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COMPARATIVE STUDY OF FRESH AND GROUND WATER QUALITY OF DIFFERENT AREAS OF FAISALABAD

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ABSTRACT

Water is necessary to all living organisms in the world and it constitute about 50-97% of all plants and animals by weight and about 70% of human body. The present Study was carried out at EPD, Faisalabad to estimate the fresh and ground water quality for drinking and domestic purposes of different areas of Faisalabad City. Total twenty four water samples were collected randomly and were subjected to analyze for various parameters like, EC, Compensated EC, DO, TDS, ORP (mV), Salinity, pH. EC, Compensated Electrical Conductivity and Salinity were estimated by conductivity / salinity / TDS / temp. Portable meter model JENCO 3010. pH was determined by using pH meter and ORP (mV) was recorded by pH/ mV/ Temperature portable meter. DO was analyzed by Heavy Duty Dissolved Oxygen Meter model EXTECH 407510.TDS was determined by evaporation method. Maximum pH recorded in Kanank Basti ground water samples and the minimum pH noted in kukianwala ground water samples similarly maximum pH was recorded in Kanank Basti fresh water samples and the minimum pH was noted in kukianwala fresh water samples. The maximum TDS (g/l) found in PC # 1 ground water samples and the minimum TDS (g/l) noted in Rehmat Town ground water samples similarly the maximum TDS (g/l) found in PC # 2 fresh water samples and the minimum TDS (g/l) was noted in Kanak Basti fresh water samples. Maximum EC obtained in PC # 2 ground water samples and the minimum EC was noted in Sarfaraz Colony similarly the maximum EC was found in PC # 2 fresh water samples and the minimum EC was noted in Sarfaraz Colony. The maximum salinity was found in PC # 2 ground water samples and minimum salinity was noted in Rehmat Town, similarly the maximum salinity was found in PC # 1 fresh water samples and the minimum salinity was noted in Kanak Basti. The maximum ORP was recorded in PC # 1 ground water samples and the minimum ORP was noted in Kanak Basti while on other hand the maximum ORP was found in PC # 1 fresh water samples and the minimum ORP was noted in Faizabad. The maximum CEC was recorded in PC # 1 ground water while the minimum CEC was recorded in Sarfaraz colony at given temperature, similarly the maximum CEC recorded in Merzi Pura fresh water while the minimum CEC was recorded in Sarfaraz Colony at given temperature. The maximum DO was noted in Mezi Pura ground water samples while minimum DO was recorded in Kanak Basti. Similarly in fresh water sample the maximum DO was noted in PC # 2 water samples while minimum was recorded in Kanak Basti. Mostly the water samples collected from these sites were not good for drinking purposes however these were good for domestic purposes.

Keywords: Ground and fresh water, pH, DO, Salinity. CEC

INTRODUCTION

Water is necessary to all living organisms in the world. Water is also a vital resource for agriculture, manufacturing, transportation and many other human activities. Despite its

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importance, water is the most poorly managed resource in the world (Fakayode, 2005). According to estimation ground water is used by one third of world's population for drinking purposes (UNEP, 1999).

But unfortunately safe drinking water is not available in developing countries of Africa and Asia like China India Pakistan etc. Out of 6 billion people on earth one billion people lack access to safe drinking water and also the adequate sanitation are not approached by 2.5 billion people on the earth (TWAS, 2002).

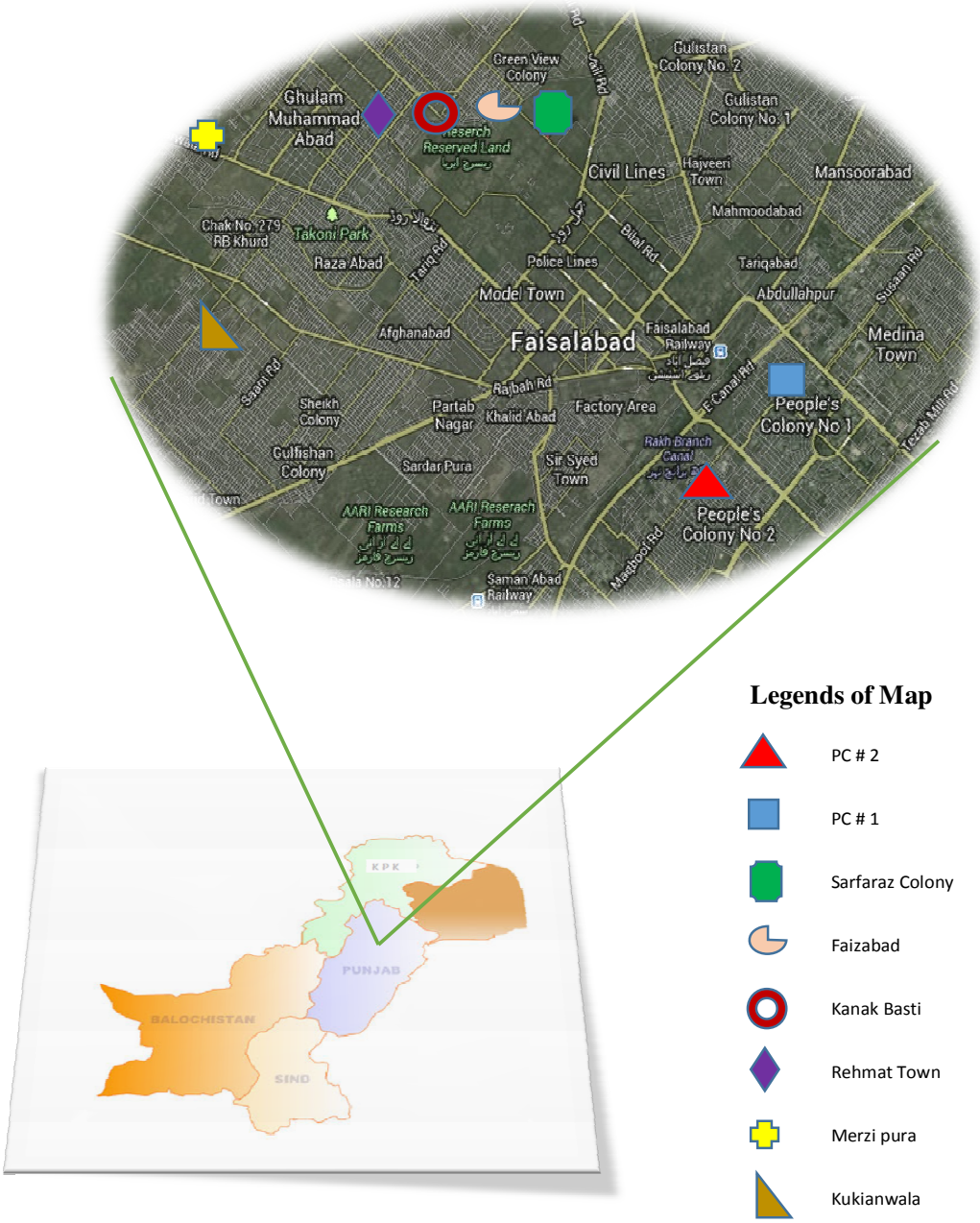

Figure 3. Map view of selected sites for this study from city of Faisalabad.

There are many sources from which ground and drinking water can be polluted. In rural areas application of fertilizers are major source (Emongor *et al.* 2005), improper disposal of

industrial wastes are major source of ground water pollution in urban areas (Chindah *et al.* 2004). The increase in demand of water supply have put pressure on water resources .While most people in urban cities of the developing countries have access to piped water, several others still rely on borehole and river water for domestic use. Rivers are the end point of industrial effluent discharge in most areas of the world, industrial effluents, can contaminate ground water if not treated and disposed of properly (Olayinka 2004)

Industrialization is the way to modernization that results in the alteration of Physical, chemical and biological properties of environment (McGrath *et al*. 1997).

The demand of growing population is fulfilled by industrial states. Industries can produce useful commodities on one hand but at on the other hand they are the cause production of some unwanted products such as solid, liquid or gas that becomes the source of the creation of hazards, pollution and losses of energy. Solid wastes and wastewater are discharged to water bodies often hence they put human and whole ecosystem at risk. In Pakistan, surface and ground water pollution are caused by the byproducts of various industries such as fertilizers, pesticides, cement textile, metal, dying chemicals, engineering, power, leather food processing, petrochemical, construction, steel, mining energy and, sugar processing, and others. Water pollution become worse and spread when Industrial effluents, sewage and urban waste water that are carried by drains and canals to rivers. The increase in water pollution causes decrease in dissolved oxygen (DO), increase total dissolved solids (TDS), Salinity and EC. Fluctuation in pH, ORP and presence of other pollutants, toxic metals such as Cd, Cr, Ni and Pb and fecal coliform and hence water become unsuitable for drinking, irrigation purposes and aquatic life. It has been estimated that 60 % of population in developing countries has no access to pure drinking water (EPA, 1996) and 3.4 million die each year in the world from water related diseases (Anonymous, 2001).

TDS, Salinity, ORP and EC in industrial effluents mostly found above the permissible limits set by *NEQS* (Khan and Noor, 2002). Highly variable pH of the industrial wastewater can leach heavy toxicity and metals from the sediments, soils and rocks and increase water pollution (Shivkumar and Biksham, 1995).

The main aim of this study was to assess the ground and drinking water quality of selected sites to find out either water was fit for drinking and domestic use. For this purpose, samples were collected from these areas and subjected to desired analysis. The Map view of selected sites is shown in Figure 3.

MATERIALS AND METHODS

The present Study was conducted at Environment Protection Department, Faisalabad to assess the fresh and ground water for drinking and domestic purposes of Peoples Colony No. 1, Peoples Colony No. 2, Kanak Basti, Merzi Pura, Kukianwala, Rehmat Town, Sarfaraz Colony and Faizabad of Faisalabad City. Total twenty four water samples were collected randomly from these areas and were estimated for various parameters like, EC, Compensated EC, DO, TDS, Oxidation Reduction Potential (mV), Salinity, pH.

Electrical Conductivity, (EC), Compensated Electrical Conductivity and Salinity were estimated by conductivity / salinity / TDS / temp. Portable meter model JENCO 3010. The meter was calibrated before analyzing the samples. Electrode was dipped in beaker containing water sample till the reading was stable and finally recorded the reading hence Electrical Conductivity, (EC), Compensated Electrical Conductivity and Salinity were determined by this method.

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pH was determined by using pH meter (Arnold *et al.* 1992) and Oxidation Reduction Potential (mV) was recorded by pH/ mV/ Temperature portable meter model JENCO 6231N.

Dissolved oxygen was analyzed by Heavy Duty Dissolved Oxygen Meter model EXTECH 407510. Electrode was dipped in beaker containing water sample and finally recorded the reading (Greenberg *et al.* 1992).

TDS was determined by evaporation method (Arnold *et al*. 1992). A 30 mL of filtered water sample was taken in china dish and evaporated in a water bath at 100oC till constant weight.

TDS was calculated by given formula:

$$TDS = \frac{(A-B) \times 100}{\text{Sample volume}}$$

Where,

A = Weight of dried residue + china dish (g)

B = Weight of china dish (g)

Statistical Analysis

The data collected from present study were entered by using software SPSS version 16 in computer. Proper tables were prepared and means were determined. Analysis of variance was carried out followed by Duncan's multiple arrange test to estimate the significant difference among means of samples. (Ali *et al*. 2011).

RESULTS AND DISCUSSION

pH

The pH values of ground and fresh water of different areas of Faisalabad are shown in Table 1 and Table 2 respectively. The values of pH of all ground water samples recorded in the range 6.7 to 6.2. The maximum pH was recorded in Kanank Basti water samples and the minimum pH was noted in kukianwala water samples similarly the values of pH of all fresh water samples recorded in the range 6.92 to 6.33. The maximum pH was recorded in Kanank Basti water samples and the minimum pH was noted in kukianwala water samples. According to the recommendations of WHO (1985) the values of safe drinking water is 6.5 to 8.5. Most of the samples had pH with in the permissible limit. Information about acidity and alkalinity of water are provided by pH (Katyal & Satake 1990). It also provides us clear information for the collection of other characteristic such as corrosion behavior (Ghandour *et al.* 1985).

TDS

The results of TDS (g/l) for ground and fresh water of different areas of Faisalabad are shown in Table 1 and Table 2 Respectively. The results of TDS of all ground water samples noted in the range 5.03 (g/l) to 2.15 (g/l). The maximum TDS (g/l) was found in PC # 1 water samples and the minimum TDS (g/l) was noted in Rehmat Town water samples while on other hand the TDS of all fresh water samples noted in the range 3.5to 0.4 (g/l). The maximum TDS (g/l) was found in PC # 2 water samples and the minimum TDS (g/l) was noted in Kanak Basti water samples. TDS standard value provided by WHO is in the range of 500-1500 mg/l (Rahman *et al.* 1991). The presence of high numbers of organic salts in form of carbonates, bicarbonates, potassium, sodium and calcium etc and also some non–volatile substances are responsible for high values of TDS in water samples that found in form of solids at room temperature. Water having 500 mg/l of TD is good for health (Sawyer 1994).

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Table 1. Values of pH, TDS, EC, Salinity and ORP of Ground Water samples

Sr.#	*Areas*	*pH*	*TDS (g/l)*	*EC (mS)*	*Salinity (ppt)*	*ORP (mV)*
1	P C # 1	6.4967c	5.03a	5.6000b	2.4933de	104.67a
2	P C # 2	6.5300bc	4.4533ab	6.1400a	4.7000a	75.667b
3	KanakBasti	6.7067a	2.4733c	3.2033ef	1.8200fg	21.000d
4	MerziPura	6.6133ab	2.7267c	3.8800c	2.8500cd	57.000bc
5	Kukianwala	6.2767c	4.33b	3.4933d	3.8867b	48.333bcd
6	Rehmat Town	6.7033a	2.1467c	3.4400de	1.4333g	60.667bc
7	Sarfaraz Colony	6.6700a	2.1567c	2.2567g	2.1233ef	58.333bc
8	Faizabad	6.5167c	2.7533c	3.0233f	3.1533c	32.8000cd

Table 2. Values of pH, TDS, EC, Salinity and ORP of fresh Water samples

Sr.#	*Areas*	*pH*	*TDS (g/l)*	*EC (mS)*	*Salinity (ppt)*	*ORP (mV)*
1	P C # 1	6.53d	3.45a	6.5ab	3.44a	92a
2	P C # 2	6.6467c	3.5533a	7.4933a	2.8767b	66.3333c
3	KanakBasti	6.9267a	0.4967e	6.7367ab	0.382f	23.6667g
4	MerziPura	6.77b	1.4267d	7.2867a	1.2833d	35.5f
5	Kukianwala	6.3333e	2.6533b	5.1633abc	1.8367c	56.6667d
6	Rehmat Town	6.8567ab	2.2233c	3.6367c	0.8767e	84.3333b
7	Sarfaraz Colony	6.58cd	1.7567d	3.5933c	0.454f	43.9733e
8	Faizabad	6.8333ab	1.4543d	4.49bc	1.45d	14.6667h

EC

The readings of EC (mS) for ground and drinking water samples of different areas of Faisalabad are described in Table 1 and Table 2 respectively. The EC of ground water samples noted in the range 6.1 to 2.25 (mS). The maximum EC was found in PC # 2 water samples and the minimum EC was noted in Sarfaraz Colony while the EC for fresh water samples found in the range 7.4 to 3.6 (mS). The maximum EC was found in PC # 2 water samples and the minimum EC was noted in Sarfaraz Colony. WHO recommended permissible limit for EC is 0.5-.1.5 dS/m (Rizvi 1994). The difference in EC is because of different composition of water in different areas because of natural geography.

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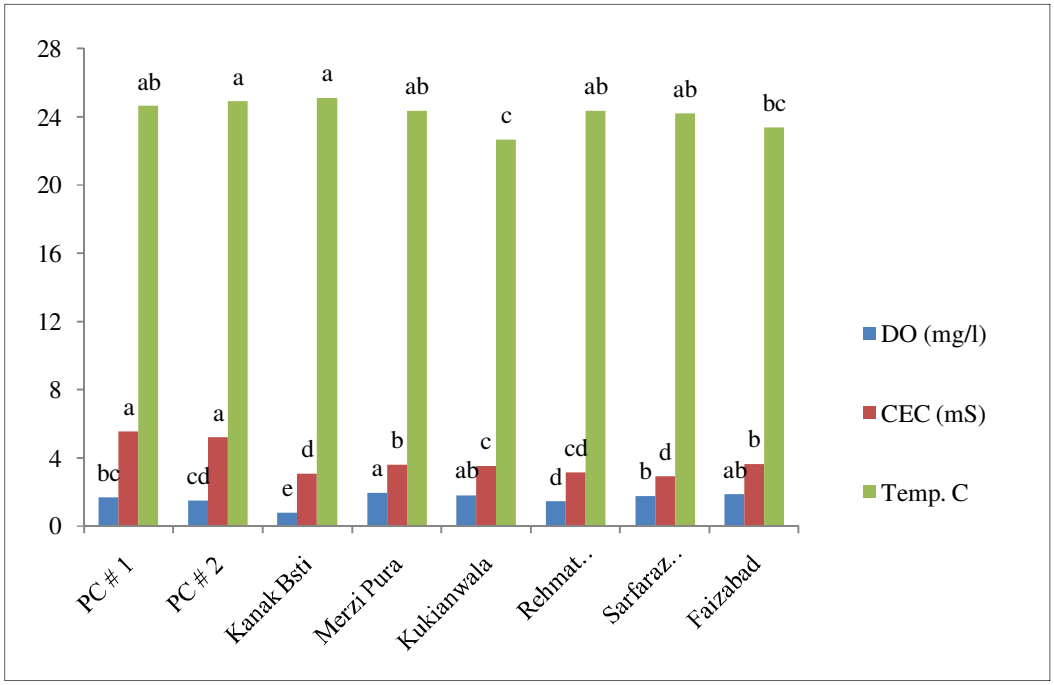

Figure 1. DO and CEC presence in groundwater samples along with respective Temperature

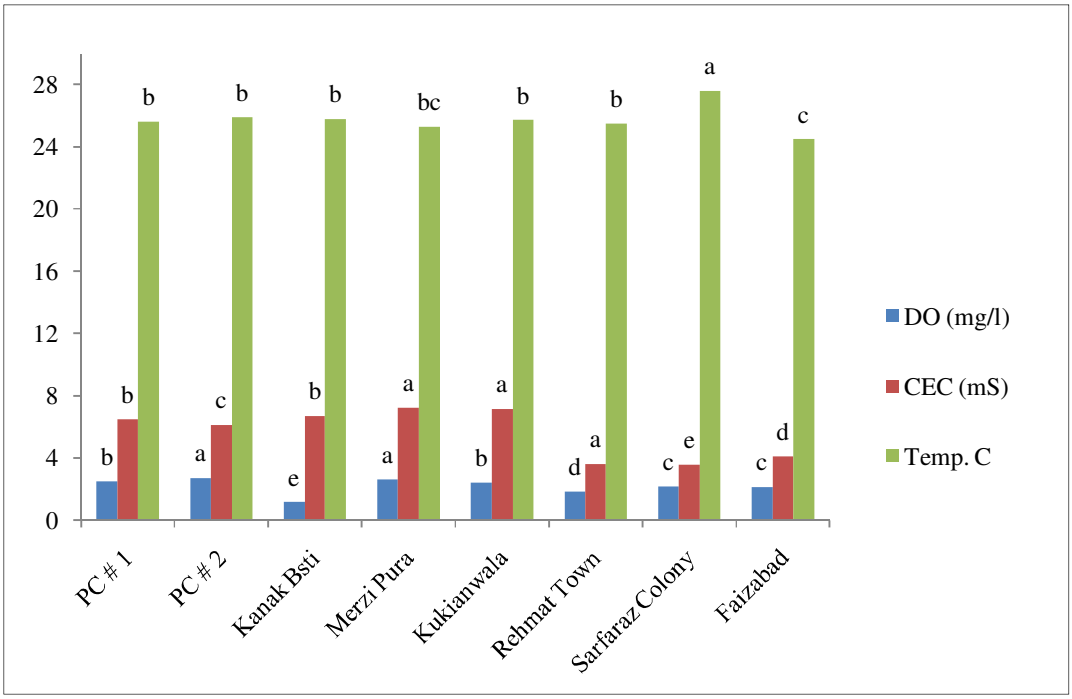

Figure 2. DO and CEC presence in Fresh water samples along with respective Temperature

Salinity

The different values of salinity (ppt) of selected areas of Faisalabad are illustrated in Table 1. The results of salinity of ground water samples lied in the range 4.7 to 1.4 (ppt). The maximum salinity was found in PC # 2 water samples and minimum salinity was noted in Rehmat Town similarly The results of salinity of fresh water samples lied in the range 3.44

to 0.38 (ppt). The maximum salinity was found in PC # 1 water samples and the minimum salinity was noted in Kanak Basti. Salts values in water increased due to excessive nutrients percolation through soil in ground and fresh water supplies. (Hussain *et al.* 2001).

ORP (mV)

The readings of ORP (mV) for ground and fresh water of different areas of Faisalabad are shown in Table 1 and Table 2 respectively. The results of ORP (mV) of ground water samples lied in the range 104.6 to 21 (mV). The maximum ORP was recorded in PC # 1 water samples and the minimum ORP was noted in Kanak Basti while on other hand the ORP (mV) of fresh water samples fell between the range 92 to 14.7 (mV). The maximum ORP was found in PC # 1 water samples and the minimum ORP was noted in Faizabad.

CEC

The values for Compensated Electrical Conductivity (CEC) and Dissolved Oxygen (DO) of ground and fresh water samples along with Temperature are described in Figure 1 and Figure 2. The values of CEC for ground water lied in range of 5.6 to 2.9 (mS). The maximum CEC was recorded in PC # 1 while the minimum was recorded in Sarfaraz colony on given temperature. Similarly values for fresh water lied in range of 7.2 to 3.5 (mS). The maximum CEC was recorded in Merzi Pura while the minimum was recorded in Sarfaraz Colony on given temperature. Since EC can be defined as the ability of water to pass the electrical current, this ability depends upon ion present, concentration and water temperature which is further known as compensated electrical conductivity CEC (Farah *et al*. 2002). High EC is because of high concentration of TDS in water (Ilyas *et al.* 2008).

DO

Contrary, on other hand the DO values of ground water samples fell between the range 2 to 0.8 (g/l). The maximum DO was noted in Mezi Pura water samples while minimum was recorded in Kanak Basti. Similarly in fresh water sample DO values recorded in range of 2.8 to 1.6 (g/l). The maximum DO was noted in PC # 2 water samples while minimum was recorded in Kanak Basti. The permissible limit for drinking and domestic use of water of DO defined by WHO is 4-6 mg/l (Rizvi 1994). The ground water having less DO concentration which increase the anaerobic microorganisms' growth and limit the water purification capacity (Sawyer 1994).While the corrosions of metal paper supported by too much dissolved oxygen while the excess of DO is not harmful to health (Rizvi 1994, Sawyer 1994).

CONCLUSION

Most of the water samples from different sites showed that ground and fresh water from these sites were not good for drinking purposes but these were good for domestic use.

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