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Studies on physico-chemical properties of ground water of Saharsa district (Bihar)

Goutam Kumar^{a*} & R.B.Jha^b

^aUniversity Department of Zoology, B.N.M. University, Madhepura, Bihar, India

^bPrincipal, R.M.College, Saharsa, Bihar, India

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Abstract: Findings of research on groundwater samples play a very crucial role to study the aquatic ecosystem and its effect on human beings since water is basic need for all living things to exist. Here in this paper different ground water samples drawn from various sites of Saharsa region was systematically studied to know more about the chemical and physical nature of water quality. The water samples were collected from 4 different sites of this region.

Key words: Groundwater, aquatic ecosystem, physico-chemical properties.

INTRODUCTION

Our planet earth despite surrounded by two third parts of it by water still there is a lack of reliable freshwater having standard physico-chemical quality. And the major problem has risen due to unpredicted human population growth, urbanization; overuse of land is increasingly becoming unsuitable & even dangerous for human consumption.^{1,2} However freshwater as well as groundwater can be used for potable water. Groundwater is the basic need of all living things directly or indirectly and mostly in many agricultural areas it functions as a backbone for agricultural as well as domestic purposes. All the living creatures in the earth depend on the free available reserve water for their growth. In many parts of the world people still have no access to clean drinking water. Once the groundwater gets polluted the quality of water not only gets affected but the existence of life also gets threatened. The quality of water usually depends upon

its physical, chemical and biological parameters or qualities. Groundwater does not only contain the purified water but it is occupied with several types of pollutants along with other type of substances which is hazardous to both health as well as life of the living organisms. The quality of groundwater is highly influenced by both natural & anthropogenic activities³. In rural areas mostly the agricultural areas excessive use of fertilizers has directly affected the ground water quality⁴. But beyond the qualitative aspect it is also advised to remain in vigilant on the level of the quality consumed by the people⁵. The report which has been recently given by Bihar government stated that the drinking water in rural areas is not safe due to which health of rural people are in risk⁶. In addition to all the problems mentioned above water logging is also a serious problem in many regions having impact on livelihood security⁷. Here in this research paper attempt was made to study the groundwater quality in Madhepura with respect to dissolved oxygen, sodium, potassium, calcium, magnesium & pH with several analysis of groundwater from different sources.

*Corresponding author :

Phone : 8340384640

E-mail : gautamrajgurukul@gmail.com

MATERIALS & METHODS

Study area

The study was conducted in different villages of Saharsa district. For studying the water quality of wells following villages were selected Sardiha, Barahi, Dumrel, Baiyanathpur, Hansa, Nandanpur, Baruwari, etc. While for studying the water quality of hand pumps the hand pumps present in the following regions were selected Kandanlura, Baryahi, Maheshi, Mohanpur, Patarghat, Raghunathpur, Mirzapur, etc, Maheshi, Patwaha, Mohanpur, Kadanlura are the villages were selected for tube well water analysis. Rivers such as Bakra nadi, Sursa nadi, Simri nadi situated under the Saharsa district were chosen for analysis.

For the present study of quality assessment of drinking water of Saharsa district, 10 open well, 10 hand pumps, 5 tube wells, 2 pond and 4 river ghats have been selected for sampling covering the entire area of the district. The sampling was done during rainy season of 2018-2019 by grab sampling method using 2.5 litre polythelene bottle marked with date, time and sampling point. In the case of well water, samples were taken from at least two meters deep from the surface of water in wells. In the case of hand pumps, it was run at first for two or three minutes and samples were collected. Water from the pond was simply drawn in plastic bottles and was filtered for removal of beverages. Similar treatment was done with the sampling or river water.

pH analysis:-

pH is considered as one of the most important operational water quality parameters, with the optimum pH required often being in the range of 6.5–9.5⁸. For the determining the pH of collected water samples electronic pH meter was used. pH is the term universally used to

express the intensity of the acid or alkaline condition of the solution.

Fluoride determination:-

For normal development of healthy teeth & bones fluoride is very important. However, higher concentration of F⁻ causes dental and skeletal fluorosis such as mottling of teeth, deformation of ligaments and bending of spinal cord⁹. Two calorimetric methods are highly used for the estimation of fluoride the SPADNS method & the Alizarian method. But here in this research work the first type of method i.e. the SPADNS was used for fluoride analysis since it requires little time for showing result.

Dissolved carbon dioxide determination:-

Since carbon dioxide is normal component of all natural water & it dissolves in water in varying amount. Therefore here in this research paper importance has been given in consideration of corrosive properties of CO₂ by titration with a standard alkali to pH 8.3.¹⁰

Chemical oxygen demand (COD)

COD is the oxygen requirement of a sample for oxidation of organic and inorganic matter. Determination of COD was done by standard method by simple oxidation & reduction method.¹⁰

Biological oxygen demand (BOD)

BOD is the requirement of oxygen due to biodegradable organic matter only is a biological phenomenon carried out at more or less natural condition. BOD was also determined by standard method.

RESULT AND DISCUSSION

This paper deals with the different results of the project including various aspects such as pH, fluoride determination, BOD, COD & dissolved carbon dioxide determination which has been discussed below in the table.

Table 1:- Different pollution parameters of well water (Ww) samples

Water sample	pH	Fluoride mgm/L	Dissolved CO ₂	COD	BOD
Ww ₁	8.00	1.52	39	3.12	0.9
Ww ₂	7.98	1.00	38	3.18	0.8
Ww ₃	7.90	0.23	34	3.52	1.41
Ww ₄	8.60	0.26	37	3.00	1.61
Ww ₅	6.96	0.15	29	3.26	1.00
Ww ₆	7.85	0.89	35	3.01	0.86
Ww ₇	7.69	0.24	36	2.68	1.21
Ww ₈	7.89	0.97	29	3.60	1.32
Ww ₉	8.60	0.98	28	3.64	1.13
Ww ₁₀	7.92	1.08	36	2.48	1.10
Average	7.939	0.732	34.1	3.149	1.134

Table 2:- Different pollution parameters of hand pump water (HPw) samples

Water sample	pH	Fluoride mgm/L	Dissolved CO ₂	COD	BOD
HPw ₁	7.98	1.00	22.56	1.72	0.60
HPw ₂	7.97	0.92	23.10	1.39	0.63
HPw ₃	8.00	0.86	22.8	1.49	0.58
HPw ₄	7.89	1.00	22.7	1.58	0.61
HPw ₅	7.91	0.91	22.5	1.56	0.62
HPw ₆	7.88	0.95	23.00	1.32	0.59
HPw ₇	7.96	0.96	23.11	1.43	0.68
HPw ₈	7.98	0.96	23.50	1.44	0.58
HPw ₉	7.81	0.89	22.9	1.31	0.58
HPw ₁₀	7.86	0.92	22.6	1.41	0.63
Average	7.924	0.937	22.8	1.465	0.61

Table 3:- Different pollution parameters of tube well water (TWw) samples

Water sample	pH	Fluoride mgm/L	Dissolved CO ₂	COD	BOD
TWw ₁	7.60	0.86	20.34	0.86	0.53
TWw ₂	7.56	0.80	20.12	0.83	0.48
TWw ₃	7.32	0.78	19.34	0.83	0.42
TWw ₄	7.50	0.52	20.00	0.84	0.42
TWw ₅	7.50	1.64	20.18	0.70	0.45
Average	6.096	0.92	19.99	0.812	0.46

Table 4:- Different pollution parameters of pond water (Pw) samples

Water sample	pH	Fluoride mgm/L	Dissolved CO ₂	COD	BOD
Pw ₁	8.32	0.92	46	4.30	4.11
Pw ₂	8.41	0.83	49	4.29	4.32
Average	8.36	0.875	47.5	4.295	4.215

Table 5:- Different pollution parameters of river water (Rw) samples

Water sample	pH	Fluoride mgm/L	Dissolved CO ₂	COD	BOD
Rw ₁	8.40	0.53	48	5.33	3.26
Rw ₂	8.32	0.69	39	5.41	3.18
Rw ₃	7.92	0.58	46	5.39	3.44
Rw ₄	8.24	0.51	43	5.37	3.38
Average	8.22	0.57	44	5.375	3.315

The above data given in the table reveals that the average pH values of different sources is pond water > river water > well water > hand pump water > tube well water. Since the tube well water is most protected from surface contamination, it is least polluted from surface contamination thus it is least polluted while open well ponds and rivers are most exposed to anthropogenic activities, they are most polluted in regard to pH.

When concerning about the fluoride concentration it has been found that hand pump water > tube well water > pond water > well water > river water. The average value

of hand pump water is just above the desirable limit while that of tube well water is just below the desirable level. However the average values of fluoride concentration of pond water, well water & river water samples are much less than the desirable limit. Thus hand pump water is safe for drinking.

Study of Dissolved carbon dioxide helps to ascertain the life system of aquatic animals and plants and at the same time we can be sure of the quality of water regarding its utility purpose. According to the data mentioned above in the table the pond water sample records the highest

concentration of dissolved CO₂ while tube well water samples record the lowest. The order is given as-

Pond water > river water > well water > hand pump water > tube well water.

The chemical oxygen demand (COD) is an important parameter which assesses the pollution load in water. This parameter is determined by refluxing water samples with a known amount of potassium dichromate in sulphuric acid. In well water sample, COD runs from 2.48 to 3.68 ppm while for land pump water samples, the minimum and maximum values are 1.31 & 1.72 ppm respectively. The tube well water samples record COD in between 0.68ppm to 0.86ppm. In pond water it is 4.29 & 4.30ppm while river water it runs from 5.33 to 5.41ppm. Since the river water is highly exposed to domestic waste therefore carries the higher average COD.

The order of the different water resources in respect of BOD content may be given as below:-

Pond water > river water > well water > hand pump water > tube well water. For open well water samples, the BOD value runs from 0.8 to 1.61 ppm. In the case of hand pump water samples, BOD runs from 0.58 to 0.68 ppm while for tube well water sample it is found in the range of 0.42 to 0.53 ppm. in the pond water it runs from 4.11 to 4.32 ppm and in river water samples it runs from 3.18-3.38. The high content of BOD in pond and river water may be attributed to the free inflow of runoff of agricultural field which carry the fertilizers and several insecticides, pesticides etc to increase the BOD load of pond water and river water.

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