© Uluslararası İnsan Bilimleri Dergisi
ISSN: 1303-5134
www.insanbilimleri.com

A STUDY ON HEAVY METAL CONCENTRATION IN İZMİT GULF

Hasibe Cingilli

ABSTRACT

Water samples taken from thirteen different stations and from three streams in İzmit Gulf where the pollution is very high have been investigated with Atomic Absorption Spectrometre for heavy metal (Cu, Fe, Pb, Cd, As and Hg) concentrations. From the data obtained, Hereke has been observed to have the highest heavy metal concentration in the area, but Gölcük is safe. Despite this, each station contains various heavy metal concentration levels. At the end of this study, it has been determined that heavy metal concentration is higher in deep waters than the surface of the water.

Key words: Water pollution, physical parametres, heavy metals (Cu, Fe, Pb, Cd, As, Hg)

1- INTRODUCTION

Water pollution shows itself with the deviation of biologic, chemical or physical parametres of water from the normal values. The quality of water is graded according to the criteria established by Public Health Units. There are various metals contaminating underground waters and the surface of water. In the Gulf of İzmit, the problems of environmental pollution and the pollution of sea waters have risen to a level which threatens the public health (3). Although some of these elements, are essential for the survival of livings as trace elements, some have toxic effects on living organisms. Water and sea environment are the basic contamination agent of heavy metals through feeding chains (7). The wastes of factories which have been established at or near the stations where the samples have been collected have been accumulated in water, in the mud at the bottom of the sea and in the organisms inhabiting in that medium and their quantity is gradually increasing.

Heavy metals are the main source of wastes contaminating the environment in the industrial regions. Many researchers have reported that toxic heavy metal compositions are detected in the industrial wastes, surface waters, rivers, lakes and the sea-bottoms. In recent years, it is pointed out that heavy metals, during the refinary processes of waste-waters with natural and artificial methods

in the area, have undergone biologic transformation by bacteria and converted into toxic metal compounds (1). Due to the industrial wastes, İzmit Gulf is continually being polluted with heavy metals. Heavy metals Such as Cadmium (Cd), Arsenic (As), Mercury (Hg), Iron (Fe), Lead (Pb), and Copper (Cu) have been examined as a cause of pollution. Following the determination of the level and the rate of pollution the next step will be to protect ourselves from the toxic effects of heavy metals. For instance, it is known for a long time that mercury has negative toxic effects on the nervous system, kidney and embryo; cadmium on the lungs, kidney and embryo; and lead on blood cells, nervous system, kidney and embryo (2).

2- MATERIALS AND METHOD

2.1- MATERIALS

Heavy Metals

Copper (Cu)

Iron (Fe)

Lead (Pb)

Cadmium (Cd)

Arsenic (As)

Mercury (Hg)

In this study, atomic absorption spectrophotometre is used for the detection of heavy metals.

2.2- METHOD

The samples have been put into brown bottles (25 ml) according to TSE criteria and examined with Atomic Absorption Spectrophotometre in the environmental laboratory at Gebze Institute of

Technology. But for mercury, 20 µl of sulphuric acid (95-97%), Nitric acid (65%) and $KmnO_4$ (5%) are put into the samples and treated.

3-FINDINS

At certain stations in the Gulf of İzmit (fig.1) thirteen different samples, according to TSE criteria, have been collected from the surface of the sea, 2 unts. deep and from the streams draining into the sea. Each samples, considering their physical parametres, has been studied using Atomic Absorption Spectrophotometre in GYTE Environment Laboratory by disolving each one for any metal. The data obtained by calculating the heavy metal concentration for **ppb** value is given in tables and graphics.

Table 1: Physical parametres of samples at different stations

Stations	**Physical parametres**							
	Temperature (^{0}C)		pH		Colour	Ador	Taste	Turbidity
	Deep	Surface	Deep	Surface				
Bayramoğlu	27	24	7	7.8	Visual	-	-	Quantitative
Darıca	24	24	8	7.8	„	-	-	„
Eskihisar	25	24	8	8	„	-	-	„
Muallimköy	25	25	7.8	7.6	„	-	-	„
Diliskelesi	25	27	7.8	8	„	-	-	„
Hereke	26.5	26	8	7.5	„	-	-	„
Yarımca	27	28	8	9	„	-	-	„
Derince	26	27	8	8	„	-	-	„
İzmit (Mkz)	27	27	8.5	8.5	„	-	-	„
Gölcük	28	27	8	7	„	-	-	„
Ulaşlı	27	27	8	8	„	-	-	„
Değirmendere	26	25	8	8	„	-	-	„
Karamürsel	25	25.5	8	8.6	„	-	-	„

Deep:2 m., surface:0.5 m (5).

Table 2: Physical features of samples for heavy metals

Parametres	**Methods of Analysis**	**Sample Container** **Plastic(P)** **Glass (G)**	**Conservative Measures**	**Sample Size (ml)**	**Max. Time Limit for Samples**	**Referances**
Copper (Cu)	AASM	C	HNO_3ile pH =2	25 ml	20 days	TS 6290 April 1997
Iron (Fe)	"	"	"	"	"	TS 8087
Lead (Pb)	"	"	"	"	"	TS 6290
Cadmium (Cd)	"	"	"	"	"	TS 6290
Arsenic(As)	"	"	"	"	"	TS 8483
Mercury (Hg)	"	"	Cooling +4 ^{0}C	"	"	TS 2537

AASM.: Atomic Absorption Spectrophotometric Method (5)

Table 3: Heavy metal concentrations of deep sea samples

Stations	**Heavy Metals (ppb)**					
	Copper (Cu)	Iron (Fe)	Lead (Pb)	Cadmium (Cd)	Arsenic (As)	Mercury (Hg)
Bayramoğlu	34.50	12140	4.3355	3.4527	0.08200	0.32645
Darıca	69.40	150.20	28.542	3.8029	0.10442	1.1631
Eskihisar	45.40	256.800	5.4479	4.2712	0.46906	0.61576
Muallimköy	24.00	29008	4.9810	3.8739	0.84074	0.87718
Diliskelesi	62.50	1549	4.2786	3.2699	0.58172	0.19028
Hereke	234.30	208000	87.696	----	0.81955	3.6571
Yarımca	141.24	324	8.6469	3.3219	0.15485	0.20056
Derince	53.30	49300	4.9651	3.1131	0.09902	0.68751
İzmit (Mkz)	39.22	1875	52.651	3.7363	0.23241	0.13879
Gölcük	----	790	0.0892	0.1693	1.5085	0.22106
Ulaşlı	17.75	664	0.1895	0.2645	0.09174	1.2226
Değirmendere	5.22	26330	27.979	3.9871	0.14421	1.2155
Karamürsel	93.40	536	2.0712	2.0925	0.08916	0.74721
References	TS 6290 April 2002	TS 8087 April 2002	TS 6290 April 2002	TS 6290 April 2002	TS 8483 April 2002	TS 2537 April 2002

Table 4: Heavy metal concentrations of surface water samples

	Heavy Metals (ppb)					
Stations	Copper (Cu)	Iron (Fe)	Lead (Pb)	Cadmium (Cd)	Arsenic (As)	Mercury (Hg)
Bayramoğlu	11.70	7818	5.0414	3.2178	0.20037	0.58726
Darıca	9.70	147.50	5.5447	4.6150	0.03534	1.1428
Eskihisar	1.00	172.70	4.4829	2.8512	0.29306	0.36035
Muallimköy	127.50	1610	4.5291	2.3221	0.13728	0.21285
Diliskelesi	----	137.20	4.4941	2.6329	0.25995	0.38289
Hereke	----	293.30	0.3130	0.0218	0.14942	0.73197
Yarımca	----	34370	4.0759	2.4335	0.03803	0.57343
Derince	----	194500	27.739	3.8014	0.03116	0.31245
İzmit (Mkz)	6.50	666	13.724	3.4406	0.17696	4.7828
Gölcük	----	990	67.277	8.5680	2.3790	0.42392
Ulaşlı	----	172	36.365	4.4756	0.16279	0.20846
Değirmendere	67.90	802	15.924	4.8133	0.07564	1.2529
Karamürsel	----	1222	15.810	2.8742	0.05462	0.63172
Referanslar	TS 6290 April 2002	TS 8087 April 2002	TS 6290 April 2002	TS 6290 April 2002	TS 8483 April 2002	TS 2537 April 2002

Table 5: Heavy metal concentrations in the streams draining into the Gulf

Stations	**Heavy Metals (ppb)**					
	Copper(Cu)	Iron (Fe)	Lead (Pb)	Cadmium (Cd)	Arsenic (As)	Mercury (Hg)
Eskihisar Merkez Dere	1.00	5687	4.1392	3.2846	0.11201	0.18374
İzmit Outlet Center Yanı Dere	---	38200	4.6313	3.0217	0.1560	1.0203
İzmit Kuş Cenneti Dere	----	702	16.752	2.8586	0.08866	0.31317

4- RESULTS and DISCUSSION

Water samples collected according to the TSE criteria from the most polluted regions in and around the Gulf of İzmit have been examined, taking the physical parametres into consideration, for heavy metal concentration. These samples collected from certain stations established in the Gulf have been studied for copper (Cu) concentration and found that the samples diluted with a ratio of 1/10 had the highest concentration in Hereke, Yarımca and Karamürsel and 5.22 μg/l (ppb) in Değirmendere. There is a danger in Hereke in Terms of Cu concentration (234.30 ppb). Gölcük which is under the same conditions, is free from copper concentration.

The result of water samples diluted at the rate 1/1000 for iron showed that Eskihisar had (256.800 ppb) value, Muallimköy (29008 ppb), Derince (49300 ppb), Değirmendere (26330 ppb), and Bayramoğlu (12140 ppb). When these results are taken into consideration Eskihisar had the highest Fe concenderation with 1/1000 dilution, Hereke had the highest (208000 ppb) and Yarımca the lowest Fe concentration.

From the results of water samples treated with 1/1000 dilution we have drawn that Hereke had the highest level of lead (84696) and Gölcük had the lowest (0.0892 ppb).

As for Cadmium (Cd) following the examination of water samples diluted with 1/1000 ratio the highest level was found in Eskihisar (4.2712 ppb) and the lowest in Gölcük (0.1693 ppb) but no Cd was found in Hereke.

With Arsenic (As), the water samples have not been diluted but Gölcük had the highest (1.5085 ppb) level and Bayramoğlu the lowest (0.08200 ppb). According to the results obtained with no

dilution of water samples for mercury (Hg), Hereke showed the highest Hg concentration (3.6571 ppb) and İzmit town center the lowest (0.13879).

When the water samples taken from the same stations were examined using 1/1000 dilutions, Muallimköy had the highest Cu concentration (127.50 ppb), Eskihisar the lowest (1.00 ppb), Diliskelesi, Hereke; Yarımca, Derince, Gölcük, Ulaşlı and Karamürsel were Cu free. Whereas Fe at 1/1000 dilution ratio is at (194.500 ppb) level of concentration in Derince, it is 78.18 ppb in Bayramoğlu. Despite this, with 1/1000 dilution Eskihisar had the highest concentration level (172.70 ppb) while the lowest level (172 ppb) was observed in Ulaşlı.

For lead (Pb), from the result of 1/1000 dilution we can see that Gölcük has the highest concentration level (16.277 ppb) whereas Hereke has the lowest (0.3130 ppb). The highest concentration level of Cadmium at 1/10 dilution rate was found in Gölcük (8.5680 ppb) and in Hereke the lowest (0.0218 ppb).

From the results obtained without dilution of lead and arsenic we have found that Gölcük had the highest arsenic concentration (2.3790 ppb) and Derince had the lowest

(0.03116 ppb). But İzmit town center had the highest mercury concentration

(4.7828 ppb) and Ulaşlı (0.20846 ppb).

According to the data provided from three streams (Eskihisar, İzmit Outlet and İzmit Kuşcenneti) the level of copper at 1/10 dilution was 1.00 ppb in Eskihisar town centre whereas the other two had none.The level of iron concentration at 1/100 dilution was 38.200 ppb in İzmit Outlet centre. In İzmit Kuşcenneti the level of lead concentration was 16.752 ppb and for Cadmium it was 3.2846 ppb in Eskihisar town centre.

When the samples are examined for arsenic and lead that are not undergone dilution, the stream near İzmit Outlet showed 0.1560 ppb and for mercury it was 1.0203 ppb at the same station.

According to the results obtained, iron is the commonest element in the streams under study. At the end of examinations of water samples taken from the deep sea water Hereke is at risk for the concentrations of Cu, Fe, Pb, and Hg for TSE criteria.

Eskihisar has the highest Fe and Cd concentrations. Darıca, Ulaşlı and Değirmendere approximate levels of Hg. Whereas Gölcük has the highest level as As. With the samples taken from the surface water Hereke, Diliskelesi, Yarımca, Derince, Gölcük, Ulaşlı and Karamürsel has no copper (Cu) concentration. This is because the heavy metals tend to go to the bottom of water. The reason why we have found heavy metals in the samples taken from the deep sea is that heavy metals are bound to the organic and inorganic structures in the water.

It is apparent from the results that it is essential to get the water samples from the deep sea water but not from the surface in order to determine the heavy metal concentration in the sea water.

Finally, we came to a conclusion that toxic heavy metals are dangerous for the environment and public health, and the plants and other workplaces in and around the stations are negligent about the refinery and purification of their wastes, because it is very important for the environment and public health to study the relation between the antibiotics and metal resistance detected in the regions where metalic contamination is high. It is claimed that metal pollutans are responsible for the selection of resistant bacteria rather than the antibiotics used for medication (6).

It is a virtual fact that a series of ecologic changes lead to the pollution of the Gulf and is necessary to examine its effects on the bacterial population, because the bacterial population of the Gulf is generally *E.coli*, *Streptococcus*, *Pseudomonas aureginosa* and the strains of *Azotobacter* and *Rhizobium* that

are responsible for nitrogen fixastion around the fertilizer plant of high concentrations. Some of these bacteria are sensitive to antibiotics and the others have gained resistance to the heavy metals present in the water. It is possible to say that the negative conditions within the likely effects will cause changes in bacterial genetics.

REFERENCES

1. Water Pollution Microbiology, Vol: 2, 1978.

2. Stephen, A. Benjamin, Chemical Mixtures as Promoters of Hepatocarcinogenesis, Colorado State University projects, proje 2, 1996.

3. Gündüz, T.,Çevre Sorunları, Ankara Üniversitesi Fen Fakültesi Kimya Bölümü, 1987.

4. TSE yayınları, (TS 6290, TS 8087, TS 6290, TS 8483, TS 2537), Nisan,1997.

5. Türk Çevre Mevzuatı, Cilt 2, Çevre Vakfı Yayını, s.1177-1195, 1991.

6. A. Ü. Veteriner Fakültesi Dergisi Fac. Vet. Med. Univ. Ankara, 30, (2), 1983

7. Vural, Y., Özbal, H., Çeritoğlu, A., Müftügil, N., Akşiray F., TÜBİTAK Marmara Bilimsel ve Endüstriyel Araştırma Enstitüsü, Beslenme ve Gıda Teknolojisi Bölümü Ekim, 1982

LIST of FIGURES

LIST of TABLES

Tablo 3. Heavy metal concentrations of deep sea sample

Tablo 4. Heavy metal concentrations of surface water samples

Tablo 5. Heavy metal concentrations in the streams draining into the Gulf