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Research article

EVALUATION OF DRINKING WATER QUALITY IN RAINY SEASON NEAR TEKANPUR AREA, GWALIOR, INDIA

Rashmi Shah, U S Sharma and Abhay Tiwari

Rustamji Institute of Technology, BSF Academy, Tekanpur, Gwalior (M.P.)
drrashmi_shah@yahoo.com

ABSTRACT: This paper presents ground water quality of Tekanpur area during rainy season. In Tekanpur, ground water is the major source of drinking water. Tekanpur lake also fulfills the need of drinking water in surrounding area of the lake. The study was carried out by collection of water samples from five sampling sites during the rainy season 2012. The physiochemical parameters studied were pH, color, odour, turbidity, total dissolved solids, nitrate, sulphate, chloride, dissolved oxygen, chemical oxygen demand, total hardness, total alkalinity and total coliform bacteria. To assess the quality of ground water in rainy season, all parameters were compared with the standard desirable limit of that parameter in drinking water as prescribed by BIS:10500[1] and WHO[2]. During the study it was found that total dissolved solids varies from 127 to 1138 mg/l and compares with permissible limits. Therefore, the best accepted option is to avoid the possibility of polluting the ground water resources[3].
Key words: pH, BOD,COD ,TDS, coliform

INTRODUCTION

Ground water is the major source of drinking water in both urban and rural areas [4]. It is the most important source of water supply for drinking and irrigation purposes in rural areas. Ground water quality plays an important role in groundwater protection and quality conservation. Hence it is very important to assess the ground water quality not only for its present use but also from the view point of a potential source of water for future consumption [5]. Water sources available for drinking and other domestic purpose must possess high degree of purity, free from chemical contamination and micro-organism [6]. The people of Tekanpur uses well, bore wells and lake water for their daily activities and also for drinking purposes. Water resources are poorly managed in rural areas. The good quality water supply to such citizens is basic need. Agricultural waste, domestic and community solid liquid waste further deteriorate the ground water quality.

Materials and Methods: The study area selected was total rural area. Water samples were drawn from bore wells, hand pumps and Tekanpur lake during monsoon period. Samples were collected during months of mid June to Mid September, 2012 from the five selected sites. Borosilicate glass wares, distilled water and standard reagents were used throughout the analysis. The various physiochemical parameters were analyzed (Table-1) according to the procedure prescribed by APHA (1995).

RESULT AND DISCUSSION

The results of physiochemical parameters of five sampling sites are shown in Table-1. It was found that all the water samples were colourless, odourless in nature.

Total hardness of sample is in the range of 96 to 552 mg/l. Hardness has no known adverse effects on health. However ISI standard permits any values less than 500 mg/l. The hardness of some samples was very high as shown in figure, it is beyond the permissible limits. It is due to dissolution of alkaline earth metal salts from geological matter [6]. Total dissolved solids are a measure of total inorganic substances dissolved in water [7]. Total dissolved solids indicates the salinity behavior of ground water. Water containing more than 500mg/l TDS is not considered desirable for drinking water supplies, but in unavoidable cases 1500 mg/l is also allowed[8]. TDS values of present samples varied from 127 to 1138 mg/l. The figure-1 indicates at the sampling points S-3, S-4, S-5, the value of TDS are higher than the prescribed value given by ISI 10500-91. Higher value of TDS of some samples shows the presence of solid waste deposits near the bore well [9]. A slow leaching process also is held responsible for such higher values [6]. High values of TDS in ground water are not generally harmful to human beings but high concentration of these may affect persons who are suffering from kidney and heart diseases [10].

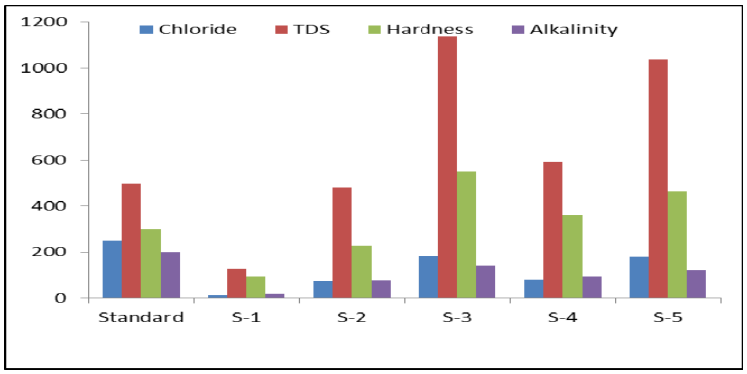

Figure1: Comparison of Chloride, TDS, Hardness and Alkalinity during rainy season.

Table 1: Average Results of Physiochemical Parameters

S. No.	Parameters	Requirements As per ISI:10500, 1993	Test Method as per ISI	Tekanpur Lake Lake water S-1	CSMT Borewell water S-2	Tekanpur Bus Stand Borewell water S-3	RJIT Borewell water S-4	TCP Borewell water S-5
1.	pH Value	6.5-8.5	3025 (Part-11)	6.97	7.25	7.04	7.17	6.97
2.	Colour	5.0 Max	3025 (Part-4)	>1	>1	>1	>1	>1
3.	Turbidity (NTU)	5.0 Max	3025 (Part-10)	>1	1.3	1.1	1.2	1.1
4.	TDS (mg/l)	500 Max	3025 (Part-16)	127	479	1138	591	1036
5.	Nitrate(mg/l)	45	3025 (Part-34)	4.2	10.64	24.18	12.20	16.42
6.	Sulphate (mg/l)	200	3025 (Part-24)	8.40	14.86	42.40	18.84	28.41
7.	Chloride (mg/l)	250	3025 (Part-32)	14.97	72.99	182.56	79.60	177.8
8.	Dissolved Oxygen (mg/l)	5.0 AS per WHO)	APHA	4.4	2.1	4.80	3.5	3.8
9.	COD(mg/l)	-	APHA	19.5	20.4	19	21.1	19.6
10.	BOD(mg/l)	-	APHA	2.2	2.6	2.4	2.2	2.5
11.	Total Hardness (mg/l)	300 Max	3025 (Part-21)	96.0	230	552	362	464
12.	Alkalinity (mg/l)	200Max	3025 (Part-23)	18.20	78.0	142	94	122
13.	Total Coliform Bacterial (Per 100ml)	10	IS1622-1998	09	02	06	02	03

(CSMT-Central School of Motor Transport, RJIT-Rustamji Institute of Technology, TCP- Tekanpur Check Post)

In present study, Total coliform bacteria found in lake as well as in ground water. It could means that surface water may be getting in to ground and lake water during rainfall. This increases the risk of animal waste contaminating water sooner or later. Total coliforms are a group of bacteria commonly found in the environment e.g. in soil or vegetation as well as the intestines of mammals including humans. Total coliform bacteria are not likely to cause illness, but their presence indicates that water supply may be vulnerable to contamination by more harmful micro-organisms (The Canadian drinking water quality guideline for total coliform is none detectable per 100 ml). The health effects of exposure to disease causing bacteria, viruses and parasites in drinking water are varied. The most common symptoms of waterborne illness include nausea, vomiting and diarrhea [11].

Dissolved Oxygen reflects the physiological & biological processes prevailing in the water. The DO values indicate the degree of pollution in the water bodies. In the present analysis of water samples DO values varied from 2.1 to 4.80. All the sampling points showed low DO values indicating contamination by organic matter [12].

The Biological Oxygen Demand (BOD) ranges from 2.2 to 2.6 mg/l which represents the amount of oxygen that microbes need to stabilize biologically oxidisable matter.

The Chemical Oxygen Demand (COD) ranged from 19 to 21.1 mg/l. The test is commonly used to indirectly measure the amount of organic compounds in water[3]. Since no prescribed standards are suggested by ISI:10500, 1991 for parameters like BOD, COD for drinking water purpose, hence no comparison can be made from observed values.

Presence of Nitrate indicates the pollution in ground water due to sewage percolation beneath the surface. The nitrate concentration is found to be in the range of 4.2 to24.18 mg/l during monsoon. It is within the desirable limit. BIS prescribed desirable limit of nitrate is 45 mg/l. Presence of nitrate in water indicates the final stage of mineralization [13].

Chloride content ranges from 14.97 to 182.56 mg/l indicating that most of the samples are below the permissible limits of chloride in drinking water prescribed by ISI i.e. 250 mg/l.

Sulphate is found naturally in ground water through the weathering of rocks. The sulphate contents varies between 8.40 to 42.40 mg/l which were also found to be within the permissible limits.

The total alkalinity of water varied from 18.20 to 142 mg/l. The values of total alkalinity were comparatively moderate. The water for domestic use having alkalinity less than 100 mg/l is safe. But here two samples shows alkalinity higher than 100 mg/l. The alkalinity varies in accordance with the fluctuation in the pollution load.

Turbidity of all samples less than 1.3 mg/l within the prescribed limits.

Hydrogen ion concentration (pH) of all samples ranges from 6.97 to 7.25 which were in desirable limits as prescribed for drinking water standard (6.5-8.5).

Conclusion: This research work is an attempt to assess the drinking water quality of Tekanpur area in rainy season. In the current study, the water samples showed deviations from water quality standards indicating groundwater contamination. As a result of high concentration of TDS, water loses its potability and reduces the solubility of oxygen in water. Total hardness of maximum study points is beyond the permissible limits and contaminated with Total coliform bacteria, because of this, people of that area are prone for the immediate health problems such as stomach diseases, gastric troubles etc.[4]. Results show that over exploitation of ground water which has the largest share of water supplied for human use has deteriorated to such an extent that the crucial parameters such as TDS, hardness, etc usually exceed the desirable levels substantially. Our study show that the lake water as well as ground water of some study area is contaminated in rainy season due to surface runoff. The leaching process through surface water during rainy season is also responsible for maximum concentration of TDS in this region [14].

Suggestions:

1. RO is the only commonly used domestic filtration system that removes even the dissolved impurities. RO is required if the Total Dissolved Solids (TDS) exceeds a certain value.
2. Rainwater harvesting is a useful permanent solution where other sources of water have unacceptably high levels of TDS or hardness. TDS of rainwater is a few tens of mg/L.
3. Disinfect wells, tube wells by using chlorine or other disinfectant.
4. Boiling is must to kill the microorganisms for atleast one minute.

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