Oriental Journal of Chemistry Vol. **26**(4), 1473-1477 (2010)

Trace metal analysis of a drinking water resource of Central India

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(Received: May 12, 2010; Accepted: July 04, 2010)

ABSTRACT

An attempt was made to assess the concentration of toxic metals in Bhoj Wetland (Upper lake) a Ramsar Site in India which is a major source of potable water catering the needs of about 1.4 million people of Bhopal. The main toxic metal namely chromium, zinc, cadmium, nickel, lead and manganese were analyzed during the period 2007-2008. Higher concentration of Heavy Metals was found in the month of March and September in most of the cases.

Key words: Trace metals, potable water, Central India.

INTRODUCTION

Large scale urbanization, a consequence of economic development is leading to production of huge quantities of effluents in India and posing serious environmental problems for their disposal. Further, increased anthropogenic activities around the urban lakes in recent years have resulted in deterioration of water quality of the lakes sometimes increasing the concentration of heavy metals (Pani et al., 2004). The Upper lake of Bhopal which contributes about 40% of water supply to the city has also become a victim of anthropogenic activities resulting in significant deterioration of water quality including an increase in heavy metal concentration in the Lake Water (Pani et al 2002).

Thus, the water quality of Upper Lake was assessed to evaluate the concentration of heavy metals caused due to input of toxic as well as domestic wastewater. The study has been focused on availability of toxic metals in the water body especially during the idol immersion period.

Study Area

The Upper Lake, created in 11th century AD, and Lower Lake, created in the late 18th century AD, are by far the most important. The Upper Lake has special significance since it has been a source of piped water supply to the city of Bhopal for over 75 years. Even now, the lake accounts for some 40% of the city's water supply. Until 1947 the water quality of Upper Lake was so good that it did not require any treatment before being supplied to the public. However, tremendous population growth of the city (about 70,000 in 1951 to about 1.4 million in 2001) and rapid urban development around Lower Lake and on the eastern and northern fringes of Upper Lake (especially during second half of the last century) subjected both the lakes to various environmental problems resulting in deterioration of their water quality mainly due to inflow of untreated sewage. The Bhoj Wetlands of Bhopal comprises of the Upper Lake and the Lower Lake. These lakes are of immense importance since they are inseparably linked with the socio, economical and cultural aspects of the people of Bhopal and are referred as lifelines of the city.

MATERIAL AND METHODS

A meticulous survey was conducted to identify the pollution prone zones of the Lake. Based on the survey, eight sampling stations were chosen

for the study (Fig-1). Monitoring of the parameters was carried out as per the guidelines of Central Pollution Control Board, New Delhi. The water samples were collected from eight different sampling sites at monthly interval from surface and bottom.

After collecting the sample, 5.0 ml concentrated nitric acid was added in one liter of sample for long-term preservation. The reason of adding nitric acid is to maintain the pH of sample below 4. Later on, the sample was filtered through Whatman No-40 filter paper and the filtrate was directly used for the analysis. Upper Lake of Bhopal also receives agricultural run off, sewage and domestic wastes etc. from number of sources, so the monitoring of heavy metal in the Lake has been done to assess the heavy metallic pollution in the Lake.

The analysis of heavy metals was done on Atomic Absorption Spectrophotometer (Perkin Elmer Analyst 100) by using Flame and Graphite Furnace (HGA 800).

RESULT AND DISCUSSION

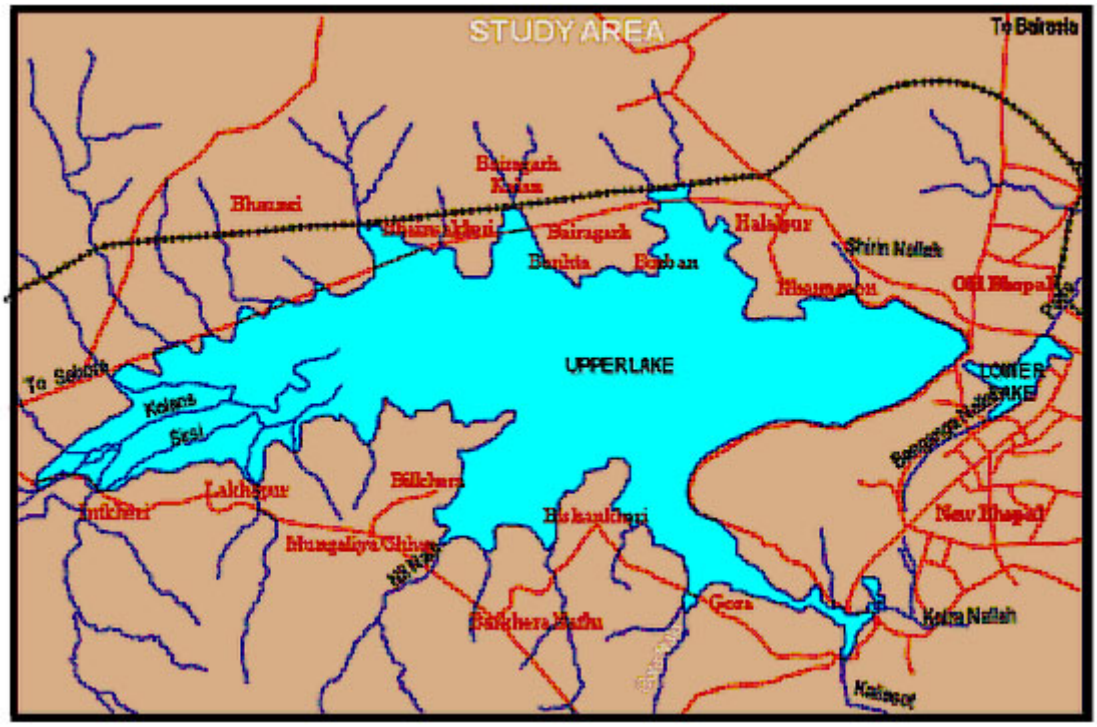
The concentration of heavy metals in different stations of the lake during the year 2006 and 2007 is depicted in Figure 2- 9.

In Upper Lake during the year 2007-2008, maximum value of cadmium was observed in the month of October while comparatively lower value of cadmium in surface water were recorded in the month of May.

Chromium concentration in the lake was observed to be maximum in the month of December while during rest of the months values were found to be comparatively low.

Concentration of Zinc in Upper Lake through out the year did not show much fluctuation in different months, although slightly higher value was recorded in the month of February.

Concentration of Copper in the lake during



Station-1 Bhainsakheri Station-2 Bairagarh Station-3 Khanugaon Station-4 Fategarh-
Station-5 Kamla Park Station-6 Bhadbhada Station-7 Sewania gond Station-8 Center of the lake

the period of study was found to be comparatively high in the month of January and August. During rest of the year values of zinc did not show much variation.

Concentration of Manganese was observed to be comparatively high in the month of April and August and December.

Concentration of Lead during the study period was observed to be high in the month of December.

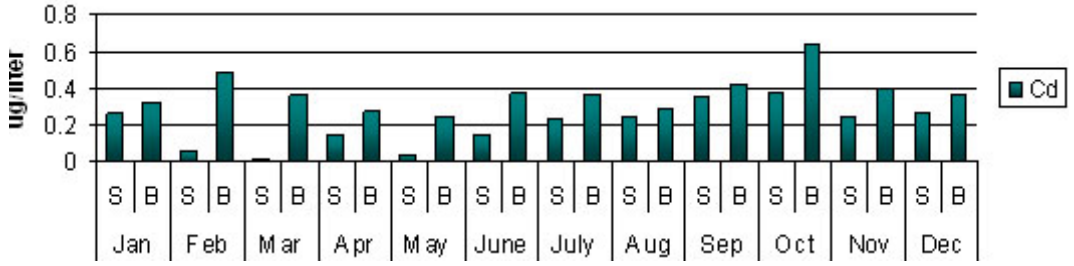


Fig. 2: Variation in cadmium concentration in upper lake during 2007-2008

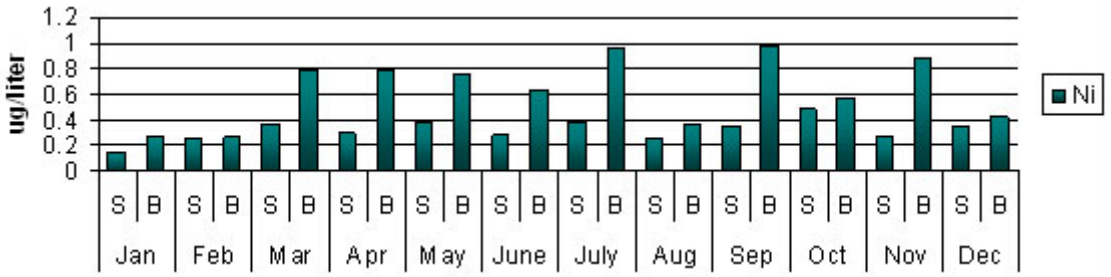


Fig. 3: Variation in Nickel concentration in upper lake during 2007-2008

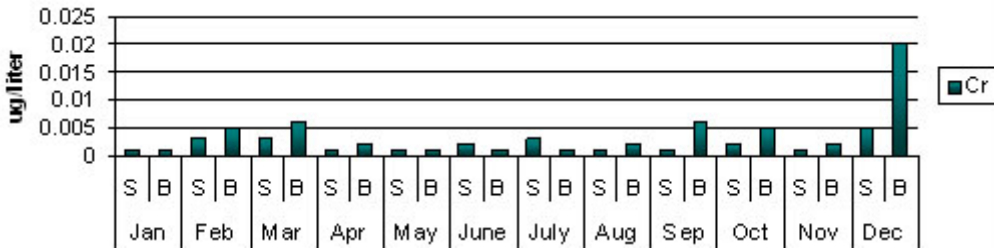


Fig. 4: Variation in Chromium concentration in upper lake during 2007-2008

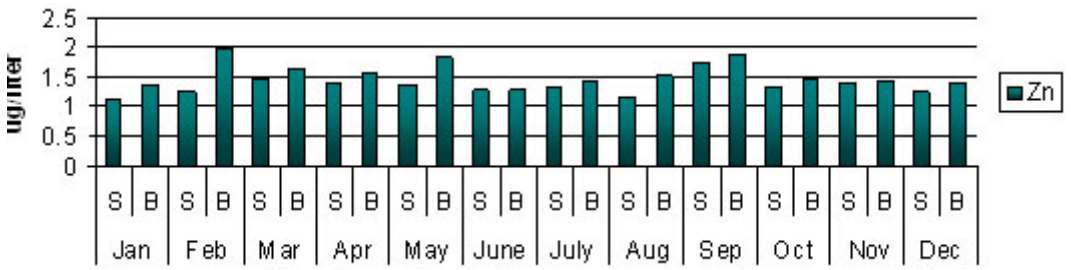


Fig. 5: Variation in Zinc concentration in upper lake during 2007-2008

Iron during the period of investigation recorded to be high in the month of March.

Heavy Metal in Water

In present study results show that the distribution of heavy metals is higher in bottom layers of water than surface layers. This was also confirmed by Lasheen (1987). Lasheen (1987) further stated that the thermal stratification has significant effects on trace metal distribution. During thermal

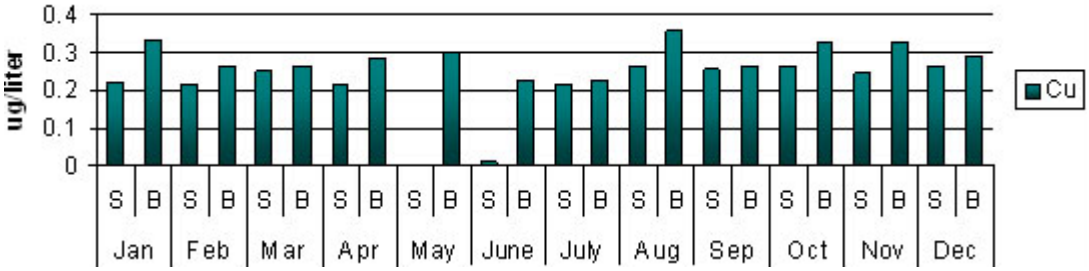


Fig. 6: Variation in Copper concentration in upper lake during 2007-2008

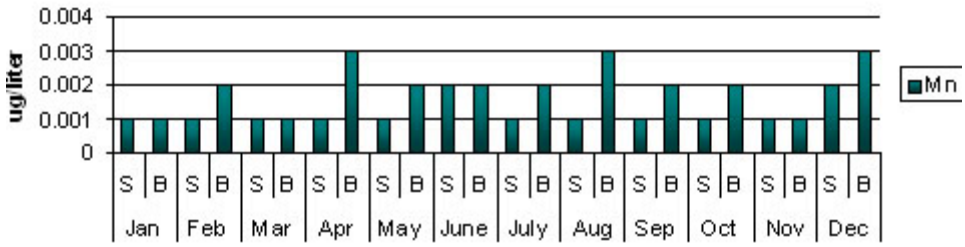


Fig. 7: Variation in Manganese concentration in upper lake during 2007-2008

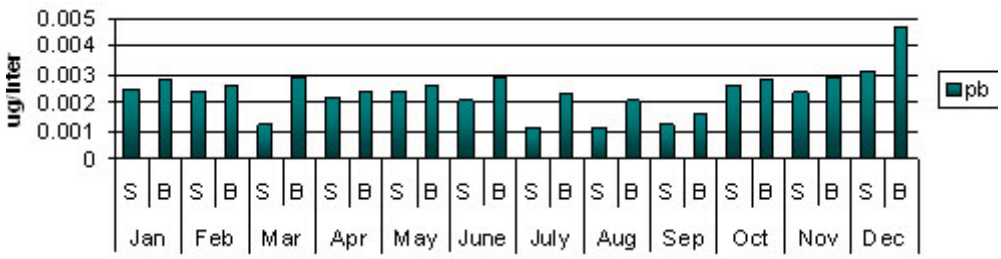


Fig. 8: Variation in Lead concentration in upper lake during 2007-2008

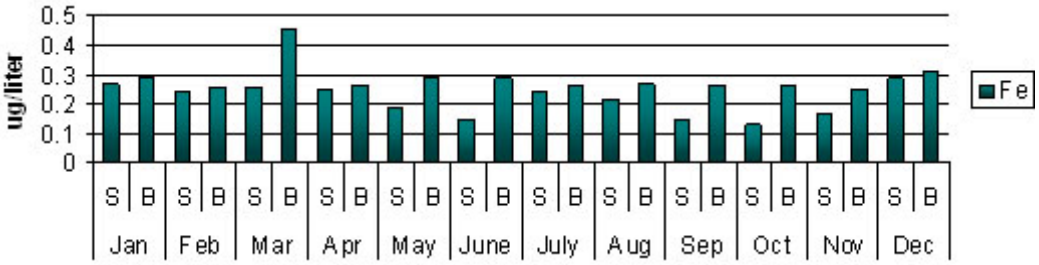


Fig. 9: Variation in Iron concentration in upper lake during 2007-2008

stratification lake develops a stagnant layer of water at its bottom representing a condition in which the dissolved oxygen is completely removed. As a result of the disappearance of dissolved oxygen, some times free sulphide will are which influence the solubility of heavy metals by forming insoluble metal sulphides.

In the present study thermal stratification was generally observed to extend from May to September. During this period, heavy metal concentration is also increased in both surface and bottom layers. This is also found by Kataria H.C., Iqbal S.A(1995), Magarde t al. (1987) and Pani etal (2002).

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