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OCCURRENCE OF MICROBIAL AND CHEMICAL CAUSATIVE AGENTS IN DRINKING WATER SOURCES OF DISTRICT HYDERABAD, SINDH PAKISTAN

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ABSTRACT

Occurrence of causative agents in drinking water concern for different waterborne-illnesses (viral, bacterial and protozoan infections). The poor quality of drinking water increasing water pollution and which is n ot only deteriorates water quality, but also contributes to public health problems, economic stress and social disprosperity. Microbial & Chemical contaminants (pH, Electric conductance , Salinity , Total Dissolved Salts, Chlorides, Co, Ni, Zn, Mn, Fe, Cd and As) in drinking water sources of urban and rural areas of Hyderabad District were examined as per recommended PSQCA (Pakistan Standard Quality Control Authority)/WHO protocols. The Present research work revealed that the potentially biohazards agents were found available in drinking water sources of District Hyderabad. This research is part of the efforts taken to evolve and develop a community based awareness and establishing spatial and temporal prevalence of biohazards in drinking water sources of the study area.

Keywords: Drinking, water, microbial, chemical, agents

INTRODUCTION

Human population suffers from various water borne diseases due to regular intervals of water contamination (1). Only 1% part of the water is available on earth for drinking and human consumption, agriculture, household power generation, industrial consummation, shipping and waste disposal (2).Contaminated water is one of the major risks to public health worldwide. Pakistan secure 80th rank out of 122 nations of the sphere, on the basis of poor water quality, where the drinking water supplies are mainly use from surface water sources or with the underground aquifers. The 70% of the whole drinking water provisions are obtained from underground aquifers. Drinking water quality of different areas of Pakistan is not in harmony to the WHO/Pakistan standard guidelines. In three districts namely Thatta, Badin, and Thar, are came under the southern Sindh, where the water quality was found poor and account for number of health ailments like gastroenteritis, diarrhea and cholera, kidney, and skin diseases (3). Deprivedorganised strategy, lack of well-prepared laboratories and the absence of a legal agency for drinking-water quality matters enlighten the situation to focus (4).Presently, Pakistan has suffered from lack of national drinking water quality standards

and WHO guidelines for drinking water (5). The figures of water are variables but according to WHO statistics the 36% of urban along with the 65% of rural Indian's have not access to clean drinking water (6). According to the UNICEF 2010 report, in the world 884 million people of the developing country use poor drinking water sources in 2010 whereas the factsin 2015 unravel that 672 million people have still using unsafe drinking water. Contaminated water groundsfor many diseases as diarrhea, vomiting, gastroenteritis, dysentery, kidney problems etc. in some districts of Sindh (7). The reason behind this worst health intimidating prospect is theindecorous disposal of solid waste, sewage water, and too much use of fertilizers (9). Pakistan Council for Research on Water Resources (PCRWR) reports in 2004 that in Pakistan around 30% to 40% of all diseases and demises are attributed to poor water quality. Moreover, the leading cause of deaths in infant and children up to age 10 years age as well as mortality rate of 136 per 1000 live births due to diarrhea is reported while every fifth citizen suffers from illness and disease caused by polluted water. Furthermore, in Karachi alone, more than 10000 people

annually reported for renal infection due to polluted drinking water.

By visualizing the seriousness of scenario the study has been design to analyze the hidden contaminants in clean drinking water to situate light on the major cause of morbidity and mortality ratio additionallythe outcomes of this study insist the governmenthealth policy maker departments and scientific community to focus on this life threatening current issue.

MATERIALS AND METHODS

26 water samples (hand Pump: 05, Motor Pump: 04, Water Supply: 17)were collected randomly from the study area into clean 1.5L plastic bottle washed twice with sample at the sampling point date and time were also noted.

The collected water samples properly labelled and safely transported to Water testing & Surveillance laboratory, LUMHS Jamshoro for further analysis in ice box. Turbidity was measured with digital turbidity meter (PCCHECKIT, Germany), Electrical Conductivity (EC) Salinity, Total Dissolved Salts (TDS) and pH were measured with conductivity meter (Model no: sanso-direct con 200).

Moreoverthe metal standard solutions were prepared by diluting 1000 mg/L stock solution of each metal.Co, Ni, Zn, Mn, Fe,

Cd metal concentrations were determined using Perkin-Elmer atomic absorption spectrometer (AAS-PEA-700) at available at Institute of Advanced Research Studies in Chemical Sciences, university of Sindh, Jamshoro with standard burner head and air acetylene flame as per recommended by the manufacturer. The analysis was carried out in triplicate with integration time 3 sec and delay time 3 sec. (18, 19, 20).

The Arsenic was determined by Arsenic kit method by MERCK the with the detection range 0.005mg/L to 0.5mg/L (23), while bacteriological analysis of water samples was evaluated for total coliforms count (TCC) and Total Faecal coliforms (TFC), all the work washandled in a laminar flow hood using sterilized culture media. The bacterial load of water samples was estimated by Most Probable Number (MPN) technique as per Standard Methods for the Examination of Water and Wastewater (24).

RESULTS & DISCUSSION

26 water samples were collected from district Hyderabad, and reveled that turbidity of 09 water samples < 5 NTU due to the ground nature and depth of boring, whereas the turbidity of samples coded THC: 01 to 06, TQ: 01,02,03,05,06, TL: 01 & 04 is much higher than the permissible limits suggested by WHO. The physical parameters observed

in this present study are in conformity with the data reported in previous research works in which (22). The drinking water should be colorless, odorless and tasteless, however pH must be in range 6.5 to 8.5 as per WHO recommendations. The Electric conductance (EC), Salinity, TDS (Total Dissolved Salts) of the ground water samples (coded: THR: 01 to 07, TQ, 04 & TL: 06) were notedmuch higher than the proposed level, the normal offered values of electric conductance is 1500 μS/cm, Salinity range 0.2 % to 0.5%, and TDS (amount of inorganic substances suspended or dissolved in water)having level up to 500mg/L.These results were in accordance with the results formerly stated for ground water sources from district Matiari, Sindh (23). Incidence of inorganic component chloride (Cl^-) in drinking water can abolish the water quality and were detected in prominent quantity in samples coded THR: 01 to 07, TQ, 04 & TL: 06 that was observed far away from the limits seted by WHO that is 250mg/L.

The similar results were described by (16) that ground water samples from Bahawalpur City, Pakistan.

Arsenic is toxic element existing in both organic and inorganicforms and the findings of present study indicating that in samples coded THR: 01 to 07, TQ, 04 & TL: 06 exceeding the arsenic level prescribed by WHO ($10\mu gL^{-1}$).

The bacteriological analysis revealed that the all ground water samples coded : THR: 01 to 07, TQ, 04 & TL: 06 shows no growth of E-Coli, Fecal Coliform and Total Coliform, all water supply samples coded THC: 01 to 06, TQ: 01,02,03,05,06, TL: 01 & 04 contain unacceptable number of coliform bacteria shown in table 1.

Cobalt, Nickel, Zinc, Manganese, Iron and Cadmium is an essential element for humans and plays a beneficial role in normal growth and reproduction (25). The minimum and maximum concentration of Cobalt, Nickel, Zinc, Manganese, Iron and Cadmium shown in figure 1 to 6.

Table 1: Sampling, Phyco- chemical and Bacteriological examination Record

Sampling Area	Sampling station	Sample Code	Date	Time AM	Source	Turbidity NTU	EC µS	Salinity %	TDS mg/L	pH	Arsenic mg/L	Chlorides mg/L	Total Coliform	Total Fecal Coliform	E–Coli Bacteria
									Physical -Chemical & Bacteriological Analysis						
District Hyderabad	**Taluka Hyderabad Rural**	**TandoFazl**	THR-01	08.03.2016	09.13	MP	B5	1802	0.9	1120	7.6	0.01	212	-ve	-ve	-ve
		TandoHyder	THR-02		10.10	HP	B5	1759	0.9	1140	7.4	0.025	289	-ve	-ve	-ve
		Tando Jam	THR-03		11.20	HP	B5	1650	0.8	1070	7.8	0.025	348	-ve	-ve	-ve
		TandoQaiser	THR-04		02.00	MP	B5	1916	1.0	1339	7.8	0.025	204	-ve	-ve	-ve
		Ghanghra Mori	THR-05		02.52	HP	B5	1320	0.7	922	7.7	0.025	176	-ve	-ve	-ve
		Hatri	THR-06		03.25	HP	B5	1662	0.9	1163	7.8	0.01	399	-ve	-ve	-ve
		Hala Naka	THR-07		04.20	HP	B5	2280	1.2	1480	7.4	0.01	365	-ve	-ve	-ve
	Taluka Hyderabad City	**Market**	THC-01	09.02.2016	09.17	WS	24	873	0.5	690	7.8	BDL	189	+ve	+ve	+ve
		Qasim Chowk	THC-02		10.10	WS	35	829	0.5	735	7.8	BDL	168	+ve	+ve	+ve
		Hyder Chowk	THC-03		11.20	WS	35	752	0.5	594	7.7	BDL	146	+ve	+ve	+ve
		NayaPul	THC-04		12.00	WS	37	847	0.5	668	7.7	BDL	159	+ve	+ve	+ve
		Badin Stop	THC-04		12.23	WS	34	875	0.5	691	7.8	BDL	165	+ve	+ve	+ve
		Memon Hospital	THC-05		01.25	WS	22	825	0.5	733	7.8	BDL	165	+ve	+ve	+ve
		Phuleli	THC-06		01.50	WS	21	756	0.5	592	7.7	BDL	153	+ve	+ve	+ve
	Taluka Qasimabad	**Qasimabad Phase –I**	TQ-01	10.03.2016	09.13	WS	43	844	0.5	667	7.7	BDL	134	+ve	+ve	+ve
		Qasimabad Phase- II	TQ-02		10.10	WS	32	879	0.5	695	7.8	BDL	156	+ve	+ve	+ve
		Naseem Nagar	TQ-03		11.20	WS	23	822	0.5	732	7.8	BDL	169	+ve	+ve	+ve
		Wahadat Colony	TQ-04		12.00	MP	B5	2280	1.2	1480	7.4	0.01	158	-ve	-ve	-ve
		Hussainabad	TQ-05		12.52	WS	12	841	0.5	665	7.7	BDL	165	+ve	+ve	+ve
		Alamdar Chowk	TQ-06		01.25	WS	19	845	0.5	666	7.7	BDL	151	+ve	+ve	+ve
	Taluka Latifabad	**Latifabad No.04**	TL-01		02.20	WS	24	870	0.5	690	7.9	BDL	172	+ve	+ve	+ve
		Latifabad No: 08	TL-02		03.12	WS	21	820	0.5	736	7.8	BDL	183	+ve	+ve	+ve
		Latifabad No:12	TL-03		4.00	WS	12	753	0.5	594	7.7	BDL	143	+ve	+ve	+ve
		Latifabad No:02	TL-04		04.15	WS	11	840	0.5	668	7.7	BDL	165	+ve	+ve	+ve
		Indus Pahari	TL-05		04.35	WS	11	877	0.5	690	7.8	BDL	171	+ve	+ve	+ve
		Fatah chowk	TL-06		05.10	MP	B5	2180	1.2	1470	8.1	0.01	355	-ve	-ve	-ve

Note: B5= below 5
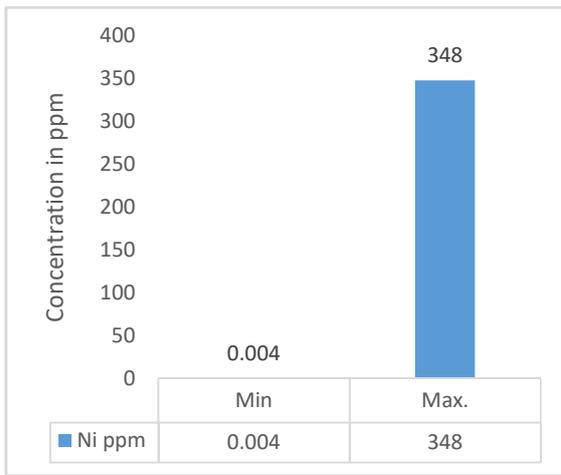**BDL= below detection limit**

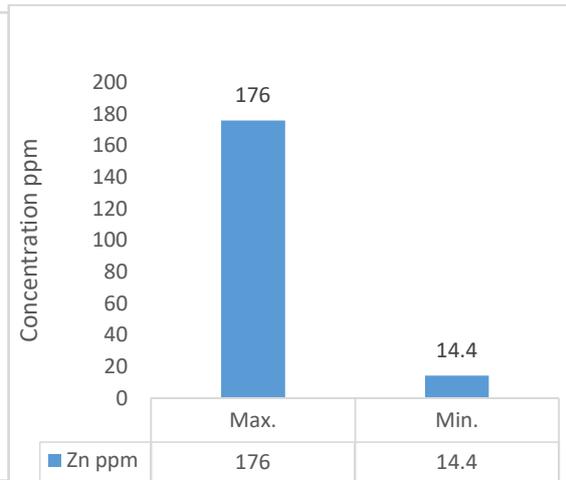**Figure 1: Concentration of Nickle**
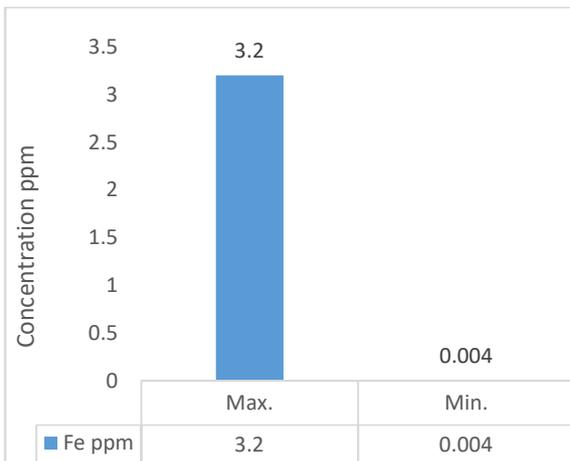

Figure 2: Concentration of Zn

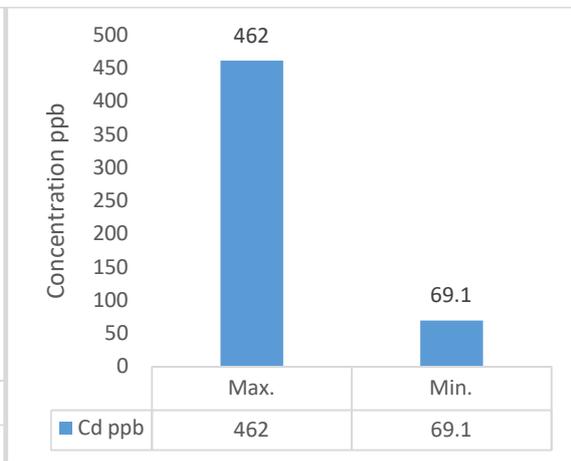**Figure 3: Concentration of Fe**

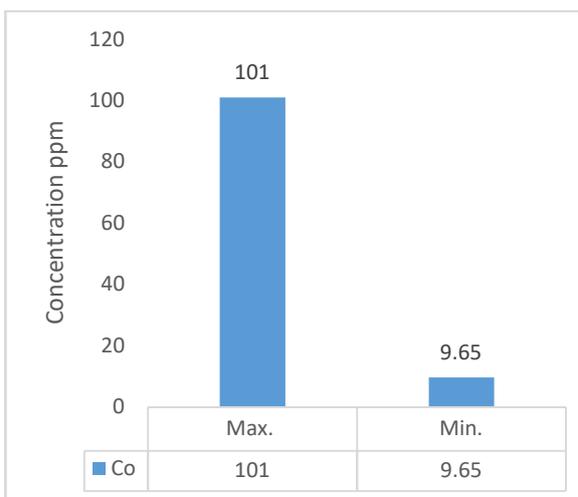**Figure 4: Concentration of Cd.**
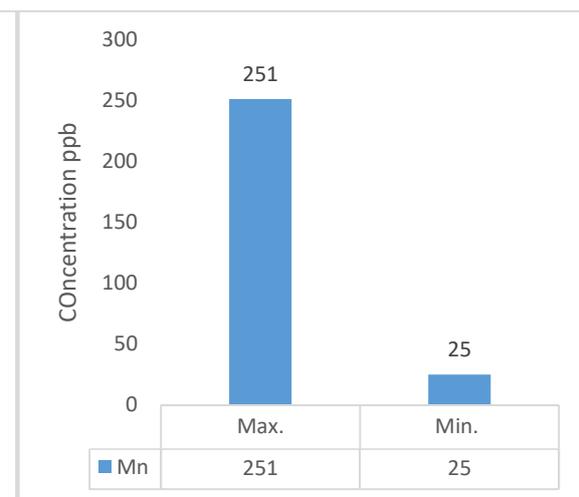

Figure 5: Concentration of Co

Figure 6: Concentration of Mn

DISCUSSION

Water being the vital source all living beings has increase the great concern of scientific research community globally. Unfortunately this imperative source of life facing many contamination of heavy metal and microbes and which become basis of many health threatening public issues worldwide as well as in Pakistan.

Instituting standards concerning water quality by World health organization are failing to comply and growing roots innumerable illness. Heavy metal contamination of water seeking the much importance because it is not only threat to public health but also poses hazardous effects on aquatic life (25).

The physical parameters recorded in present study showing conventionality with results of earlier reported data that the ground water were observed colorless, odorless but were slightly saline (22).

The occurrence of turbidity was also notes in surface water which may be permanent or seasonal, the 5 NTU in drinking suggested normal level by WHO the level higher that this frequentlylinked with higher number of disease-causing microbes constituting health problem (08).

Electric conductance (EC) of water is a quantifyingindicating concentration of total dissolved solids that makes water conductor of heat, the drinking water were highly ionized due to excessive dissolve solids and other impurities therefore found with higher value i-e 1562 µS/cm recommended by WHO figure. The results were in consistent with data of ground water samples from Bahawalpur City, Pakistan (16). Total dissolved solids Total Dissolved solids (TDS) refer to the amount of inorganic substances suspended or dissolved in water and the founded results showing similarity with the facts for ground water sources from district Matiari, Sindh where the EC, TDS concentration was originated above the permissible value which make the water unsuitable for human drinking. Additionally elevated TDS concentration left serious affects upon the individuals anguishing from heart and kidney diseases, and causing skin rashes, and depressed body hair growth. The extended utilization of TDS overhead 500 ppm make joints stiff, kidney stones, gallstones, and hardening of arteries, TDS also decreases the tastiness and causes gastrointestinal irritations in human and laxative effect mainly upon transits (26).

Elevated chloride level was causing thecorrosion of pipes which can lead to increased concentration of metals in the water supply and leaving perilous effect

indirectly. In Pakistan the arsenic concentration was beyondthe WHO figures (10 ppb or µg/L), the fact was conforming by the study conducting in eleven cities of Punjab Pakistan pebbledash surplus level of arsenic (15). Zinc (Zn) is crucial element and performs a valuable role in normal growth and reproduction if within permissible of 3 mg/L level and in most water samples, Zn was found within the normal range in Pakistan. However, published data that Zn concentration in drinking water varied between 0.040 to 0.046 mg/L in pre-monsoon and post-monsoon seasons of district Thatta, Sindh. Likewise manganese (Mn) is known as usual integral of human diet though creating a small problem in some parts of Pakistan if the level increased above the WHO standard limits (0.5 mg/L). it was reported that Mn with 2.56 mg/L was found in groundwater samples of Khyber Pakhtunkhwaand Over exposure of manganese also causes enduring neurological disorders similar in symptoms to idiopathic Parkinson disease. (14)Cadmium (Cd) incidence higher than 0.003 mg/L fixed by WHO may origin acute gastrointestinal problems, such as nausea and diarrhea, while chronic exposure may causing kidney damage , reproductive problems , bone damage and many cancer. The superfluous

concentration of different salts like sodium (Na), calcium (Ca),magnesium (Mg), potassium (K) and chlorides (Cl) were found from sewerage water of Fullali Canal, Hyderabad (27). Besides the beneficial role of iron (Fe) in normal physiology its deficiency along with its overexposure both are associate with many health problems, although deficiency is much common than its overexposure in drinking water but it may root the cancer, diabetes liver and heart diseases as well as neurodegenerative disorders. Therefore WHO set the allowable limit for iron i-e 0.3 mg/L and 28% cases of groundwater and 40% of surface water cases was found with burdened iron concentration (13, 14, 28)

Incidence of cobalt was foundcomparatively low in water and water becomes suitable for drinking purpose, as it is advantageous in production of red blood cells stimulation. Excess nickel (Ni) concentration above the WHO limit 0.02mg/L is the known source to produce cancer, dermatitis, cardiovascular diseases, lung fibrosis, kidney problems and cancer of the respiratory tract. The nickel was detected in drinking water samples of Karachi in ground water(0.01–2.19 mg/L) and 75% of surface water(22). Alongsidethe peak contactof heavy metals lead to many

adverse effects on all living beings despite of its crucial role in metabolic actions (21).

Arsenic (As) a potentially toxic element can exist in organic and inorganic form. Arsenic in drinking water can impact human, exposure to lower levels can cause nausea and vomiting, decreased production of red andwhite blood cells while ingesting high levels of inorganic arsenic can cause cancer. The concentration of Arsenic is toxic element existing in both organic and inorganic form and is known as potent carcinogen when ingesting high level of it, even the lower exposure to this element can become the cause of nausea and vomiting, decreased production of red and white blood cells. Arsenic occurrence poses big health issues in Bangladesh, India, China, Vietnam, Nepal and Myanmar furthermore our results are in agreement with previously reported research study (10, 24).

The concentration of Cd in water ranged between 0.15-0.22mg/L during study period.In both season the Cd concentrations are above the safe limit set by WHO (2011). Cadmium being a toxic metaland in both acute and chronic exposure may produce the gastrointestinal disorder like diarrhoea, vomiting and kidney damage (13,26,27). Zinc (Zn) upon over exposure initiate the nastiest health consequences. Lead (Pb) even

in trace amount affecting developmental delay, miscarriages and low birth weight, chronic exposure could adversely affects major organs and body systems i.e immunological, digestive as well as skeleton and kidneys(04,15,17). Copper (Cu) is a vital metal for all living organisms, playing significant role in several enzymatic reactions. Copper content present in the samples ranges from 0.001- 0.87mg/L are within the permissible limit set (29). A few chemicals and metals polluted the drinking water sources and allied with human security and that ruining gastrointestinal, liver, kidney, cardiovascular, and neurological infections and malignancy(27).

CONCLUSION

It was sum up from the present results and preceding reported data that the several chemicals and toxic metals contaminate the water sources and make water unfit for drinking which consecutively grows many roots of adverse problems linked with human health.

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