



**Physico-chemical studies of groundwater quality in Shahdadkot City and its suitability for drinking purpose:
A case study for clean water security**

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Abstract: Present comparative study was aimed to evaluate the ground water quality of in Shahdadkot City, District Kamber Shahdadkot Sindh. The water samples were taken at random locations based on the population density and water consumption pattern of each site. A total of ten sites were selected. The standard physicochemical parameters i.e. electrical conductivity (EC), pH, water salinity, total dissolved solids (TDS), water temperature, dissolved oxygen (DO), alkalinity, hardness, chlorides, nitrates, turbidity etc. were analyzed following standard APHA methods. The average results found were as pH 6.99, E.C 7398.3(μS/cm), TDS 4493.7mg/L, chlorides 848.4 mg/L, alkalinity 239.2mg/L, Turbidity 1.28 NTU, D.O 2.28 mg/L, nitrates 2.75 mg/L etc. The findings of present study show that the concentration of some physicochemical parameters i.e. E.C, hardness, TDS, were found exceeding the safe limits of WHO for drinking water. This indicates that drinking water at study sites is not suitable for human consumption. To ensure the safety of local resident, a regular assessment should be carried out at different time intervals and appropriate measures must be taken to treat contamination in drinking water prior to its human consumption.

Keywords: Drinking water; Contamination; Shahdadkot; Physico-chemical parameters

1. INTRODUCTION

Water is one of the fundamental needs of life and vital for survival (Zillaro2004). Fresh Water is the most essential element for the survival of all the living beings (Aelion *et al.*1997). It is also very important for the human being as they rely on it for sustenance creation, industrial and waste transfer (Hargas 2013). The quality of water is significantly concerned with mankind and related with welfare of human beings (Akhtar and Khan 2015). In Sindh, nearly 90% population is relied on underground water for drinking and other domestic reasons. Among one of them is Kamber-Shahdadkot district, which is also dependent on ground water (Tariq 2015). As indicated by WHO, around 80% of the considerable numbers of diseases in people are brought about by water (Tao *et al.* 2013). Once the underground water is defiled or contaminated, its quality can't be reestablished back effectively and ways and means must be concocted to ensure it (Sen2015). Ground water gets polluted or contaminated because of uncontrolled utilization of fertilizers, herbicides and pesticides and unplanned utilization of industrial and urban waste (Ritter and Chirnside1995). The aim of this study was to

evaluate physico-chemical parameter of the ground drinking water around the city zone of Shahdadkot and provide awareness to the people regarding present quality of water. The results were compared with WHO standards (Sorg *et al.* 2014; Khan, *et al.* 2014).

2. MATERIALS AND METHODS

Sample collection

A total of 10 sampling locations in Shahdadkot City were identified based on the consumption of water used for drinking purpose, prior to collecting water samples. A total volume of 1000 ml water sample was collected in clean and washed polyethylene plastic bottles. The bottles were thoroughly washed with tap water first then deionized water followed by drying in the room temperature. Samples were labelled and transferred to lab for further analysis. Initially, samples were stored in refrigerator at 4^o C. The samples were collected in triplicate. Coordinates were taken from sampling location using GPS.

Determination of water quality parameters

The water samples were analyzed for temperature, pH, turbidity, total dissolved solids (TDS), electrical

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conductivity (EC), alkalinity, nitrates, chlorides, and hardness. The selected physicochemical parameters were tested based on the standard protocols of world health organization (WHO), Sindh Environmental Protection Agency (SEPA) and US-EPA.

3. RESULTS AND DISCUSSION

pH

It is a measure of acidity or alkalinity of water soluble substances. The pH scale measures how acidic or basic a substance is (Miller, 1997). In the current study, pH was found within permissible limits for drinking ranging from 6.8 to 7.2 at temperature 25 to 28 °C.

Total dissolve solids (TDS)

Water has the ability to dissolve a wide range of inorganic and some organic minerals or salts such as bicarbonates, calcium, chlorides, magnesium, potassium sodium, sulphate. These minerals produce unwanted taste and diluted color and appearance of water. The results of present study revealed that all the water samples were exceeding the safe limit of WHO except S4, S7, and S9. The TDS concentration was found within range of 642-11350 mg/L.

Electrical conductivity (E.C)

Electric conductivity is a measure of water's capability to pass electrical flow (Brahman 2013). The results of Electrical conductivity were ranging from 958-19500 ($\mu\text{S}/\text{cm}$). E. C of the all water samples was found higher than the WHO standard.

Hardness

Hardness in water or hard water refers to specific minerals that consume soap and cause scaling in water

heaters and boilers. The more minerals, the harder the water. All water samples were found exceeding results from the WHO standards limits (500mg/L), except S4, S7, S8, and S9. The results of hardness were ranging from 130- 1240 mg/L.

Chloride

Chloride is mainly obtained from the dissolution of salts of hydrochloric acid, added through industrial waste, sewage, sea water etc. Surface water bodies often have low concentration of chlorides as compare to ground water. WHO recommend the chloride range from 0 to 250 mg/L. All the water samples were exceeding the range of WHO standards. The results of chlorides in ground water samples were very high ranging from 537 to 1362 mg/L as compared to WHO limit (250 mg/L).

Turbidity

The large size particles in the cause the haziness or cloudiness of water and this phenomenon is visible to naked eye. The concentration of turbidity in our samples remained in the range of WHO guidelines. All the samples of ground water are within limit as compared to WHO standard (5 NTU).

Nitrates

The presence of nitrates in drinking water can cause methaemoglobinaemia (blue babies) disease in babies and can be potentially hazardous with health risks. The nitrate content in our samples were remaining in the range of 2.2 to 3.4 mg/l. Nitrates were within safe limits 50 mg/l according to NEQS of Pakistan.

Table 1. Showing Physico-Chemical results of ground water

S. No	Sampling location	Hardness (mg/l)	Temp. (°C)	pH	EC ($\mu\text{S}/\text{cm}$)	Salinity (ppt)	TDS (mg/l)
1	Hindu Muhalla	960	24	7.0	7810	4.6	4908
2	MastoiMuhalla	790	25	6.8	14460	8.9	8950
3	Saifullah Colony	788	27	7.0	9830	5.6	5840
4	Masan Muhalla	130	23.5	7.1	958	0.5	642
5	Kala Makan	1240	22.9	6.9	19500	11.3	11350
6	HeerabadMuhalla	520	28	7.0	7105	4.1	4395
7	Village Qambrani	200	28	7.1	1313	0.7	822
8	KambohMuhalla	296	28	6.8	4586	2.5	2705
9	Takki Shah	280	28	7.2	1131	0.6	707
10	Baqarabad Muhalla	581	28	7.0	7290	4.3	4618
Average		578.5	26.24	6.99	7398.3	4.31	4493.7
WHO		500	12	6.5-9.2	0.4	NGV	1000

Table 2 shoeing results of physico-chemical properties of ground water

S. No	Site	Chloride (mg/l)	Alkalinity (mg/l)	Turbidity (NTU)	DO (ppm)	Nitrates (mg/l)
1	Hindu Muhalla	837	280	1.24	2	2.9
2	MastoiMuhalla	700	288	0.64	2.4	3.1
3	Saifullah Colony	812	240	0.94	2.3	2.8
4	Masan Muhalla	850	221	0.74	2.6	2.7
5	Kala Makan	1062	300	1.21	2.2	3.4
6	HiraabadMuhalla	912	215	0.89	2.4	2.7
7	Village Qambrani	537	209	1.61	2.1	2.5
8	KambohMuhalla	1362	223	1.94	2.3	2.4
9	Takki Shah	700	210	2.11	2.2	2.8
10	BaqarabadMuhalla	712	206	1.48	2.3	2.2
Average		848.4	239.2	1.28	2.28	2.75
WHO		200-500	NGV	NGV	3	50

4.

CONCLUSION

The purpose of present investigation was to evaluate the quality of groundwater and compare results with WHO standards in Taluka Shahdadt, district Kamber-Shahdadt. The concentration of physicochemical parameters like Conductivity, Hardness, TDS, were exceeding the safe limits of WHO for drinking water. This indicates that drinking water at study area is not suitable for human consumption.

REFERENCES:

Aelion, C. M., J. N. Shaw, and M. Wahl, (1997). Ground water quality affected by impact of suburbanization and de-nitrification in coastal aquifer sediments *Journal of Experiment Marine Biology and Ecology*, 213, 31-51

Ahmad, S. K. A, and A. Khan, (2015). "Arsenic Contamination in ground water and its Health effects in Bangladesh" *Handbook of Arsenic Toxicology*, 6- 51-72

Brahman, D. K., G. K. Tasneem H. I. Afridi, S. Naseem, Arain, and S. S. Naemullah (2013). "Evaluation of high levels of fluoride, arsenic species and other physicochemical parameters in underground water of two sub districts of Tharparkar" *Water Research*.47, (3), 1005-1020.

Hargas, M. A. (2013).Water Quality Assessment and Hydrochemical Characteristics of Groundwater in Punjab, Pakistan 16 (2), 11-33

Khan, S., M. Q. Hayat, S. Jabeen, M. T. Shah, and I. Ahmed, (2014). "physicochemical parameters of

ground and water surface and their environmental impact assessment in the (Haripur)Basin Pakistan *Journal of Geochemical exploration*,138.1-7.

Miller, G. T. Jr. (1997). *Environmental Science: Working with the Earth*. (6thed.). California: Wadsworth Publishing Company.

Ritter W. F, and A. E. M Chirnside, (1995). "Groundwater quality affected by impact of dead bird disposal on the Delmarva Peninsula" *Bio resource Technology*.53, (2).105-111.

Sen, Z., (2015). "Ground water Quality " *Practical and applied Hydrogeology*12- 279-339.

Sorg, T. J., A. S. C. Chen, L. Wang, (2014). "Arsenic species in drinking water wells in the USA with high arsenic concentrations" *water research*.48.156-169.

Tariq, S. M. (2015). "Arsenic and other fluorosis causing substances in the ground water of Bangladesh " *hand book of Arsenic Toxicology*, 17, 73-93

Tao, P. Y. He, T. Zhang, J. Wu, G. Zhu, and L. Chang, (2013). "Ground water affecting by geological pattern " *Applied Geochemistry*,199-212.

Zillaro, A., (2004). WHO standards and guidelines *Practical Journal of Ecological Management*, University of California, 2, 1-5.