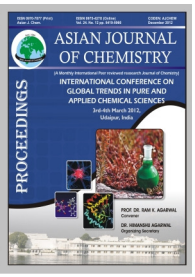
Asian Journal of Chemistry; Vol. 24, No. 12 (2012), 5959-5960

ASIAN JOURNAL OF CHEMISTRY

www.asianjournalofchemistry.co.in



Chemical Monitoring of Metal Pollutants Along the Mumbai Coastline†

SHAHIN D. IRANI* and D.V. PRABHU

Department of Chemistry, Wilson College (University of Mumbai), Mumbai-400 007, India

*Corresponding author: E-mail: shahindirani@gmail.com

AJC-11809

Industrial effluents introduce several metal pollutant into the marine waters around the island city of Mumbai. Heavy metals like iron, chromium, copper, zinc and lead are potentially hazardous to aquatic life. Metal pollutant were monitored at 10 sites along the Mumbai coastline during pre rainy season (June), rainy season (September) and winter (December). The water samples were collected using standard methods. Calcium and magnesium were estimated complexometrically using Erichrome Black T and Patton and Reeder indicators. Iron, chromium and cadmium were estimated spectrophotometrically at 510, 540 and 520 nm respectively. The high cadmium content in the month of September at almost all the city beach fronts has been attributed to the influx of cadmium salts due to the immersion of the clay idols of Lord Ganesh during the religious festivals of Ganapati. The chloride content was also monitored iodometrically and seasonal variation explained. The variation of the metal content with seasons has been explained and the chemical quality of the coastal waters was compared with the WHO and ISI standards for potable water. It was concluded that the Mumbai coastal water have a high dose of metal contaminants and hence cannot sustain acquatic life.

Key Words: Industrial effluents, Metal pollutants, Cadmium, Acquatic life.

INTRODUCTION

The discharge of industrial effluents into the coastal waters around Mumbai city has introduced toxic metal pollutants, which have adversely affected the quality of seawater and acquatic life.

In the present study, 10 sampling sites were selected and Fe, Ca, Mg, Cr and Cd as well as chloride were determined in the pre rainy season (June), rainy season (September) and winter (December).

Standard methods for examination of water[1-3] were used to estimate the heavy metal content in the water samples. The seasonal variation of metal content during the year especially at the end of the religious festival of ganapati in September, has been explained. The chemical quality of the water was compared with the WHO and ISI standards for potable water[4,5].

EXPERIMENTAL

Ten sampling sites were selected along the coastline of Mumbai. The sites selected included the city beaches where the clay idols of Lord Ganesh were immersed during the religious festival of Ganapati.

Collection of water samples: Water samples were collected in 1000 mL clean polythene bottles from a depth of one metre of water. The water samples were collected upto the brim of the bottles without leaving any space so as to prevent the premature release of any dissolved gases. The sampling bottles were labeled and the samples were filtered upon arrival at the laboratory.

Determination of metal pollutants: (1) The total hardness (Ca and Mg) was determined complexometrically using Erichrome Black T and Patton and Reeder indicators. (2) Iron and chromium were determined spectrophotometrically by measuring absorbance at 510 nm and 540 nm respectively. (3) Cadmium was estimated spectrophotometrically with dithizone-chloroform extraction, by measuring absorbance at 520 nm. For all absorbance measurements, Systronics UV-VIS spectrophotometer 118 was used. (4) The chloride content was estimated iodometrically using starch as indicator.

RESULTS AND DISCUSSION

The seasonal variation in the metal pollutants is depicted in Table-1.

Calcium ions are introduced into the coastal waters due to the immersion of clay idols which mainly contain calcium silicates. This accounts for the maxima in calcium ion concentration in September.

†Presented at International Conference on Global Trends in Pure and Applied Chemical Sciences, 3-4 March, 2012; Udaipur, India

TABLE –1
SEASONAL VARIATIONS OF METAL POLLUTANTS AT COASTAL WATERS

	Gateway	Worli	Balkum	Gorai	Dadar	Girgaum	Nariman point	Bandra	Marve	Juhu
					Calcium					
June	240	160	28	35	140	180	240	230	35	170
September	721	336	528	432	529	432	336	336	480	430
December	528	480	480	529	480	480	432	528	516	480
					Magnesium					
June	393	254	9	11	194	286	379	377	9	263
September	662	748	705	777	748	691	619	729	729	720
December	820	835	849	691	806	878	777	864	878	792
					Iron					
June	0.3	0.25	0.35	0.8	0.6	0.5	0.8	0.35	1.12	0.7
September	0.2	0.2	0.6	0.25	0.35	0.35	0.5	0.6	0.35	0.6
December	0.35	0.2	0.4	0.35	0.35	0.35	0.35	0.4	0.4	0.35
					Chromium					
June	2	2	2	8	4	0	2	2	6	0
September	2	2	2	6	4	2	4	4	8	2
December	0	4	6	6	4	4	2	4	8	2
					Cadmium					
June	0	0	0	0	0	0	0	0	1	0
September	0	1	2	2	2	4	0	2	4	2
December	0	0	0	0	1	2	0	0	2	1
					Chloride					
June	32	30	61	45	100	28	31	11	31	14
September	9	20	30	50	20	20	9	10	50	10
December	40	40	60	20	50	30	14	60	20	30

Magnesium content shows slight increase at all sites except at Gorai beach.

During the rainy months, the Fe(II) ion concentration is maximum at all sampling sites due to the influx of rust from the corroded sewage pipes. There is a decrease in the iron content after the rainy season.

An important finding of the present investigation is the high chromium content and the high cadmium content at all sampling sites just after the Ganapati festival. The increase in heavy metal content is pronounced at Girgaum, Dadar, Bandra, Marve ad Gorai beaches where most of the Ganapati idols are immersed. The chromium and cadmium salts present in the paints used for decorating the clay and plaster of paris idols enter the water bodies and render them polluted.

The chloride content is high in the prerainy season, reaches a minimum in September and again increases with the onset of winter (Table-1).

The presence of toxic metals pollutes the marine ecosystem rendering it unfit to sustain acquatic life.

Conclusion

High concentrations of chromium and cadmium are observed at almost all sites during the Ganapati festival due to the immersion of the decorated idols which releases toxic salts into the coastal waters.

The total hardness of water is also high in September. The chemical quality of the Mumbai coastal waters does not match with WHO and ISI standards.

ACKNOWLEDGEMENTS

Valuable help rendered by Jessy Chirayath and Bhakti Chavan in collection of experimental data, Dr. M.A. Tandel and Dr. Jamson Masih in the preparation of the manuscript is acknowledged and appreciated. Thanks are due to Principal Dr. V.J. Sirwaiya (Wilson College, Mumbai) and Dr. A.M. Amlani (Head, Chemistry Department of Wilson College, Mumbai) for experimental facilities provided.

REFERENCES

1. APHA Standard Methods for the Examination of Water and Waste Water, 19th Edition, American Health Association, Washington, D.C., U.S.A. (1996).
2. A.K. De, Environmental Chemistry, Wiley Eastern Ltd., New Delhi, edn 7 (1989).
3. S.M. Khopkar, Environmental Pollution Analysis, Wiley Eastern Ltd. and New Age International Ltd., New Delhi, pp. 33-34, 97-99 (1994).
4. WHO, International Standards for Drinking Water, World Health Organization Technical Report (1984).
5. ISI (Indian Standards Institution) IS: 10500-1995. Specifications for Drinking Water. ISI, New Delhi (1995).