

*Full Length Research Paper*

# Drinking water quality status of district Charssadda – Pakistan

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**This study was designed to evaluate the drinking water quality of the District Charssadda. About 216 water samples from different part of the district were collected regularly for a period of 12 months. Results indicate that most of the water quality parameters tested is within the limits of available drinking water guidelines. The surface water samples were within the limits for iron and magnesium, but 11% and 32% of the ground water samples were found to be crossing the standards. Surface water is found comparatively more alkaline than the ground water, owing to greater microbial contamination. Total coliform contamination was found both in ground water and surface water samples. Nearly 57% and 98% microbial contamination was observed in the ground water and surface water samples, respectively. The correlation and regression analysis gives a significant relation between total coliform and pH, 0.43 for ground water and 0.78 for surface water, between EC and TDS, 0.78 for ground water and 0.15 for surface water, between TA and TDS, 0.43 for ground water and 0.11 for surface water, and between TH and TDS, 0.19 for ground water and 0.20 for surface water. The results of this study suggest a cost-effective treatment prior to drinking usage, particularly in case of surface water.**

**Key words:** Water quality, groundwater, surface water, correlation, World Health Organization (WHO).

## INTRODUCTION

Nature has blessed Pakistan with sufficient water resources but due to rapid population growth, lack of proper water management issues, urbanization and continued industrial development has put a huge stress on its water reservoirs. Pakistan's current population of 141 million is expected to grow to about 221 million by the year 2025. This increase in population will have direct impact on the water sector for meeting the domestic, industrial and agricultural needs (Tallat et al., 2011). Pakistan has now essentially exhausted its available water resources and is on the verge of becoming a water deficit country. Consequently the per capita water availability in Pakistan is decreasing continuously, i.e. it was recorded as 5640m<sup>3</sup>/c/day in 1960, but has been observed as 1400m<sup>3</sup>/c/day in 2000 (Arshad et al., 2011; PCRWR 2005). The extended droughts and non-development of additional water resources have further aggravated the water scarcity situation. The water

shortage and increasing competition for multiple uses of water adversely affected the quality of water

Moreover, the available water is being polluted at an alarming rate. In this regard, the results of various investigations and surveys by several agencies had indicated that water pollution has become a serious problem in Pakistan (Imran et al., 2009; 5 Environmental Draft Report, Pak-EPA. 1999). Most of the reported health problems are directly or indirectly related to water (Arshad et al., 2011). The quantitative and qualitative concerns of water call for an action plan for efficient development, utilization and monitoring of the water resources of the country. The water quality deterioration problems are caused by the discharge of hazardous industrial wastes including persistent toxic synthetic organic chemicals, heavy metals, pesticide products and municipal wastes, untreated sewage water to natural water bodies. In several areas, increased arsenic, nitrate and fluoride contamination was detected in drinking water in addition to microbial contamination (Farooq et al., 2008; Jehangir, 2002; Khurram, 2010).

Therefore, this study was design to evaluate the water

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**Table 1.** Water quality analysis of Charssadda District.

Parameter	Surface water	Ground water	WHO
pH	8.9	7.6	6.6-8.5
Turbidity, NTU	4.8	1.7	5
EC, $\mu\text{S}/\text{cm}$	262	498	--
TDS, mg/L	163	241	1000
Temp, $^{\circ}\text{C}$	13.6	8.2	<25
Total Alkalinity, mg- $\text{CaCO}_3/\text{L}$	167	94	
Chloride, mg/L	84	186	250
Nitrates, mg/L	2.4	1.1	10
Ammonia, mg/L	1.9	0.4	--
Total Hardness, mg- $\text{CaCO}_3/\text{L}$	138	222	500
Iron, mg/L	0.01	0.42	0.1
Manganese, mg/L	0.02	0.09	0.3
Total Coliform, MPN/100mL	76	23	Nil

quality of the local area of Charssadda District and its surrounding areas, which was greatly affected by the Flood-2010 (Arshad et al., 2011). The main objective of the study was to check out the water quality in terms of physio-chemical and biological characteristics.

## METHODOLOGY

A total of 216 water samples were collected from different part of District Charssadda during the year 2010-11, both from ground water and surface water sources. Water samples were collected in proper sterilized sampling bottles each of 1.5 liter capacity. Ground water samples were collected following the flushing of water for sometime after operating the hand-pumps. The water samples were analyzed for physio-chemical and biological characteristics within 3-4 hours after collection using standard methods (AWWA, 2005). Temperature, pH, EC (Electric Conductivity) Turbidity was measured in-situ. Whereas, TDS (Total Dissolved Solids), TA (Total Alkalinity), TH (Total Hardness), chlorides, nitrates, ammonia, iron and manganese were determined in the laboratory (US-EPA 1978).

## RESULTS AND DISCUSSION

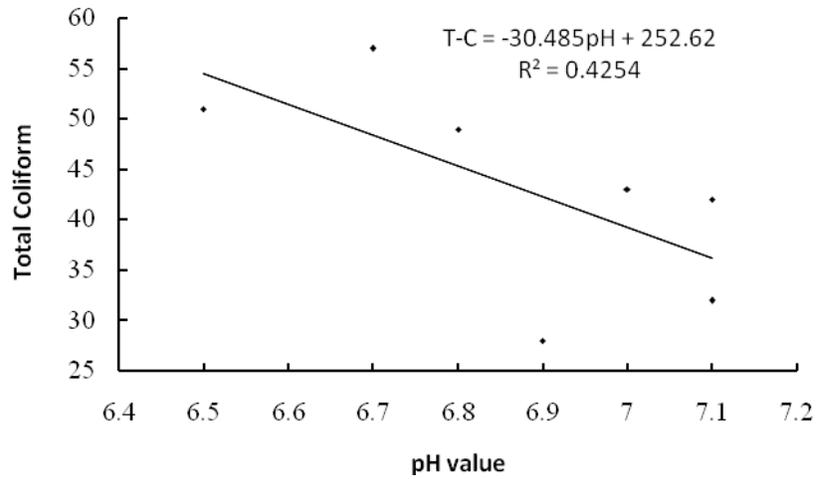
In Table 1, none of the surface nor the ground water samples have violated the WHO drinking water quality standards in term of turbidity, TDS, temperature, total alkalinity, chlorides, hardness and manganese. The results relating to total hardness indicates the existing of soft water in the region. The pH of surface water, i.e. 8.9 as observed, is slightly greater than the required limits of WHO. This might be due to the presence of excessive microbial pollution in case of the surface water. Though the concentration of iron in case of surface water is less as observed, i.e. 0.01mg/L, but it was observed to be

0.42mg/L, which is more that the available limits. The higher concentration of such nutrients or elements is mostly due to the inferior aerobic environment within the water courses. The concentration of total coliform observed in the surface and ground water samples was 76MPN/100mL and 23MPN/100mL, respectively. The existence of much high level of microbial pollution both in the surface and ground water sources is mostly due to the uncover of these reservoirs, the prevailing anthropogenic activities in the surrounding belt, grazing of domestic animals, live stocks, the inappropriate disposal of solid wastes, cross contamination from the sewer lines etc. Since, the surface sources are subjects more to these types of problems; therefore, in surface water samples the concentration of total coliform is comparatively more.

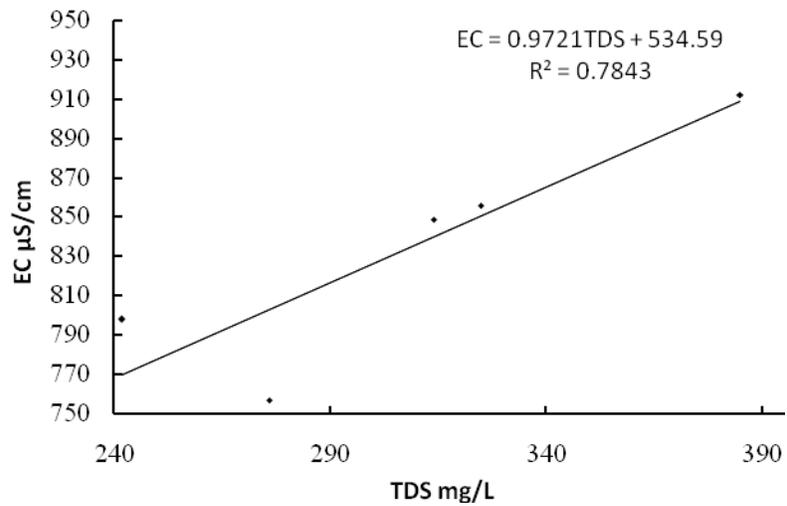
Figures 1-4 and 5-8. show the different correlation and regression factors of both the surface and ground water samples, respectively. The correlation between total coliform and pH, EC and TDS, TA and TDS, and TH and TDS were calculated as 0.43, 0.78, 0.43 and 0.19, respectively for the surface water analysis. These regression analyses indicate a proper relation ship between these significant water parameters, and show that the surface water chemistry is governs by these parameters. Similarly, the correlation between total coliform and pH, EC and TDS, TA and TDS, and TH and TDS were calculated as 0.78, 0.15, 0.11 and 0.02, respectively for the ground water analysis. Unlike the correlation between TH and TDS in case of surface water and TA and TDS, TH and TDS in case of ground water, which are much noteworthy, the other correlations, like EC and TDS for surface water samples, total coliform and pH for ground water samples, are highly significant.

## CONCLUSION AND RECOMMANDATIONS

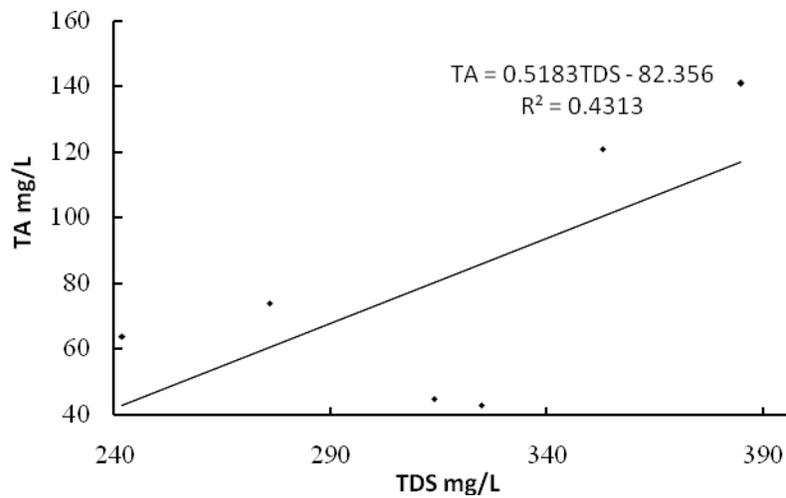
The conclusion drawn from this study is, that the water



**Figure 1.** Correlation between total coliform and pH.



**Figure 2.** Correlation between EC AND TDS.



**Figure 3.** Correlation between TA and TDS.

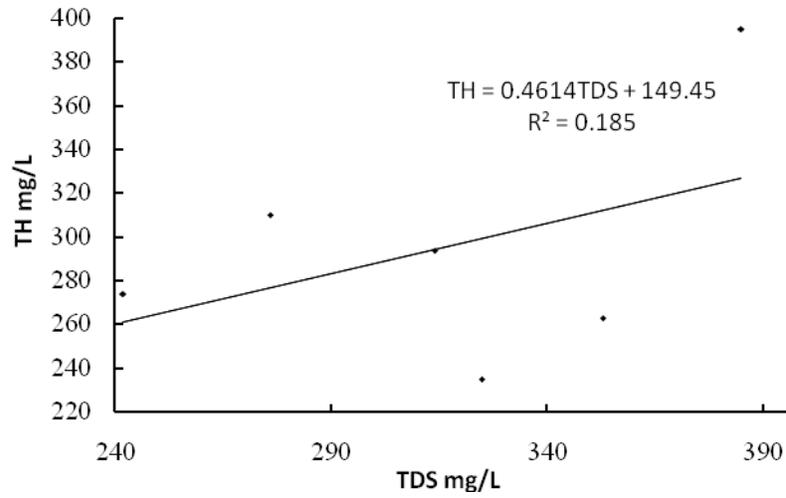


Figure 4. Correlation between TH and TDS.

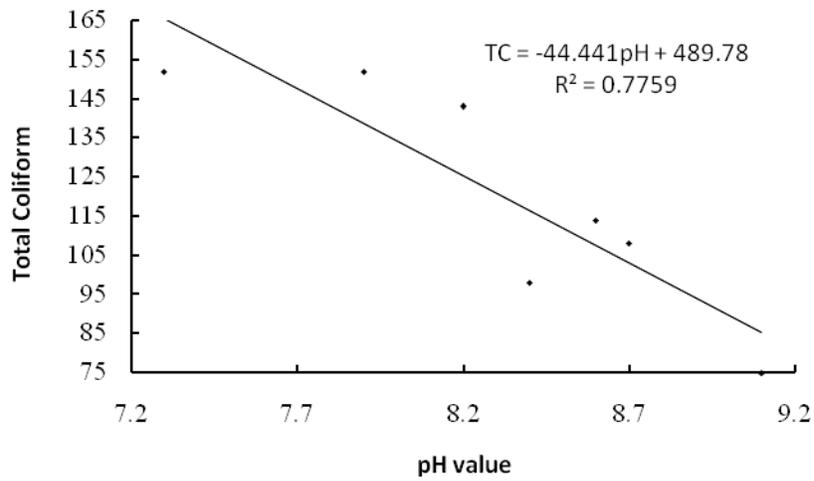


Figure 5. Correlation between total coliform and pH.

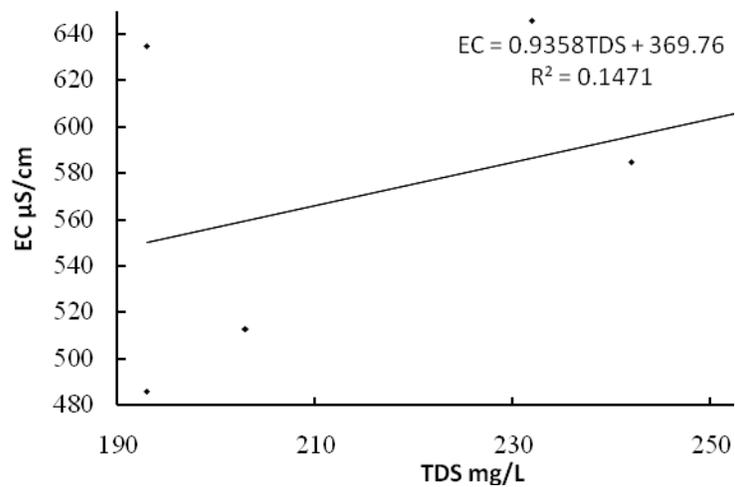


Figure 6. Correlation between EC and TDS.

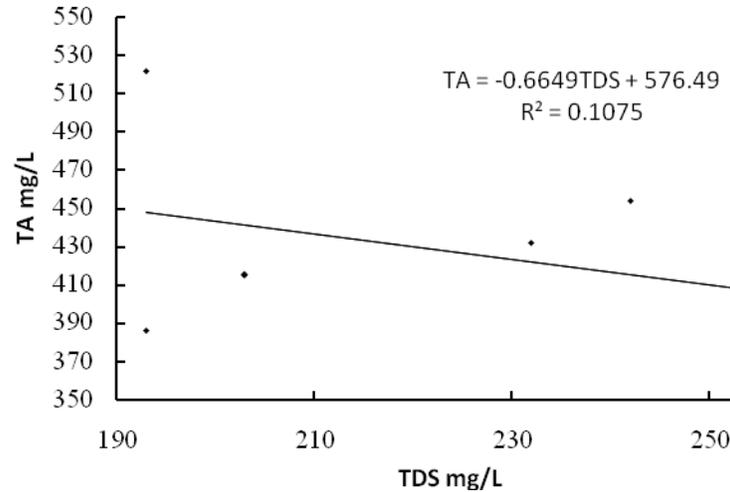


Figure 7. Correlation between TA and TDS.

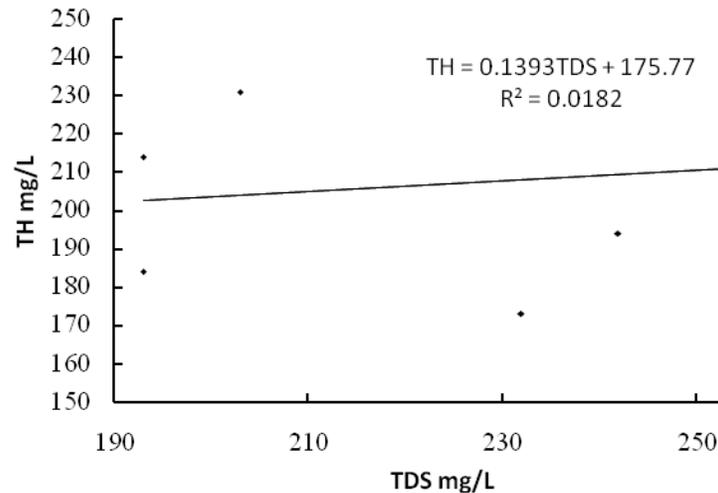


Figure 8. Correlation between TH and TDS.

being utilize in District Charssadda is highly polluted in terms of microbial contamination, and it is one of the major source of prevailing water borne diseases, especially after the recent flood in the area. Though the physio-chemical quality of water is comparatively better in reference to the available water quality standards, but yet the water need suitable treatment for the removal of microbial contamination prior to its drinking usage. The correlation between EC and TDS in case of surface water samples and total coliform and pH in case of ground water samples are analyzed, i.e. 0.78 and 0.78, respectively are of much importance with reference to understand the chemistry of the existing water sources.

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