INT. J. BIOL. BIOTECH., 3 (3): 631-637, 2006.

HEAVY METAL ANALYSIS OF DRINKING WATER IN KORANGI, LANDHI AND MALIR TOWNS OF KARACHI

A. A. Langah [1], Qamarul Haque [2], Z. T. Maqsood[3] and Shahnaz Perveen[4]

[1]*Environmental Protection Agency, Government of Sindh Karachi, Pakistan*
[2]*Federal Urdu University of Arts, Science and Technology, University Road Karachi, Pakistan*
[3]*Department of Chemistry, University of Karachi, Karachi-75270, Pakistan*
[4]*PCSIR, Laboratories complex, Karachi, Pakistan*

ABSTRACT

This study was conducted for the investigation the status of drinking water of various towns of Karachi city from various sources including municipal water supply. The present study conducted to evaluate the suitability of surface water/ tap water provided by the KW&SB water quality for drinking purpose with respect to the levels of heavy metals Cd, Cr, Cu, Ni, Fe, Zn, Pb, Mn, The city has been divided in 18 towns and samples of the drinking water were collected from each town at the consumer end. Quality of drinking water was examined by Atomic Absorption Spectrophotometer as per method described in APHA (1998) and it was found that municipal water is almost contaminated with the organisms of public health importance in a higher than any permitted standards. This is an acute problem in Karachi city. Where free style of disposal of toxic industrial waste water/effluents into the natural water bodies contaminate the surface and ground water.

Key Words: Drinking water, heavy metal analysis, Korangi, Landhi, Malir, Karachi.

INTRODUCTION

Water is the most essential for living things and it supports the life process. Without water it would not have been possible to sustain life on this planet. We use water for various purposes and for each purpose we require water of appropriate quality. Evaluating the physical, chemical, biological, bacteriological and radiological characteristics of water assesses the quality of water; water for drinking purpose must be free from turbidity, color, odor and objectionable taste as well as from toxic metals which are the causes for the diseases by the organism and inorganic and organic substances, which may produce adverse physiological effect.(S.M. 1995) The hazard to the environment caused by discharge of industrial effluents is an acute problem in Pakistan the present free style way of disposal of the industrial effluents into the natural water bodies' results in serious surface and ground water contamination.

Drinking water contains different kinds of contaminants such as microorganism, inorganic and organic chemicals etc. These contaminants are considered to have harmful affects on human health when present in concentration above the recommended level (S.M. 1975). Heavy metals get into water from many sources, including industries, automobile exhaust, mines, waste and even natural soil. Like pesticides, heavy metals become more concentrated as animals feed on plants and are consumed in turn by other animal. When they reach high levels in the body, heavy metals can be immediately poisonous, or can result in long-term health problems similar to those caused by pesticides and herbicides (Buell.*et. al.*1994).

The industries discharge their effluents into the streams which finally merge into Lyari and Malir rivers. Effluents from Korangi Industrial Trade Estate (KITE) & Landhi Industrial Trade Estate (LITE), discharge their effluent into Malir River which linked to Ibrahim Hydri fish harbors. It discharges about 75,000-80,000, 95,000-100,000 M^3, per day into sea respectively from above rivers. Karachi is one of the twenty mega city of the world and largest metropolitan city of Pakistan. It has population of 10.4 millions and covers an area of more than 800 Km^2. (Naz, *et.al.* 2004). Karachi Water and Sewerage Board have three treatment plants for the treatment of the domestic sewage water generated in the city (Table-1). Treatment plants are treating only 94 MGD out of 172.5 MGD rest of the waste water is going into the sea without any treatment through the Lyari and Malir rivers.

The purpose of the study is to acquire knowledge on water quality status in Karachi, and to generate data that can be used to provide awareness to the community and also help the concern water supplies departments to improve their efficiency.

Table 1. Treatment plants in Karachi city.

S. No	Name of the Treatment Plant	Capacity	Working capacity
1.	SITE Treatment Plant (T.P-I)	50MGD	20 MGD
2.	Mahmoodabad Treatment Plant (T.P-II)	46.5 MGD	18-20 MGD
3.	Maripur Treatment Plant (T.P-III)	76 MGD	54 MGD

Table 2. Landhi town physical parameters analysis.

S. No	Sample ID No	Union council	Location	pH	Temp: ^{0}C	Dissolve Oxygen mg/l	Turbidity NTU	Cond: Umhos/cm	TDS mg/l
1	1001	1	New Mustafa abad	7.6	35.0^0	3.1	<5	430.0	266.6
2	1002	1	Old Muzzafar abad	7.5	36.0^0	2.9	<5	446.2	272.2
3	1003	1	Majeed colony	7.66	34.0^0	2.9	<5	244.3	253.9
4	1004	2	Muslim abad	7.65	34.0^0	3.2	<5	401.1	252.7
5	1005	2	Bilal colony	7.57	33.5^0	2.9	<5	416.6	262.5
6	**1006(b w)**	3	Sher Pao colony	7.11	34.0^0	3.1	<5	802.4	783.9
7	1007	3	Sher Pao colony	7.51	36.0^0	3.1	<5	450.8	279.5
8	**1008(b w)**	3	Labour colony	6.86	32.0^0	2.9	<5	830.0	634.7
9	1009	3	Tuheedabad	7.44	34.5^0	3.2	<5	446.2	272.2
10	1010	3	Firdous colony	7.76	32.2^0	2.9	<5	339.1	217.4
11	**1011(b w)**	3	Dawoud chorangi	7.01	33.0^0	3.0	<5	307.5	370.6
12	1012	3	Dawoud Challi	7.62	34.0^0	3.1	<5	273.1	302.8
13	1013	4	Moinabad	7.33	33.0^0	2.9	<5	457.9	293.1
14	1014	4	Mansehra colony	7.36	35.9^0	3.1	<5	440.0	277.7
15	1015	4	Mansehra colony	7.29	36.0^0	2.9	<5	456.7	283.2
16	1016	5	PeerBakhash Goth	7.73	34.0^0	3.1	<5	422.5	266.2
17	1017	5	Sharafi Goth	7.65	35.0^0	3.1	<5	441.7	278.3
18	1018	5	Naik Muhammad	7.62	34.0^0	3.1	<5	457.0	283.4
19	1019	5	Awami colony	7.19	35.0^0	3.1	<5	676.2	752.8
20	1020	5	Bhutto Nagar	7.85	34.5^0	3.0	<5	533.6	325.2
21	1021	6	Sector# 37-B	7.41	34.8^0	3.1	<5	397.4	250.4
22	1022	6	Sector # 37-D	7.16	34.0^0	2.9	<5	381.6	236.6
23	1023	7	Sector # 37-A	7.4	33.9^0	2.9	<5	398.4	251
24	1024	7	K-Area	7.63	33.0^0	3.0	<5	386.2	252.9
25	1025	7	Shah Khalid Colony	7,3	34.0^0	2.8	<5	366.3	241.8
26	1026	7	Peer bukhari	7.29	33.5^0	3.1	<5	414.3	265.2
27	1027	7	Sector# 37-C	7.68	34.0^0	2.9	<5	363.0	228.7
28	1028	7	Khawajw Ajmeer	7.66	36.0^0	3.1	<5	402.0	257.4
29	1029	8	Sector # 36-B	7.5	35.0^0	3.1	<5	452.3	271.4
30	1030	8	Sector # 36-E	7.5	35.8^0	2.8	<5	371.6	245.3
31	1031	9	Awami Colony	7.84	34.3^0	3.1	<5	491.6	299.9
32	1032	9	Future Colony	7.63	34.0^0	2.9	<5	486.7	301.8
33	1033	9	Future Colony S.S	7.23	36.0^0	3.1	<5	462.7	282.3
34	1034(b w)	10	Sector # 36-C	7.25	33.5^0	3.1	<5	502.9	311.8
35	1035	10	Sector # 36-G	7.56	35.4^0	3.0	<5	401.2	252.8
36	1036(b w)	11	Sector #44-A	7.08	36.0^0	2.9	<5	584.8	374.3
37	1037	11	Sector # J-1	7.38	36.2^0	3.1	<5	399.3	251.6
38	1038	11	Sector # 43-F	7.2	35.0^0	3.1	<5	826.8	520.9
39	1039	12	Sheerabad	7	34.5^0	3.2	<5	1145.1	732.9
40	1040	12	Sweeper colony	7.6	34.8^0	2.9	<5	487.9	307.4
41	1041	12	Sector # 35-D	7.63	32.7^0	2.9	<5	453.9	286
			Range	6.86-7.84	32-36	2.82-3.2	<5	273-584.8	228-783.9

*NTU= Nephlometric Turbid Unit, Cond= Conductivity, TDS= Total Dissolved Solids

MATERIALS AND METHODS

This study based on Korangi, Landhi, and Malir towns and these towns are the main targets of this study. The 97 samples were collected from the consumers end, and samples were analyzed in the Environmental Protection

Agency, Monitoring Lab Karachi. Water samples for the heavy metal analysis were collected in sterilized water sampling bottles and avoid any possible contamination from out side environment. Sample bottles were labeled properly assigning a sample ID number and placed in icebox, maintaining temperature at 4-8^{o}C and transport to the laboratories of Environmental Protection Agency, Monitoring Lab Karachi for analysis. Most of the NEQS parameters were analyzed with a (HACH) DR-2010 Spectrophotometer (Model No. 8021), using the technique/methods as prescribed in the instrument manual (Khan *et al*., 2005). Temperature of all water samples was determined upon collection with an YSI-Telethermometer 400 series. All the standard procedures for the calibration of the lab equipments and field equipments were followed "standard method" APHA 1998, (Evans *et al*., 1981).

RESULTS AND DISCUSSION

Samples of water was collected from different sources of water supply in Karachi showed metal contamination in drinking water. Physical parameter and heavy metal analysis of these raw water samples are presented in Tables 2-7. The quality of water in these towns is poor and no residual chlorine was detected in any sample. The quality of water in town Malir is also not satisfactory although this area is close to Malir River where all the domestic and industrial untreated waste water is discharged illegally in to this river which is finally discharged into Arabian Sea and make costal area polluted. It was observed that the concentration of the heavy metals in the Malir is greater than other two towns because the Malir town is very close to the Malir river and majority of the textile, chemical industries are discharging their industrial toxic waste into this river without any proper treatment. It was also noted that the ground water of this town is also contaminated with industrial waste water. High concentration of the chromium (0.06 mg/l), copper (2.5 mg/l), iron (2 mg/l), manganese (1 mg/l), lead (1.2 mg/l)and nickel (0.05 mg/l) were found in this town. It is also noted that all the industrial waste water from Bin Qasim and Landhi industrial area is discharged into the Malir River. In Landhi town high concentration of cadmium (0.024 mg/l) was noted in the drinking water samples. As Korangi is also industrial area where majority of the different types of the industries are discharging their industrial waste water without any treatment into the Malir River. Therefore this river is totally toxic so the quality of ground water of this area is very poor.

Table 3. Korangi town physical parameters analysis.

S. No	Sample ID No	Union council	Location	pH	Temp: ^{0}C	Dissolve Oxygen mg/l	Turbidity NTU	Cond: Umhos/cm	TDS mg/l
1	1101	1	Bilala Colony	7.5	33.5^{0}	3.1	<5	442.8	279
2	1102	1	Nusrat Colony	7.5	35.2^{0}	3.1	<5	490.5	299.2
3	1103	2	Nasir Colony	7.7	33.3^{0}	2.9	<5	491.0	314.3
4	1104	2	Sector-T	7.69	34.5^{0}	2.9	<5	579.7	365.2
5	1105	2	Allah Wala Town	7.81	33.2^{0}	2.8	<5	530.3	339.4
6	1106	2	Allah Wala Town	7.75	32.9^{0}	3.2	<5	560.6	342
7	1107	2	Sector # 31-D	7.62	33.1^{0}	3.2	<5	553.9	349
8	1108	2	Karimabad	7.49	34.9^{0}	3.0	<5	589.2	383
9	1109	3	Norani Basti	7.52	25.3^{0}	2.9	<5	571.9	366
10	1110	3	Norani Basti	7.7	34.6^{0}	3.1	<5	592.0	373
11	1111	3	Charka Goht	7.69	33.1^{0}	2.8	<5	612.7	386
12	1112	4	Mustafa Taj Colony	7.33	34.3^{0}	2.9	<5	650.8	493
13	1113	4	Silver Town	7.93	32.1^{0}	3.0	<5	437.2	271.0
14	1114	4	Zaman Town	7.68	30.1^{0}	3.1	<5	590.3	366.0
15	1115	4	Zaman Town	7.81	30.9^{0}	2.9	<5	595.0	374.8
16	1116	5	100 Quarters	7.75	31.3^{0}	2.8	<5	550.0	346.5
17	1117	5	Sector #50-A	7.81	32.3^{0}	3.2	<5	527.2	348.0
18	1118	6	Zia Colony	7.94	32.2^{0}	2.9	<5	552.0	977.8
19	1119	6	Gulzar Colony	7.66	32.3^{0}	3.2	<5	542.0	341.4
20	1120	6	Gulzar Colony	7.76	30.4^{0}	3.1	<5	477.3	315.0
21	1121	7	Sector #34	7.8	30.6^{0}	3.1	<5	591.6	355.0
22	1122	8	Sector #23-B	7.93	32.1^{0}	3.1	<5	606.6	370.0
23	1123	8	Data Nagar	7.714	32.9^{0}	3.1	<5	586.9	358.0
24	1124	7	Sector #34 –A	7.65	31.3^{0}	2.9	<5	549.2	346.0
25	1125	9	Sector #51-B	7.76	33.8^{0}	2.9	<5	557.1	351.0
			Range	7.33-7.94	25.3-35.5	2.8-3.2	<5	437.2-650.8	2.71-977.8

*NTU= Nephlometric Turbid Unit, Cond= Conductivity, TDS= Total Dissolved Solids.

CONCLUSION

This study shows that the water quality in Karachi region dose not meet the WHO guide lines. It is suggested that the supplies of drinking water should be examined regularly to conform that they are free from the pollutants and not injurious to public health. A regular monitoring of the chlorine in water supplies up to the consumer level is recommended. It is believed that the filtration plant and reservoirs are chlorinating water adequately and chlorine

levels were, in most cases adequate throughout the distribution net work. However, the level fell during storage in the under ground and over head tanks of the consumers. This may be simply due to excessive storage time or an excess of organic material in the tanks, which may be cleaned by the consumers. It is also observed that majority of the industries discharged untreated toxic waste in the sewage lines. The fact that contaminant are normally associated with acute and widespread effect on human being and places them in high priority category than chemical contaminants according to World Health Organization. Indeed, it can be argued that chemical standards for drinking water are of secondary consideration in a supply subject to serve bacterial contamination. Water constituents may affect the appearance, odor, or taste of the water and the consumer will evaluate the quality and acceptability of the water on the bases of these criteria. Water that is highly turbid, highly colored, or has an objectionable taste or odor may be regarded by consumer as unsafe and may be rejected for drinking purpose. It is therefore vital to maintain a quality of water that is acceptable to the consumer, although the absence of any adverse sensory effect does not guarantee the safety of water. International standard methods were used to evaluate the quality of water under local circumstances before adopted in the surveillance programs (APHA 9221 C, D, and E). All quality impacting processes was carried out in testing of water. Planning and control of these processes was executed according to quality plans. Appropriate equipments were used and suitable working environment was regularly maintained. The standards for drinking water quality for Pakistan are being adopted from the guidelines provided by WHO 1993. Since these standards directly affect the human health, and lot of research and health considerations have been given in framing WHO guidelines. These guidelines have been accepted internationally and no relaxation can be acceptable in view of its direct impact on human health.

Table 4. Malir town physical parameters analysis.

S. No	Sample ID No	Union council	Location	pH	Temp: ^{0}C	Dissolve Oxygen mg/l	Turbidity NTU	Cond: Umhos/cm	TDS mg/l
1	1601	1	Malir Halt	7.5	33.0	3.0	<5	1317.1	843.0
2	1602	1	Gulshan Amna	7.52	34.0	3.0	<5	408.4	261.4
3	1603	1	Security Print	7.17	33.0	3.1	<5	521.9	328.8
4	1604	1	Rahim Jokhyo	7.6	32.5	2.9	<5	468.0	290.2
5	**1605 (b w)**	1	Jokhyo Goth	7.05	33.0	2.9	<5	637.2	969.0
6	1606	1	Moeen Abad	7.5	35.3	3.1	<5	415.0	261.5
7	**1607(b w)**	1	Modle Colony	7.26	32.9	3.0	<5	516.8	906.8
8	**1608(b w)**	1	Jaffer Bagh	7.15	36.6	3.1	<5	531.7	785.0
9	1609	2	Kala Board	7.34	33.2	2.9	<5	387.0	251.6
10	1610	2	Darkhshan Society	7.65	33.0	2.9	<5	338.7	213.4
11	**1611(b w)**	2	Malir A-area	7.6	33.5	2.9	<5	422.5	266.2
12	1612	2	Malir Colony-Area	7.58	34.4	3.1	<5	412.8	243.6
13	1613	2	Christhen Colony	7.68	32.8	2.9	<5	409.1	253.7
14	**1614(b w)**	2	Malir Colony Area	7.34	34.7	2.9	<5	436.3	274.9
15	1615	2	Sadat Goth	7.41	35.4	3.0	<5	398.2	266.8
16	**1616(b w)**	2	Sheet# II Malir col.	7.25	33.4	3.1	<5	661.0	414.7
17	1617	2	Liaqat Markeet	7.15	32.3	3.1	<5	514.0	705.0
18	**1618(bw)**	3	S-2 Area	6.96	33.4	3.1	<5	693.6	604.0
19	**1619 (b w)**	3	Malir colony H Area	7.22	32.1	3.1	<5	425.7	268.2
20	1620	3	Saoudabad	7.16	31.5	3.1	<5	562.2	709.0
21	**1621(b w)**	3	S-1 Area	7.5	26.2	2.9	<5	457.5	292.8
22	1622	4	Kouser Town	7.54	36.5	3.1	<5	419.2	264.1
23	1623	4	Pak Kouser Town	7.45	34.6	3.0	<5	405.3	271.6
24	1624	4	Indus Mehran	7.4	33.2	2.9	<5	435.6	274.4
25	1625	4	Khokhra par	7.73	31.5	3.2	<5	427.8	273.8
26	**1626(b w)**	4	E-1Khokhra par	6.8	32.2	3.1	<5	704.6	508.0
27	**1627(b w)**	5	Madina Colony	7.06	32.0	3.1	<5	584.3	430.0
28	1628	6	Adam Hingorja	7.92	32.2	3.1	<5	397.8	254.6
29	**1629(b w)**	6	Chaman Colony	7.39	33.0	3.0	<5	563.0	593.6
30	1630	6	Gharib abad	7.7	34.3	2.9	<5	436.0	274.7
31	1631	7	Ghazi Brohi Goth	7.98	33.8	3.1	<5	440.0	277.2
			Range	6.80-7.98	26.2-36.6	2.9-3.2	<5	397.8-826.8	228-906.8

*NTU= Nephlometric Turbid Unit, Cond= Conductivity, TDS=Total Dissolved Solids

REFERENCES

Anonymous (1975) Standard Methods for the examination of water and waste water, 14th ed., APHA-AWWA-WPCF.

Anonymous (1995). Standard methods for the examination of Water Sewage and Industrial Waste Public Health Association Inc. New York, 10th ed, p. 411.

Buell, P. and J.Girard (1994). *Chemistry an Environmental Perspective Prentice Hall* 9th ed., 505, 1994.

Dara, S.S. (2004). *A Text Book of Environmental Chemistry and Pollution Control*, 6th ed, p-100.

Evans, T.M., C. E. Waarvick, Ramon J. Seidler, and M. W. Lechevallier (1981). *Applied and Environmental Microbiology*, 41: 130-138.

M.A khan, O. Hany, M.A. Khan, S.A. Hasan and M. Altaf Khan (2005). Bacteriological quality and chlorination status of drinking water in Karachi region. *Int. J. Biol. Biotech*., 2: 383-387.

MacDonald and Partners (1985).

Naz, J.M. Khan, O. Hany, M.A. Khan, S.A. Hasan, M. Azeem, S. Jabeen and N.A. Zaigham (2004). Flouride levels in drinking water in the districts of Karachi. *Int. J. Biol. Biotech*., 1: 687-692.

(*Accepted for publication June 2006*)