INTERNATIONAL JOURNAL OF SCIENCE AND NATURE

STUDY OF PHYSIOCHEMICAL PARAMETERS OF UNDERGROUND WATER AT TEKANPUR, GWALIOR, M.P.

Rashmi Shah and Abhay Tiwari
Rustamji Institute of Technology, BSF Academy, Tekanpur, Gwalior (M.P.)

ABSTRACT

In the present study we have determined some Physiochemical parameters like pH, Total hardness, TDS, BOD, COD etc. in underground water samples taken from the different locations in the radius of 10 km of Tekanpur area near Gwalior city. In Tekanpur, groundwater is the major source of drinking water. The water supply for human consumption is often directly sourced from ground water without biochemical treatment. The present study is an attempt to assess the quality of drinking water in Tekanpur area. A laboratory study of Physiochemical parameters was carried out. To assess the quality of underground water, each parameter was compared with the standard desirable limit of that parameter in drinking water as prescribed by Indian Standard Institute (ISI) and World Health Organization (WHO)[1]. The study showed that the ground water of Tekanpur is though fit for drinking purpose needs treatment to minimize the contamination especially the alkalinity

KEYWORDS: Physiochemical analysis, drinking water, BOD, TDS.

INTRODUCTION

The water used for drinking purpose should be free from toxic elements, living and non living organisms and excessive amount of minerals that may be harmful to health. Ground water is ultimate, most suitable fresh water resource with nearly balanced concentration of the salts for human consumption. It is the major source of drinking water in rural areas. Water of good drinking quality is of basic importance to human physiology and man's continued existence depends very much on its availability. The importance of ground water for the existence of human society cannot be overemphasized. It is also an important source of water for the agricultural and industrial sector. During last decade, it has been observed that ground water gets polluted drastically because of increased human activities[2,3]. Consequently a number of cases of water borne diseases are seen which is a cause of human health hazard[4,5,6]. About 10 percent of the rural and urban population does not have access to regular safe drinking water and many more are threatened to depend on unsafe water sources for their daily needs. Pollution of ground water from pesticides and fertilizers posses a major environmental health hazard. So basic monitoring on water quality has been necessitated to observe pollution level of ground water. The present study is an attempt to assess the quality of underground water of Tekanpur area.

MATERIALS &METHODS

All the samples were collected from January 2012 to June 2012 and the experiments were carried out in the temperature between $15-45^0$C. The collected samples were analyzed for major physical and chemical water quality parameters such as total dissolved solids, pH, total hardness, chloride, chemical oxygen demand, biological oxygen demand as per standard procedures mentioned in APHA (1995). The different parameters in water samples were calculated by various methods[7,8]. Total hardness was determined by complex-metric method. Total alkalinity

was determined by visual titration method using methyl orange and phenolphthalein as indicator. The temperature, pH, total dissolved solids and total suspended solids were determined by thermometer, pH- meter and TDS meter. BOD and COD of the water samples were determined by BOD incubator and open reflux method respectively and Chloride content was determined by argentometric method.

RESULT AND DISCUSSION

All the observations of ground water samples S-1 to S-6 collected from different sites of Tekanpur are summarized in Table-1. The results are also analyzed graphically (Figure1-8). In present study pH values range between 7.16-9.6. It is observed that the pH of the water was slightly alkaline. Generally the pH of the water is influenced by geology of that particular area and buffering capacity of water. Water is buffered by the presence of bicarbonates, carbonates and hydroxyl ions. The standard desirable limit of alkalinity in potable water is 120 mg/l. The maximum permissible level is 600 mg/l. In present study alkalinity of all samples (except mineral water) exceeded the desirable limit. The value of alkalinity in water provides an idea of natural salts present in water. The cause of alkalinity is the minerals which dissolve in water from soil. Alkalinity is a big problem for industries also, as alkaline water if used in boilers for steam generation may lead to precipitation sludge, deposition of scales and cause caustic embrittlement. This study also indicates that any industry establishment in this area must have alkalinity treatment plan prior to use of ground water or should go for some alternate water source. Excess alkalinity in water is also harmful for irrigation which leads to soil damage and reduce crop yields.

TABLE- 1: Physiochemical Parameters of Ground Water Samples at Different Sites of Tekanpur

S. No.	Parameter	Standard Value	S-1	S-2	S-3	S-4	S-5	S-6
1.	pH	6.5 to 8.5	8.76	9.16	8.26	9.6	7.16	7.7
2.	Total Hardness	300	160	156	164	172	170	20
3.	Total Alkalinity	120	350	380	480	520	390	30
4.	Chloride	250	142	148	232	205	75	85
5.	BOD	-	9	8	6	9	9	Nil
6.	COD	255	26.60	24.90	35.15	27.70	79.88	Nil
7.	TSS	-	70	75	82	80	42	Nil
8.	TDS	500	260	150	215	245	485	Nil

*S= Sample, S-1 = CSMT Area, S-2 = TCP Area, S-3 = RJIT Campus, S-4 = RJIT Office Area,
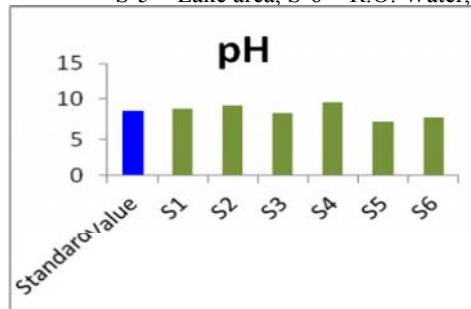S-5 = Lake area, S-6 = R.O. Water, S. No. 2-8 all values are in ppm or mg/litre

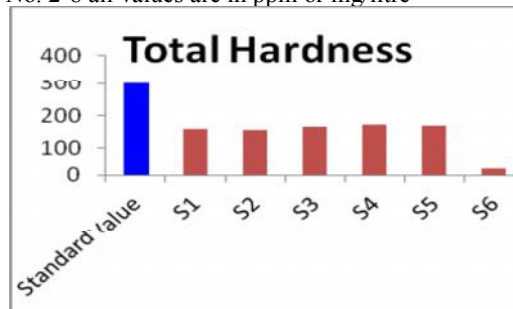**FIGURE1**: Graphical representation of standard and sample pH values.

FIGURE2: Graphical representation of standard and sample total hardness.
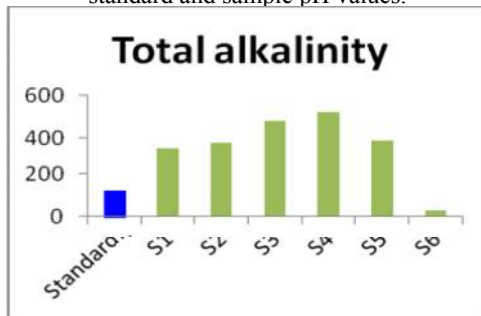

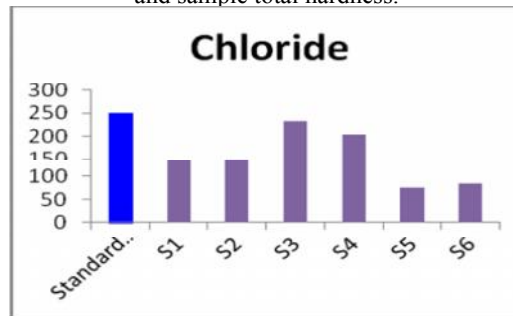**FIGURE3:** Graphical representation of standard and sample total alkalinity.

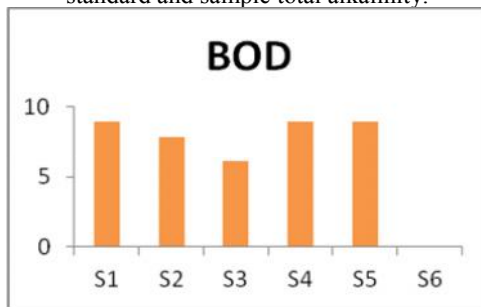**FIGURE4:** Graphical representation of standard and sample chloride values.

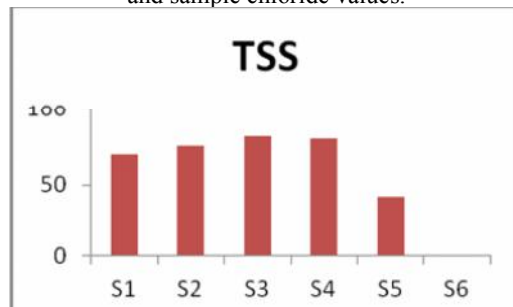**FIGURE 5:** Graphical representation of standard and sample BOD.

FIGURE 6: Graphical representation of standard and sample TSS.
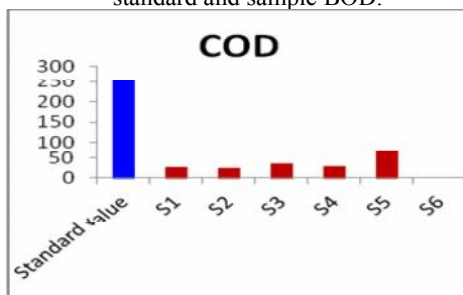

FIGURE7: Graphical representation of standard and sample COD.
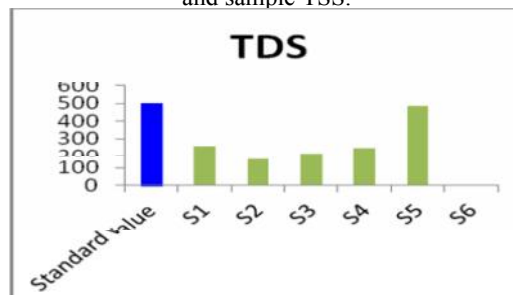

FIGURE8: Graphical representation of standard and sample TDS.

Total hardness of water samples ranges between 20-172 ppm. Hardness of water is caused by the presence of multivalent metallic cations and is largely due to calcium (Ca^{2+}) and magnesium (Mg^{2+}) ions. Hardness is reported in terms of $CaCO_3$.

Hardness is one of the very important properties of ground water from utility point of view for different purposes. ISI has specified the desirable limit for total hardness to be within 300 mg/l of $CaCO_3$. There is no evidence that chlorides cause any human health hazard. For this reason chlorides are generally limited to 250mg/l in supplies intended for public use. In present study the chloride amount in the samples ranges between 75-232mg/l which is within the desirable limit prescribed by ISI[9]. The average value of TDS in the ground water samples of Tekanpur was 150-485 mg/l. ISI prescribed the desirable limit of TDS is 500mg/l. Many dissolved substances are undesirable in water. Dissolved minerals, gases and organic constituents may produce aesthetically displeasing color, taste and odor. Some dissolved organic chemicals may deplete the dissolved oxygen in the water and some may be inert to biological oxidation, yet others have been identified as carcinogens.

In present study the observed COD values in all the samples range between 24.90-79.88.The permissible limit of COD for drinking water is 255mg/l. Hence the observed COD values in all the areas are well within the desirable limit. The BOD of all samples ranges from 6-9 mg/l. Total suspended solids (TSS) found in the range from 42-82mg/l. TSS also known as non-filterable residue of minerals and organic materials. Suspended solids can enter ground water through runoff from industrial, urban or agricultural areas [10]. TSS reduces water clarity, degrades habitats, decrease photosynthetic activity and causes an increase in water temperature. TSS has no drinking water standard.

CONCLUSION
The analysis of drinking water quality of groundwater taken from different sites of Tekanpur shows that all the parameters i.e. pH, total hardness, BOD, COD, TDS, TSS and chloride values are well within the permissible limits. Total alkalinity of ground water samples have exceeded desirable limits prescribed by WHO, but are within the limits prescribed by ISI (1983) and BIS. According to this study, the ground water of Tekanpur is though fit for drinking purpose needs treatment to minimize the contamination especially the alkalinity. The water treated by Reverse Osmosis (RO) system is found to be safe for drinking.

REFERENCES:
[1]   Guidelines for drinking water quality-WHO, Geneva, 2nd Ed., 97-100 (**1999**).

[2]   Abdul Jameel A, Poll.Res. **17(2)**, 111-114(1998).

[3]   Sirkar A G et al, J IWWA, 215-220 (**1996**).

[4]   Desai P V, Poll. Res. **4**, 377-382(**1995**).

[5]   Elizabeth K M & Premnath Naik L, Poll. Res, **24(2),** 337-340 (**2005**).

[6]   Muller E E, Ehlers, M M & Grabow, Wat. Res., **35**, 3085-3088(**2001**).

[7]   Meybeck M, Rev. Geol. Dyn. Geogr. Phys., **21**, 215-246(**1997**).

[8]   Manivasakam N, Physical Chemical Examination of Water, Sewage and Industrial effluents, 3rd Ed., Pragati Prakashan, Meerut, India, (**1996**).

[9]   ISI, Indian Standard Specifications for Drinking Water, ISI 10500, ISI, New Delhi, (**1983**).

[10] Rani, D F G, Geetha S and Ebanazar, J Pollut Res., **22(1)**, 111-115(**2003**).