological organisms. It has been very well established that industrial activities is one of the major causes for the discharge of Hg in environmental components. Another interesting study on the Hg is the bio-magnification of Hg in the flora and fauna.

The results of our preliminary analysis of the suspected lake water have shown that there is contamination of Hg in considerable amount. Our results substantiate the earlier findings of environmental Hg discharge into the Kodaikannal lake water (Sharma, 2003). It is suggested that even after the closure of the thermometer factory six years back there may still be a chance of mercury contamination. Although our present result may not ascertain the exact reason and the variations of Hg content in water samples. Hence, it is desirable that much more clear and precise studies should be undertaken to know the contamination of Hg due to the discharge from the suspected scrapyard of thermometer factory in question. It is also suggested that an advanced technology should be employed for the determination of Hg in environmental sample such as Gold Mass Atomic Absorption Spectroscopy or Hg analyzer.

Authors' affiliations:
K.JAYAPRAKASH, Department of Zoology, Chikkanna Government Arts College, TIRUPUR (T.N.) INDIA
N. SIVAKUMAR, Department of Chemistry, Chikkanna Government Arts College, TIRUPUR (T.N.) INDIA

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