Original Research Article

Analysis of physiochemical parameters of ground water: A case study

Abstract: The main sources of water are rain, surface and ground water. These resources are contaminated due to human and industrial activities. Both urban and rural areas ground water is an eminent source of drinking water. The main objective of this study was to access the quality of ground water in Faisalabad city. From twelve different colonies of the Faisalabad water samples were collected to estimate their physiochemical parameters. The physiochemical parameters like (pH, EC, TDS, Calcium, Bi-carbonates, Total Hardness and chloride) were analyzed by comparing these parameters with standard values given by the WHO. In many colonies some parameters were found within permissible parameters of above standard such as pH and total hardness. But in few colonies EC, TDS, Bi-carbonates and chlorides values deviated with reference to the recommended values. On the completion of data physiochemical parameters of ground water, statistical analysis was applied. Analysis of the variance was carried out to evaluate the significant different between means of samples.

Keywords: Water quality; Groundwater; Physiochemical parameters; Analysis.

INTRODUCTION

The rain water sieve slowly through a permeable surface to down through unfilled spaces (fractures, crevices and pores) engrossed in the ground, rocks, gravel, and soil states as Groundwater (Miller, 2007). Through wells and tube wells, the water can be obtained that found underground in the soaking coats of the rocks. Soil penetration ability can vary up to 500 m in different zones (Reshma and Prakasma, 2007).

To sustain life on earth water is one of the most essential and dynamic components. Water accounts for about 70% of the total body weight almost in all organisms. The main causes for quick increase in water pollution that have raise the concern over its protection and future uses are rapid growth in population, fast industrialization, more increasing human requirements and

increase in the use of agricultural fertilizers and chemicals. Globally it is becoming an adverse resource (Jothivenkatachalam *et al*., 2010).

Groundwater have significant importance for human drinking, also give support to surrounding, and it is extensively spread, renewable most essential reserve presents on earth. Defiantly, it is colorless, clear and needed a least administration mostly free from microbial contamination, naturally drawn in its sequence of flow through the ground (Babiker *et al*., 2007). Hygienic water is essential and significant for communal health and sustainability of marine ecosystems so, for theses reason analyzing the quality of water is important (Hiyama, 2010). In different nations due to increasing living ethics and population growth, the need of advanced quality of water resources for various uses such as drinking, agricultural and industrial use (Rahmani, 2010).

Due to frequently raising quantity of soluble damaging ingredients from urban wastes, industrial wastes and present agricultural activities, the threat of contamination in ground water is increased. Furthermore, sweeps, other surface activity and fires that decrease or increase infiltration that could also contaminate the fineness of surface groundwater. Water pollution is slightly biological, chemical and physical variation in water quality that have been harmful impact on prevailing organisms or marks water unsuited for desired uses. The chemical physiognomies of water can be calculated such as Dissolved oxygen, Chloride, alkalinity, Magnesium, hardness, Bi-carbonates, chloride, Phosphate, BOD, Nitrate, Calcium and pH, by the chemical parameters of water. Due anthropogenic and physical activities quality of water changes, revealed in its chemical, biological and physical states are influenced (Miller, 2007).

In Pakistan, the main reasons of surface and ground water pollution are side effect of several manufacturing industries such as dying chemicals, cement, textile, engineering, steel, pesticides, metal, power, leather, petrochemical, construction, sugar processing, mining, energy, food processing and fertilizers. Water pollution become unpleasant and increased that are carried by drains, canals to river and industrial wastes, urban waste water runoff and sewage. Due to increase in water pollution, the total dissolved solids (TDS) increases, dissolved oxygen (DO) decrease, EC and Salinity also increase. Nearly 60% people has no access to clean and pure drinking water in growing countries (EPA, 1996) and nearly 3.4 million people decease each year in the globe due to transmitted diseases through polluted water. It is assessed that unfortunately, pure drinking water is not available to people in developing countries of Asia and

Africa like China, Pakistan, India etc. (Anonymous, 2001). One billion people from 6 billion peoples lack correspondence to harmless drinking water, and the satisfactory hygiene is not managed by 2.5 billion people on the planet (TWAS, 2002).

The main intention to design this study was to determine the important physiochemical parameters, to estimate the parameters of ground water, and to observe that whether the water of these areas is suitable for domestic use and drinking purposes or not and to relate the acquire values of parameters with the drinking water quality strategies of National standards and WHO.

MATERIALS AND METHODS

Sample of collection

The present study was intended from different colonies of Faisalabad to estimate the water quality parameters. From different colonies of Faisalabad and these Sites were twelve in number i.e Fareed colony, Al-Najaf, Rehman town, Peoples colony, Zulfiqar colony, Bawa chak, Muslim town, Gulshan colony, Bhatala colony, Awami colony, Sarfaraz colony and Dhodi-wala the water samples were collected.

Preparation of samples

In clean polythene bottles the samples were collected deprived of any air foams. Before sampling the containers were washed and firmly closed after collection and tagged. The temperature of the samples was precisely deliberated in the field itself at the time of sample collection. Samples were kept at 4°C in freezer.

Figure 1 Sampling area location

Analysis of water sample

Several water quality parameters were analyzed such as Total Alkalinity, Total Dissolved Solids (TDS), Total Hardness, pH, Calcium and Chlorides.

Determination of water quality parameters

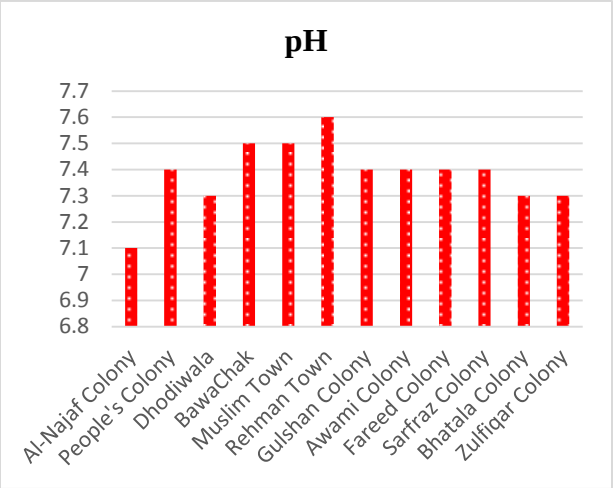
Scholler's diagram method is most popular and extensively used for drinking water quality estimation. The distinct variability of groundwater quality cannot be estimatied simply and for this purpose, Babiker *et al*., 2007 had presented groundwater quality index (GQI) (Rahmani *et al.*, 2011). The quality parameters were analyzed as follow; Total Dissolved Solids (TDS) was estimated by standard methods3, pH- was measured using standard pH meter, calcium content by EDTA titrimetric method, methyl orange alkalinity, total hardness (TH) by EDTA titrimetric method, chloride content by argentometric method.

Statistical Analysis

On the complete data of the physiochemical parameters of ground water Statistical analysis was applied. Suitable tables were arranged, and means were assessed. The t-test was applied to analysis of variance and to estimate the significant difference among means of samples was carried out.

RESULTS AND DISCUSSION

From different colonies of Faisalabad, the water samples were collected esteems to analyze their physiochemical parameters like (, TDS, EC, Ca, pH, Mg, chlorides, total hardness and bicarbonates of ground water. According to (Table 2) results has been significant by varying the values of recorded data. Mean pH value was (7.3833) which is the fair in accordance with the WHO values and EC mean is 3566 which is very high compared with the given values. Whenever, TDS T and P values were 2.02 and 0.069 showing the significant result.



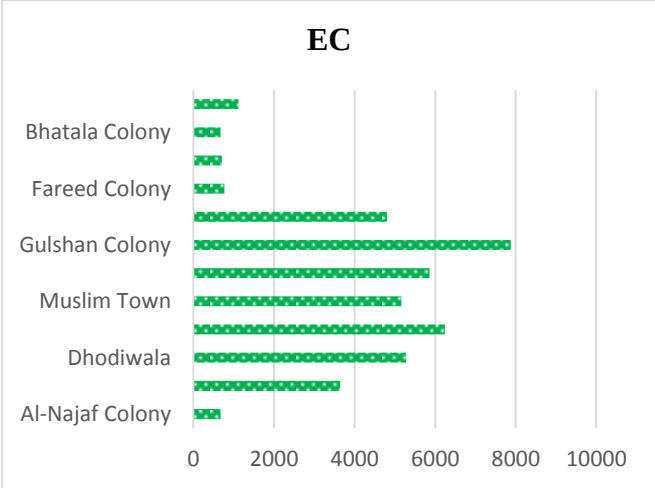


Figure 2 **Figure 3**

Comparison of pH and EC of ground water in different colonies

In the graphical representation (Figure 2) pH values from the water samples of all the mentioned areas are in normal range (6.5-8.5) which is given by the WHO standard and highest and lowest pH was recorded for Al-Najaf colony and Rehman Town respectively. While EC value was recorded highest for Gulsan colony (7880 µS/cm) and least for Bhatala colony and Al-Najaf colony (670 µS/cm) (Figure 3). Exceeding EC from the normal range reveal that water of these colonies also contained contaminations which are not good for human health, whereas 58.33% samples exceeds the optimum limit of EC. These results are also according with the previous studies (Macka *et al*., 1994).

Table 1: Physiochemical Parameters of Ground Water

Sr. No.	Identification	pH	EC	TDS	Ca^{+}	Mg^{++}	Total Hardness	Bi-Carbonates	Chlorides
Units		--	µS/cm	Mg/l	Mg/l	Mg/l	Mg/l	Mg/l	Mg/l
WHO Guideline		**6.5-8.5**	**1000- 2000**	**1000**	**75-200**	**50-150**	**10-500**	--	**250**
1	Al-Najaf Colony	7.1	670	330	51	12	172	248	70
2	People's Colony	7.4	3640	1800	53	45	312	596	464
3	Dhodiwala	7.3	5280	2620	48	45	300	1024	670
4	BawaChak	7.5	6240	3100	45	42	280	756	900
5	Muslim Town	7.5	5160	2560	24	24	156	1140	616
6	Rehman Town	7.6	5860	2910	54	72	424	680	320
7	Gulshan Colony	7.4	7880	3910	59	77	452	784	570
8	Awami Colony	7.4	4800	2370	109	84	608	584	726
9	Fareed Colony	7.4	770	370	59	18	216	248	78
10	Sarfraz Colony	7.4	700	340	118	19	220	236	84
11	Bhatala Colony	7.3	670	320	53	17	200	236	74
12	Zulfiqar Colony	7.3	1120	550	80	30	320	368	124

120 **Table 2: Statistical analysis (ANOVA) of all parameters**

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Sr. No.	Parameter	Total Sampling	Mean	95% CI	T	P	Result
1	pH	12	7.3833	7.3028 - 7.4639	-3.19	0.009	Significant
3	EC	12	3566	1887 – 5245	---	---	
4	TDS	12	1765	929 - 2601	2.02	0.069	Significant
5	Calcium	12	62.75	45.66 - 79.84	-9.63	0.000	Significant
6	Mg	12	40.42	24.42 - 56.42	-8.20	0.000	Significant
7	Total Hardness	12	305.0	220.5 - 389.5	1.30	0.219	Non-Significant
8	Bi Carbonates	12	575.0	374.5 - 775.5	---	---	
9	Chlorides	12	391.3	198.9 - 583.8	1.62	0.134	Non-Significant

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Muslim Town water sample showed minimum Calcium value. But Awami colony, Sarfraz colony, and Zulfiqar colony water samples Calcium values are in normal range. In case of Magnesium, recorded highest in Awami colony and lower in Al-Najaf colony But Rehman colony, Gulshan colony, and Awami colony water shows normal value of Magnesium (Figure 4). According to value obtained from analysis of water samples, Gulshan colony water sample showed maximum TDS values while Bhatala colony water sample show minimum TDS value. Almost all samples fluctuate to normal range. The normal value for TDS is (1000 mg/L) that is given by the WHO standard and distribution of measured TDS values in the study area is shown in Table1).

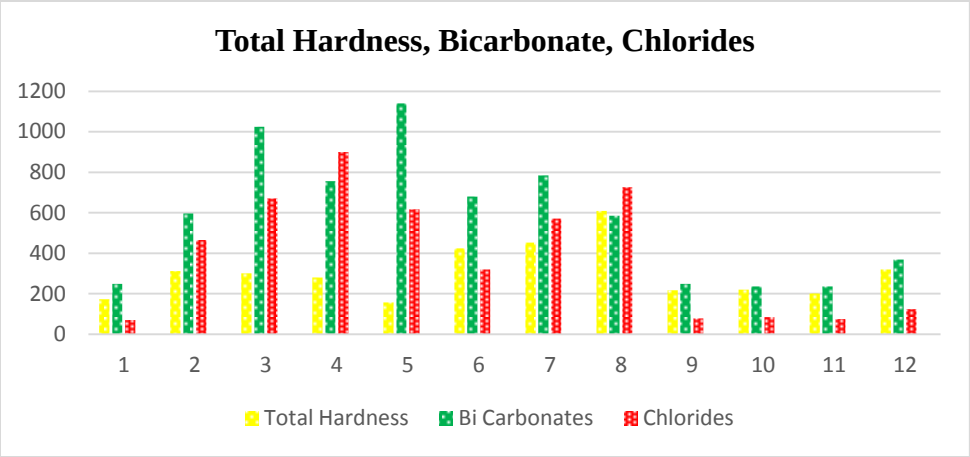

Figure 4 Comparison of Total Hardness, Bicarbonates and chlorides of ground water in different colonies

(Figure 4) shows that almost all areas have normal Total Hardness of Water sample except of Awami Colony. The water having hardness up to 75 (mg/L) arrangement as soft, 76-150 (mg/L) is respectably soft, 151-300 (mg/L) as hard and more than 300 (mg/L) as hard (Farid et al., 2013). Al-Najaf colony water shows less Total Hardness as compared to other colonies. Muslim Town water sample show highest value of Bi-carbonates but Sarfraz and Bhatala colony shows less amount as comparaed to other colonies, as previously study result (Khurshid 1999). According to values Bawa chak water shows highest value of Chlorides and Bhatala Colony shows less value as compared to other colonies water as in the previously assessment of ground water (Sajjad and Rahim 1998; Balakrishnan *et al*., 2008).

In the Fareed Colony water sample, the experiential valve of chlorides, Total Hardness, pH, TDS, Bicarbonates and EC falls in the normal range. In most of the colonies calcium and magnesium are still less than standard range. But only the experiential quantity of magnesium is less than the normal range in the Sarfraz Colony water. For domestic purposes the water of both colonies is useful. Due to the difference in the depth of the ground, the observed value of parameters is different, where the water was reserved pollutants and it also the reason of changes in the value of water parameters.

CONCLUSION

The assessment of the groundwater quality parameters from twelve different areas in the Faisalabad city demonstrate that the total hardness and pH value are well within the permissible limits while others are high or below of the WHO standard. Limited water samples of ground water from these areas were useful for residential use but rather these were bad to drink uses. From the results of the proposed study it may be concluded that the groundwater of Faisalabad is though unfit for domestic and drinking purpose and treatments should be applied to minimalize the pollution particularly the TDS, alkalinity and EC. As a result of high concentration of TDS, water drops its potability and decreases the solubility of oxygen in water.

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