

Analysis of Physico-chemical Characteristics of Ground Water in Samastipur, Bihar

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Abstract: The paper presents Physico-chemical study of ground water from downstream area of Budhi Gandak River in Samastipur district of Bihar during monsoon season of 2021. The study reveals that, the quality of ground water in the selected study area is not same at different sites. The present analysis reveals that ground water available in areas is moderately benign in irrigation. It is indicating that, quality of ground water should be improving slightly and maintained properly. So, the study may prove to be of some help in understanding the quality of ground water resources of study area.

Keywords: River, Ground water Quality, Physico-chemical

I. INTRODUCTION

Water has always been an important and life-sustaining drink to humans and is essential to the survival of all organisms. Excluding fat, water comprises approximately 70% of the human body by mass. It is a crucial component of metabolic processes and serves as a solvent for many bodily solutes. Water is not only one of the most essential commodities of our day-to-day life, but the development of this natural resource also plays a crucial role in economic and social development processes. Groundwater is an invisible natural resource and is present in the dark pores and fissures of sands and rocks of the upper portion of the earth's crust [1]. Ground water is regarded as pure form of water. The various physico-chemical parameters have a significant role in determining portability of water [2]. Water intended for human consumption must be free from harmful micro-organisms, toxic substances, excessive amount of minerals and organic matter. Ground water is less susceptible to bacterial pollution than surface water because the soil and rocks through which ground water flows screen out most of the bacteria. As per World Health Organization (WHO), safe and wholesome drinking water is a basic need for human development, health and well-being, and it is an internationally accepted human right. Due to continuous population growth, demand for fresh water has increased rapidly. Dumping of wastes near road sides, flood due to heavy rains, improper waste management in hospitals, markets, flats etc. increases the pollution of ground water. Various research groups have analysed the ground water quality at different locations of Samastipur and the results are published [3,4,5]. Previous studies show that, ground water resources in Samastipur are at a higher risk of environmental pollution and are susceptible to contamination [5]. Chemical contamination is one of the prominent problems associated with ground water. The main chemical contaminants include pesticides and heavy metals [6,7].

Today, the groundwater contamination is widely taking place because of either natural reasons or human actions. Thus, it requires a regular monitoring of water quality to device ways and means to maintain it. The ground water important sources of water being use for irrigation in the Samastipur. The practice of over irrigation, use of pesticides, weedicides, chemical fertilizers and discharge of industrial effluent may affect the groundwater quality [6]. Thus, this communication describes a systematic study on Physico- chemical characteristics of ground water from downstream area of Budhi Gantak River in Samastipur district in Bihar, India.

II. MATERIAL AND METHODS

Samastipur city, the headquarters of Samastipur District, is located on the bank of Budhi Gandak River in Bihar state. It lies between 25° 51'39" N latitudes and 85° 46' 56" E longitudes with an area of 2905 km². Here, the maximum temperature ranges from 26.1 °C to 34.6 °C and sometimes raises up to 41°C in summer season. Minimum temperatures range between 10.5 °C to 22.2 °C while coolest climatic conditions prevail in winter.

The Ground water samples were collect from randomly selected eleven dug wells in Samastipur, Bihar. Each samples from the area of a separate village, located in downstream area of Budhi Gandak river. The samples of water were collected from eleven villages according to eleven villages Udapatti. Bathua, Sarairanjan, Narghogi, Manikpur, Khetapur, Bakhri, Sihma, Harsinghpur, Khumbhara and Bhatgama. The ground water Samples collected during monsoon season month of June 2021, in sterilized plastic bottles were brought to the laboratory and the studied Physico-chemical parameters. Unstable parameters viz. pH, Electrical Conductivity (EC) and Temperature were measurement in site.

Carbonate (CO_3^{--}), Bicarbonate (HCO_3^-), Chloride (Cl^-), Magnesium (Mg^{++}), Calcium (Ca^{++}), sodium (Na^+) and Potassium (K^+) were analyzed by applying standard methods.

Table 1. Ground water samples analysis of different sites

Sl No.	Name of site	Temp	pH	EC	CO_3^{--}	HCO_3^-	Cl^-	Ca^{++}	Mg^{++}	K^+	Na^+
1.	Udapatti	31.5	7.2	2.0	00	5.2	3.6	4.4	7.6	0.0385	1.14
2.	Bathua	31.7	7.5	1.6	00	2.0	5.2	27.2	11.1	0.0159	3.2
3.	Sarairanjan	29.6	7.0	11.5	00	2.0	49.5	19.2	68.3	0.0192	9.29
4.	Narghogi	32.0	7.1	2.0	00	1.7	3.5	14.4	11.0	0.021	4.61
5.	Manikpur	28.3	7.1	5.7	00	6.0	12.7	14.4	38.7	0.0396	6.42
6.	Khetapur	30.5	7.5	1.9	00	6.8	10.2	14.0	26.2	0.0159	13.9
7.	Bakhri	27.9	7.5	2.2	00	2.0	30.9	1.7	10.3	0.0127	4.33
8.	Sihma	29.6	7.3	11.4	00	1.8	8.1	8.0	107.0	0.029	14.1
9.	Harsinghpur	31.5	7.0	4.3	00	2.3	24.2	4.4	15.8	0.068	7.51
10.	Kumbhara	31.6	7.5	1.8	00	2.4	25.5	2.4	59.3	0.346	0.19
11.	Bhatgama	29.6	7.4	8.1	00	2.0	18.7	12.8	62.9	0.0289	7.01

Notes: All parameters are expressed in meq/lit except temp., pH and EC (mmhos).

III. RESULTS AND DISCUSSION

The temperature of ground water samples collected from different wells is found in a range of 27.9⁰ C and 31.7⁰ C. The maximum temperature was observed at Bathua, while minimum temperature was record at Bakhri. The pH values were varying from 7.00 to 7.5, indicating alkaline nature of ground water in the study area. The maximum pH was observed at Bathua, Khetapur, Bakhri and Khumbhara while, the minimum of it was recorded at Sarairanjan and Harsinghpur. The electrical conductivity was found between 1.4 and 11.5 mm. The maximum value of it was recorded at Sarairanjan and the minimum at Bathua. It is noteworthy that, not a single site of sampling has reported the presence of carbonate. The values of bicarbonate were observed between 1.7 and 6.8 meq/lit. The maximum value was recorded at Khetapur and the minimum was recorded at Narghogi and Sihma. The values of chloride were found in the range of 3.5 and 49.5 meq/lit. The maximum value was recorded at Sarairanjan while the minimum of it was found at Narghogi.

The calcium values were in a range of 1.7 (Bakhri) and 27.2 meq/lit (Bathua). The values of magnesium were recorded between 7.6 and 107.0 meq/lit. at Udapatti and Sihma respectively. The Potassium values were in the range of 0.0137 and 0.346 meq/lit. The maximum value was recorded at Khumbhara while, minimum was found at Bakhri. The range of Sodium was observed from 0.19 to 14.1 meq/lit at Khumbhara and Sihma respectively (Table 1).

The suitability of ground water for irrigation depends on the amount of salts present in it. High or little amount of salts present in the water to be used for irrigation thus, decide the water quality.

Table 2. Ground Water Quality Indices for irrigation Purpose in study area

Site No.	Site	SAR	RSC	KR	SSP
1	Udapatti	0.43	-7.2	0.08	7.0
2	Bathua	0.69	-31.0	0.08	7.0
3	Sarairanjan	1.31	-82.0	0.10	9.0
4	Narghogi	1.22	-22.0	0.17	14.0
5	Manikpur	1.19	-43.5	0.11	10.0
6	Khetapur	2.95	-31.2	0.33	24.0
7	Bakhri	1.73	-8.7	0.35	71.0
8	Sihma	1.77	-113.1	0.11	9.0
9	Harsinghpur	2.15	-16.5	0.35	25.0
10	Kumbhara	0.03	-56.9	0.01	1.0
11	Bhatgama	1.12	-71.0	0.08	7.0

The ground water concentrations of these salts and their ratios were obtained by using water quality indices viz. Sodium



Absorption Ratio (SAR), Residual Sodium Carbonate (RSC), Kelly's Ratio (KR) and Soluble Sodium Percentage (SSP). The obtained values are presented in Table 2. It is clear from, the ground water quality is moderately safe (USDA, 1954) for irrigating the crops [8].

CONCLUSION

The physico-chemical properties studied revealed that the ground water quality in the study area is moderately safe for irrigation purpose and it is varying from different sites areas. This qualitative variation in ground water may be the result of variation in geographical background, unplanned disposal of sewage and industrial effluent etc. It has been suggested that water pollution is the leading worldwide cause of deaths and diseases. Thus, it is recommended that, the ground water in the study area should be analyses before using it for irrigation. However, it is essential to carry out the in depth study of quality parameters of ground water to be used for irrigation in the study area.

Conflicts of Interest: The authors declare no conflict of interest.

Author Contributions: Authors are equally contributed to the paper.

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