AN ASSESSMENT OF PHYSICO-CHEMICAL CHARACTERISTRICT OF GROUND WATER IN KATIIHAR TOWN, BIHAR, INDIA

Dr. A.K. Deo

Dept. of Chemistry, K.D. College, Raniganj (Araria)

Abstract : The physico-chemical quality of ground water of the town Katihar was studied for 3 months from December 2016-February 2017. Water samples were collected at fortnight intervals from tubewell water from areas Mangal Bazar, Binodpur, Baniatola, Bara Bazar and Gamitola in Katiihar town. The ground water from six stations was analysed. Alkalinity, Total Dissolved Solids (TDS) and Nitrate concentrations in some stations were found above the drinking water standards.

Keywords: ground water, Physico-chemical quality, Katihar.

INTRODUCTION

Water priceless gift of nature, is most essential for all living organism. Water from surface source provides sustenance to plant and animal and constitutes the habitat for aquatic organisms and meet importance of agricultural and industrial needs. The rapid industrialization, growing urbanization and increasing use of chemicals in agriculture constitute some of the important factors responsible for various forms of pollution of water bodies.

Water is extremely essential for survival of all living organisms. Life can not exist on this planet without water. Approx 97.2% of water on earth is salty and only 2.8% is present as fresh water from which about 20% constitutes ground-water. (Jameel and Sirajudeen, 2006) Ground water is also very important to many agricultural areas. Since it is filtered through the ground, it is usually cleaner than surface water. Unfortunately, it is threatened every day by public who do not even realize how important it is or how they are affecting it. All forms of life on earth draw their prolong and growth from nature's most rich and free available reserve of water. But in many parts of the world humans have no access to the clean drinking. Groundwater resources are dynamic in nature and are affected by different factors such as, irrigation activities, industrialization and urbanization.

A serious groundwater crisis prevails currently in India due to excessive overdraft and groundwater contamination covering nearly 60 percent of all districts in India and posing a risk to drinking water security of the population, as more than 80 percent of India's drinking water needs are serviced by groundwater resources. In addition to overdraft and biological and chemical pollution, water logging is also a serious problem in many regions, impacting livelihood security of large sections of society. (Jain and Sharma, 2011)

Groundwater is generally considered to be much cleaner than surface water. However, several factors such as discharge of industrial, agricultural and domestic wastes, land use practices, geological formation, rainfall patterns and infiltration rate affects the groundwater quality and once contamination of groundwater in aquifers occurs, it persists for hundreds of years because of very slow movement in them. (Jayalakshmi Devi O and Belagali, 2006)

Water pollution are mainly due to contamination by foreign matter such as microorganism, chemicals, industrial or other wastes or sewage which deteriorate the quality of the water and render it unfit for its intended uses. Ingestion of polluted water can result various health hazards. Disposal of sewage water into fresh water aquifers is the main cause of groundwater pollution. Hence determination of groundwater quality is important to observe the suitability of water for particular use. Groundwater monitoring of hands pump is one of the important tool for evaluating groundwater quality. Considering these aspects of hand-pump water pollution the present study of groundwater monitoring was undertaken to investigate physicochemical characteristics of some groundwater samples from different area of Katihar town.

MATERIALS AND METHODS

The physico-chemical quality of groundwater of the town Katihar was studied for 3 months from December 2016 to February 2017. The samples were collected from areas of Mangal Bazar, Binodpur, Baniatola, Bara Bazar and Gamitola in Katiihar town. The samples designated as T1 and T5 were collected from these sources at fortnight interval for about a period of 3 months (Dec., 2016 to Feb., 2017) in 5 litre plastic cans and were analyzed for pH, Turbidity (Turb), Total Alkalinity (TA), Total Dissolved Solids (TDS), Dissolved Oxygen (DO), Total Hardness (TH), Calcium (Ca^{2+}), Magnesium (Mg^{2+}), Chloride (Cl^-) count by standard methods.

Analysis of water samples

The physicochemical parameters such as pH, Turbidity (Turb.), Total Alkalinity (TA), Total Dissolved Solids (TDS), Dissolved Oxygen (DO), Total Hardness (TH), Calcium (Ca2+), Magnesium (Mg2+), Chloride (Cl-), were determined using standard methods. [4-6] Specific reagents were used for the analysis and double distilled water was used for preparation of solutions. The methods used for estimation of various physicochemical parameters are tabulated in Table 1.

Table 1. Methods used for estimation of physicochemical parameters

S.No.	Parameters & units	Method
1	pH	pH Metry
2	Turbidity (NTU)	Turbiditi metry
3	EC(micromhos/cm)	Conductometry
4	Total Alkalinity(mg/l)	Titration method
5	Total Dissolved Solids (ppm)	Filtration method
6	Dissolved Oxygen (mg/l)	Iodometric method
7	Total Hardness (mg/l)	EDTA titration
8	Calcium(mg/l)	EDTA titration
9	Magnesium(mg/l)	EDTA titration

10	Chloride(mg/l)	Silver Nitrate method

RESULTS AND DISCUSSION

pH : pH is a measure of the intensity of acidity or alkalinity and the concentration of hydrogen ion in water. The pH values in sampling areas ranged from 7.2 to 8.5 and so alkaline in nature. According to WHO (1984), the desirable pH of drinking water is 7 to 8.5. In the present study, the pH values of water samples varied between 7.93 to 8.92 and samples **T1** & **T2** were found beyond the limit prescribed by CPHEEO. (Table 2)

Turbidity : Turbidity makes water unfit for domestic purposes, food and beverage industries and many other industrial uses. In the present analysis, turbidity values varied between 0.0 to 1.0 NTU and found within the normal limit prescribed by CPHEEO. (Table 2)

Total Alkalinity : Total Alkalinity is a total measure of substance in water that has 'acid-neutralizing' capacity. The main sources of natural alkalinity are rocks which contain carbonate (CO_3^{2-}), bicarbonate (HCO_3^{1-}) and hydroxide (OH^{1-}) compounds; silicates (SiO_4^{3-}) and phosphates (PO_4^{2-}) may also contribute to alkalinity. (Shrinivasa and Venkateswarlu, 2000) Total alkalinity values for tested samples **T1**, **T2** and **T6** were found to be greater than the value prescribed by ISI 10500-91.

Total dissolved solids (TDS) : High concentrations of total dissolved solids may cause adverse taste effects. TDS values varied from 426.53 mg/L to 490.81 mg/L. (Table 2) The all investigated samples showed within the normal limit prescribed by ISI 10500-91 except **T1** sample.

Table 2. Physical-chemical characteristics of drinking water at Katihar town.

S. No.	Parameters & units	Sampling points						ISI 10500- 91
		T1	T2	T3	T4	T5	T6	
1	pH	8.65	8.92	8.06	8.23	7.93	7.95	7.0-8.5*
2	Turbidity (NTU)	0.5	0.9	0.3	0.0	0.4	1.0	1*
3	Total Alkalinity(mg/l)	300	280	185	190	180	210	200
4	Total Dissolved Solids (ppm)	490.81	480.07	427.13	426.53	475.16	450.46	500
5	Dissolved Oxygen (mg/l)	4.46	5.60	6.24	5.20	7.36	5.76	5.0#
6	Total Hardness (mg/l)	400	290	330	260	250	280	300
7	Calcium(mg/l)	36.07	28.06	48.09	44.08	36.07	40.08	75
8	Magnesium(mg/l)	35.42	23.60	21.16	38.42	27.98	23.09	<30
9	Chloride(mg/l)	28.4	56.8	92.3	71.0	35.5	142.0	200*

Dissolved oxygen (DO) : Dissolved oxygen reflects the physical and biological processes prevailing in the water which indicate the degree of pollution present in water bodies. In the present study of water samples, DO value varied from 4.46 to 7.36. (Table 2) The sampling points **T1** showed low DO values indicating borderline contamination by organic matter according to WHO.

Total hardness (TH) : Hardness in water is due to the natural accumulation of salts from contact with soil and geological formations or it may enter from direct pollution by industrial effluents. Hardness of water mainly depends upon the amount of calcium or magnesium salts or both. (Shrinivasa and Venkateswarlu, 2000) In the present study, total hardness varied from 250 mg/L to 400 mg/L. (Table 2) The values for sample **T1** was higher than the prescribed limit by ISI 10500-91.

Calcium (Ca^{2+}) : Water with high calcium content is undesirable for household uses such as washing, bathing and laundering because of consumption of more soap and other cleaning agents. In the present investigation, calcium concentration ranged from 28.06 mg/L to 48.09 mg/L. (Table 2) The values ware within the limit prescribed by ISI 10500-91.

Magnesium (Mg^{2+}) : At high concentrations, Magnesium salts have a laxative effect particularly when present as magnesium sulphate. (Karunakaran, et.al, 2009) Magnesium content in the investigated water samples was varied from 21.16 mg/L to 35.42 mg/L. (Table 2) The values ware within the limit in samples **T1** and **T4** according to ISI 10500-91.

The most important source of chlorides in the waters is the discharge of domestic sewage. (Patil and Patil, 2010) In the present analysis, chloride concentration was found in the range of 28.40 mg/L to 142.0 mg/L. (Table 2) The values ware within the limit according to CPHEEO.

Conclusion

Groundwater is one of the major sources of potable water in Katihar town. Over abstraction of this limited resource, in addition to erratic waste disposal in surface waters, enhances the contamination of groundwater. It thus becomes obligatory to identify suitable management strategies to balance development without compromising on environment or public health. Groundwater pollution will increase regional water scarcity; leading to a humanitarian crisis. The successful implementation of projects requires an intensive, daily investment in coordination between the parties. The responsibility for this coordination lies with all parties.

Preventive management is the preferred approach to drinking-water safety and should take account of the characteristics of the drinking-water supply from catchment and source to its use by consumers. As many aspects of drinking-water quality management are often outside the direct responsibility of the water supplier, it is essential that a collaborative multiagency approach be adopted to ensure that agencies with responsibility for specific areas within the water cycle are involved in the management of water quality.

REFERENCES

Jameel, A. and Sirajudeen, J., *Environ. Monit. Assess*. **2006,** 123**,** 299.

Jayalakshmi Devi, O. and Belagali, S. L., *Nature, Environment and pollution Technology***.2006, 5(4)**, 553.

Jain, S. K. and Sharma, V., 2011. Report on Contamination of Ground Water by Sewage, Central Ground Water Board, Government of India.

APHA. 1985. Standard methods for the examination of water and wastewater, *American Public health Association*, Washington, D.C. 16th ed. Pp. 245 - 246.

Shrinivasa Rao B and Venkateswarlu P, *Indian J Environ Prot*., **2000, 20(3),** 161-164.

Karunakaran, et.al, *India E-J Chem*., **2009**, **6(3)**, pp 909- 914

Patil, V.T. and Patil, P.R (2011) : *E-Journal of Chemistry*, **2011**, **8(1),** 53-58