Biological Forum – An International Journal **7**(2): 699-702(2015)

ISSN No. (Print): 0975-1130
ISSN No. (Online): 2249-3239

Quality Assessment of Drinking Water from the Different Colonies of Quetta City, Pakistan according to WHO Standards

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(Received 02 August, 2015, Accepted 15 October, 2015)
(Published by Research Trend, Website: www.researchtrend.net)

ABSTRACT: The present study was undertaken to examine the quality of tap water of Quetta city used for drinking purpose during the period of October 2014 to April 2015. Total 16 water samples were collected four from each four colonies (point1, point 2, point 3, and point 4) and analyzed for their physicochemical characteristics. The pH, Total dissolve solids (TDS), Electric conductivity (EC), Hardness and chemical oxygen demand (COD) have been determined. The experimental procedures were set according to the international drinking water standards set by WHO. The obtained results revealed that pH, TDS, hardness of all collected samples was within WHO limits, while the value of EC was high in all samples except two houses of point 4. Furthermore, the chemical oxygen demand (COD) value was also high in all samples of the present study. Thus, present study revealed that except the electrical conductivity and chemical oxygen demand,each selected parameters was fulfilling the permissible limit for drinking water guidelines of WHO standards.

Keywords: Tap water, WHO standards, Quetta city.

INTRODUCTION

Water plays an important role in sustenance of life and in support of human health, since 80% of diseases are spreading in developing countries because of the shortage of good quality water (Cheesbrough, 2006). The precaution of good quality water is a basic factor in guaranteeing public health, protection of the environment and sustainable development (Ranjini *et al.*, 2010). The quality of drinking water is a prevailing environmental determinant of health (WHO, 2010).Good quality water is one of the basic important factors for human configuration and man's sustained existence depends very much on its accessibility (Lemikanra, 1999; FAO, 1997). Drinking water quality management has been a key pillar of primary prevention for last few decades, as it is being considered the basis for the prevention and control of various water borne diseases (WHO, 2010).A significant proportion of the world's population use clean water for drinking, cooking, personal and home hygiene etc (WHO, 2004).

Contaminated water is a global public health threat placing people at risk of diarrhea and other illness (Okonko *et al.*, 2009). The occurrence of diarrhea among children and infants can be due to the use of perilous water and unhygienic practice (Oladipo *et al.*, 2009; Tortora *et al.*, 2002). Diseases due to drinking of contaminated water leads to the death of five million children yearly and make 1/6 of the world population ill (Shittu *et al.*, 2008). Water may also contain toxic inorganic chemicals that may cause different severe or persistent health effect. These severe effects include nausea, skin rashes, lung irritation, vomiting and dizziness due to which sometime death may occur. Persistent effect like birth defects, cancer, organs damage, disorder of the nervous system and damage to the immune system are usually more common (Erah *et al.*, 2002).

In many developing countries, availability of clean water has become a serious and burning problem because it is a matter of great concern to families and communities which are depending on non-public water supply system. Water meant for drinking purpose must be therefore meet quality standards. Water quality is essentially determined by its physical and chemical characteristics (WHO, 2004).

Good quality of water resources depends on a large number of physico-chemical parameters and biological characteristics. Therefore, present study was conducted to find out different physicochemical parameters of drinking tap water samples collected from four different sites of Quetta City of Pakistan in order to observed that whether all these samples are fulfilling the quality standards of WHO or not.

MATERIALS AND METHODS

In present investigation, tap water samples were collected from sixteen houses located in four different colonies of Quetta city during the period of October 2014 to April 2015. These four selected colonies were designated as points such as,
(i) Ameerabad (Point 1),
(ii) Wahadat colony (Point 2),
(iii) Chamanphatak (Point 3)and
(iv) Serki road (Point 4).
In each colony, four houses were selected and designated as follows;
Point 1= Ht1a, Ht2a, Ht3a and Ht4a
Point 2= Ht1b, Ht2b, Ht3b and Ht4b.
Point 3= Ht1c, Ht2c, Ht3c and Ht4c) and
Point 4= Ht1d, Ht2d, Ht3d, Ht4d).
All water samples were collected in polythene bottles and before sampling, the bottles were washed three times with sample water. The major water quality parameters selected for the present study includes i.e., pH, total dissolved solids (TDS), electrical conductivity (EC), dissolved oxygen (DO), total hardness and chemical oxygen demand (COD).The taste of water was tested by the panel of 10 laboratory analysts and co-workers. pH was carried out at room temperature by portable pH meter (Jenway 370) after calibrated with pH 7 and 4 buffer. Conductivity and TDS were carried out at 25ºC by conductivity meter (Jenway 470) after calibration with calibration solution (HI7031, Henna instrument Hungry). Hardness was determined by complexometric titration method and COD was determined by titration method.

RESULTS AND DISCUSSION

The results obtained about physicochemical analysis of different tap water samples from different colonies of Quetta city are presented and recorded in Tables 1-4, respectively.

Table 1.showing physiological parameters of water collected from location point 1.

S. No.	Samples	Samples code	pH	EC	TDS	Hardness	COD
				(µs/cm)	(mg/l)	(mg/l)	(mg/l)
1	House no.1a	Ht 1a	8.09	380	228	20	32.4
2	House no.2a	Ht 2a	8.23	333	201	18	31.2
3	House no.3a	Ht 3a	8.15	347	208	20	30.0
4	House no.4a	Ht 4a	8.00	367	221	25	30.4

Table 2: Showing physiological parameters of water collected from location point 2.

S. No.	Samples	Samples code	pH	EC	TDS	Hardness	COD
				(µs/cm)	(mg/l)	(mg/l)	(mg/l)
1	House no.1b	Ht 1b	6.95	650	985	58	28.8
2	House no.2b	Ht 2b	7.68	815	243	40	30
3	House no.3b	Ht 3b	7.66	502	248	38	30.4
4	House no.4b	Ht 4b	6.85	503	308	30	30.4

Table 3: Showing physiological parameters of water collected from location point 3.

S. No.	Samples	Samples code	pH	EC	TDS	Hardness	COD
				(µs/cm)	(mg/l)	(mg/l)	(mg/l)
1	House no.1c	Ht 1c	7.95	543	328	20	24
2	House no.2c	Ht 2c	7.33	418	327	25	24.8
3	House no.3c	Ht 3c	7.44	525	307	20	25
4	House no.4c	Ht 4c	7.66	560	342	28	28

Table 4: Showing physiological parameters of water collected from location point 4.

S. No.	Samples	Samples code	pH	EC	TDS	Hardness	COD
				(µs/cm)	(mg/l)	(mg/l)	(mg/l)
1	House no.1d	Ht 1d	7.88	123.3	134.2	70	25.3
2	House no.2d	Ht 2d	7.85	159.6	104.9	70	25
3	House no.3d	Ht 3d	8.00	334	205	75	25.8
4	House no.4d	Ht 4d	7.79	345	210	70	24.9

In the present investigation, most water samples were colorless, tasteless and odorless.

A. pH of water samples

The pH values of drinking water samples from point 1 samples are greater as compared to other water samples, which mean that water samples of this point show slightly basic character, as shown in Tables 1-4, respectively. This increase in pH values indicates the presence of calcium and bicarbonate ions due to lime stone weathering in the catchment and underground water beds. While pH of point 2 sample was slightly acidic, hence, indicates the presence of acidic water added in the clean water sources as a result of agriculture and domestic activities. From the present results, it was concluded that the pH values of all drinking water samples lies in permissible limit that is 6.5-8.5 recommended by WHO (see Table 1-4). Thence, all these water samples are safe for drinking purpose.

B. Electrical conductivity (EC)

Electrical conductivity (EC) is the function of total dissolve solid, so it is commonly known as ions concentration because through EC, we can easily determine the quality of water. The results of present study shows that EC values of all water samples are greater than permissible limit recommended by WHO except two water samples obtained from Ht1d and Ht2d, whose values were within WHO limit. Such difference in EC values is might be due to the reason that the composition of water of different areas is different geographically and sometimes by other different reasons.

C. Total Dissolve Solids (TDS)

Total Dissolve Solids (TDS) is an important parameter that imparts unusual taste to water and reduce its portability. The TDS values of point1, point 2, point 3, and point 4 are shown in Tables 1-4, respectively. The TDS vales of water samples of Ht1d and Ht2d is low as compared to other water samples, while on the other hand, water sample from Ht1b possesses high TDS value as compared to other locations. However, in general, the TDS values of all collected water samples were lies in permissible limit prescribed by WHO (1000mg/L).

D. Hardness and Chemical Oxygen Demand (COD)

The chemical parameters like hardness and Chemical oxygen demand (COD) are also very important in the determination of water quality. Hardness is a measure of the capability of water to cause precipitation of unsolvable calcium and magnesium salts of higher fatty acids from soap solution.

Water hardness is a reflection of the quantity of ions in water as the quantity increase. If the value of hardness is between 0 to 60mg/l water is considered soft, fairly hard from 61 to 120mg/l, hard if value is among 121 to 180 mg/l and very hard if more than 180mg/l. Hence, present study indicated that the hardness of all water samples was within permissible limit as prescribed by WHO (500mg/l). COD is the parameter used to assess the pollution of surface and ground water. These observed values are very much higher than the standard value recommended by WHO 4mg/l. This indicates the problem of highly organic contamination make it harmful to human contamination. It might be due to agriculture and cattle particles, which are the rich source of organic pollutants.

CONCLUSION AND RECOMMENDATIONS

In the present work, the analysis reports revealed that approximately all the water quality parameters lies within WHO guideline for drinking water thence may be suitable for drinking purpose, but few parameters such as, EC and COD were higher than permissible limits. Furthermore, some samples of point 4 were reported with lower EC value than WHO guideline for drinking water, however such value have not any serious impact on drinking water quality. Therefore, from the present results, it was concluded that all water samples were highly polluted specially by organic pollutants and pose a serious risk to consumers without treatment.

According to WHO and USEPA recent news and reports, most tap, boreholes, streams and rivers waters in human use are not safe for drinking due to heavy industrial and environmental pollutions. Toxic chemical, heavy metal and bacteria in water can create serious illness while revealing them to long term health circumstance. Therefore, water quality should be controlled in order to reduce keen problems of water related diseases that are prevalent to health of man. Therefore, an effective and thorough hygienic condition should be given to these water bodies in Quetta city in order to maintain a good water quality.

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