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Hydrochemical Analysis and Evalution of Ground Water Quality in Sandesh Block, Bhojpur (Bihar)

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ABSTRACT

Sandesh block is located in the eastern part of Bhojpur district .Water samples are collected from ten stations (five samples from each station) and were subjected to analysis. Pollution of water bodies is one of the areas of major concern to environmentalists. Water quality is an index of health and well being of a society. Industrialization, urbanization and modern agriculture practices have direct impact on water resources. These factors influence the water resources quantitatively and qualitatively. The physico-chemical parameters like colour , pH, turbidity, TA,TH,EC,DO,BOD,COD, chloride, nitrate, sulphate , sodium, potassium, calcium, magnesium, carbonate, bicarbonate, arsenic and fluoride content in water of Sandesh block were studied to ascertain the drinking and domestic as well as irrigation water supply . In this present study, water quality was also studies for suitability of water for irrigation are evaluated.

Keywords- Ground water, water quality, SAR, RSC, %Na

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INTRODUCTION

Water is one of the most common yet the most precious resources on earth without which there would be no life on earth. Pollution is a serious problem as 70% of India's surface water resources and as growing number of its ground water reserves have been contaminated by biological, organic and inorganic pollutants. In south Asian countries such as Nepal, India and Bangladesh, pollution of rivers is more severe and critical near urban stretches due to huge amounts of pollution load discharged by urban activities. [1] Ground water often consists of eight majors' chemical elements – Ca^{2+}, Mg^{2+}, Cl^{-}, HCo_3^{-}, CO_3^{2-} Na^{+}, K^{+} and SO_4^{2-}. The chemical parameters are playing an important role in classifying and assessing water quality. Considering the individual and pairing ionic concentration, certain indices are proposed to find out the alkali hazards. Residual sodium carbonate (RSC) can be used as a criterion for finding the suitability for irrigation waters. It was observed that the criteria used in the classification of the water for a particular purpose considering the individual concentration may not be find its suitability for other purpose and better result can be obtained only by the combined chemistry of all ions rather than the individual or paired ionic characters. [2-4]Chemical classification also throws lights on the concentration of various predominant cations, anions and their interrelationships. The objective of the present study is to discuss the major's chemistry of groundwater of Sandesh block and critically the hydro chemical characteristics of studied block.

EXPERIMENTAL

STUDY AREA- Sandesh is a block of Bhojpur district. It is a part of Patna Division. Bhojpur district (Plate I) falls within 25^0 00'' to $25^0$30'' N and $84^0$15" to 84^0 45''E, the area is bounded by river Son in the east, Dharmawati-Gangi rivers in west and river Ganga in the the North. Its area spread over a total geographical area of 23.75 sq/Km. Sandesh block having 143395 population and this adopts tropical monsoon climate.[5] People of Sandesh block are mainly work in agricultural activities. The main sources of water supply in the area is hand pumps , bore holes and manually operated hand pumps, dug wells. The precipitation which is the sole source of ground water recharges in the study area is very low due to rain fall.

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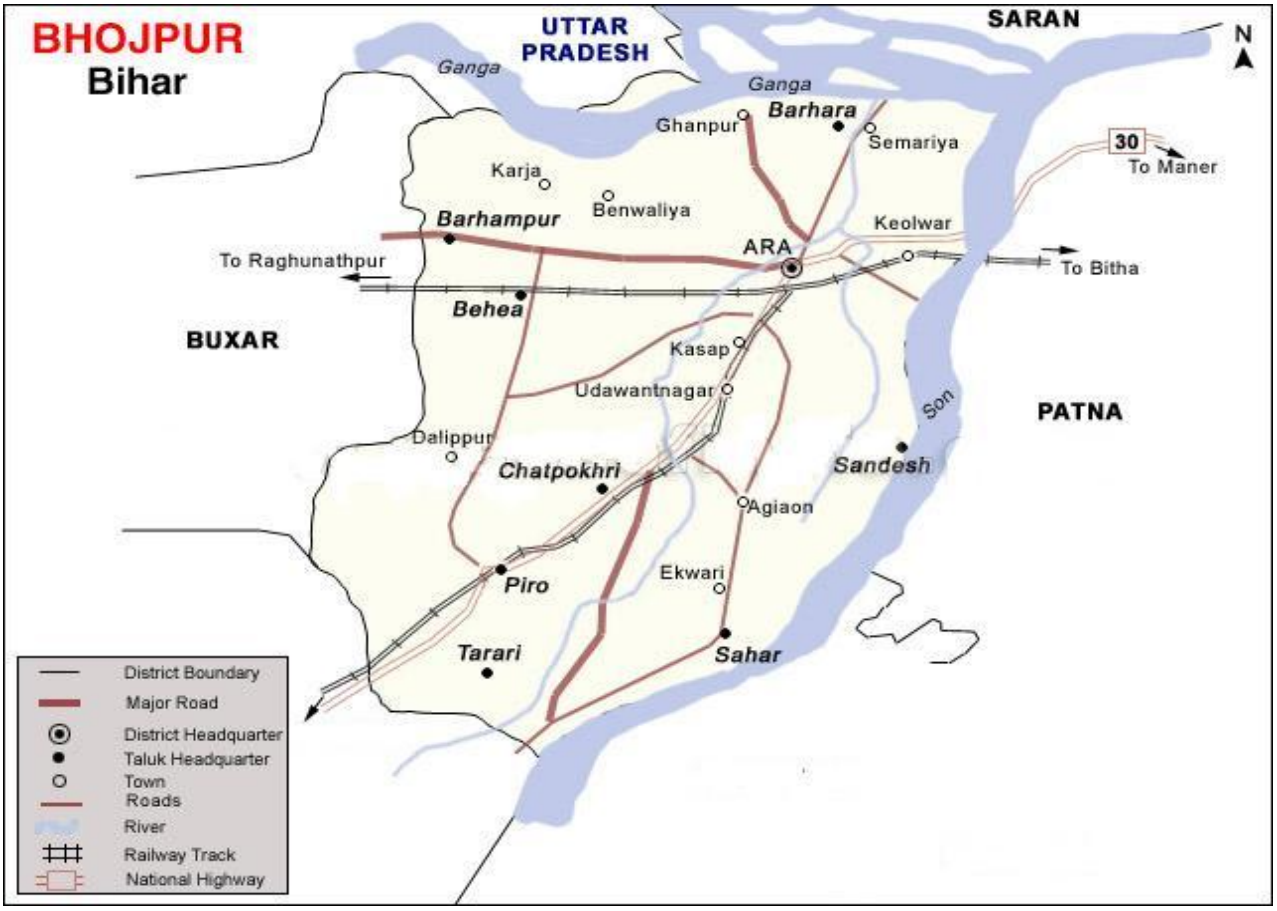
Figure 1- Location of Sandesh Block in Bhojpur district



WATER SAMPLING - In present investigation ten stations are selected in Sandesh block fifty Ground water samples are collected. The water samples were collected in polythene bottles which were cleaned with acid water, followed by rinsing twice with distilled water. The water samples are chemically analyzed. [6] The analysis of water was done using procedure of standard methods.

METHODOLOGY- The pH and EC were measured by using Eutech-cybernetics PH meter and EC scan meter. [7] Total hardness, calcium, magnesium were measured by EDTA titration methods. [8] Total alkalinity was determined by volumetrically by silver nitrate titrametric methods using potassium chromate as indicator. [9]. Sulphate was determined nepthalometrically using ELICO-52 Nepthalometer. [10] Fluoride content in water was measured by ELICO-52 Spectrophotometer. Carbonate and bicarbonate and all physico- chemical parameters determined according to standards methods. [11, 12, 13] TDS were observed with the help of digital water kit. [14] Nitrate and arsenic was observed by phenol dysphonic acid method and colorimetric methods. [15, 16] Sodium, potassium was determined by flame photometer and Iron was determined by spectrophotometer. [17] DO, BOD, COD was determined by fixation

regent. [18] The sodium in irrigation waters is usually denoted as percent sodium and can be determined using the following formula

$$\%Na = Na^{+} \times 100 / (Ca^{2+} + Mg^{2+} + Na^{+} + K^{+}) \quad [19]$$

As a result the relative proportion of sodium in water is increased in the form of sodium carbonate. RSC is calculated using the following formula

$$RSC = (HCO_3^{-} + CO_3^{2-}) - (Ca^{2+} + Mg^{2+})$$

The most important properties of irrigation water in determination it's related to calcium and magnesium and its carbonate and bicarbonate. A better measure of the sodium hazards for irrigation is the SAR which is used to express reaction with the soil. SAR is computed as

$$SAR = Na^{+} / (Ca^{2+} + Mg^{2+} / 2)^{1/2} \quad [20]$$

RESU LT AND DISCUSSION

The maximum value of pH of the water samples was recorded as 7.7 at station 7 and minimum value of pH was recorded as 6.2 at station 2. In general pH was within the limits of standard value. For drinking water, a pH range of 6.0-8.5 is recommended. The alkalinity of water is its capacity to neutralize acids. The maximum alkalinity was recorded as 396 ppm at station 3 and minimum value is recorded as 140 at station 7. BIS has set a desirable level of alkalinity in drinking water to be 200 ppm where as its value has been prescribed to be 600 ppm in the absence of alternative source. So in maximum stations value of total alkalinity were present in water not higher. In the present study water samples of different locations was observed in the range of 132-386 ppm. The hardness of water is not a pollution parameter but indicates water quality. Dissolved oxygen in water was in the range of 1.10-4.60. Biochemical oxygen demand is usually defined as the amount of oxygen required by bacteria in stabilizing the decomposable organic matter. BOD gives an idea about the extent of pollution. In present study water samples, sampling stations BOD was found in the range of 0.60-11.80 ppm, it indicates that the low amount pollution affects the water quality. The chemical oxygen demand is a measure of oxygen equivalent to the requirement of oxidizing organic matter contents by a strong chemical agent. The COD test is helpful in indicating toxic conditions and the presence of biologically resistant organic substances. The low range 0.6.-2.10 value of COD due to low level of pollutants present in water samples. Chlorides occur in all natural waters in widely varying concentrations. The chloride contents normally increases as the mineral content increases [19]. In present study the chloride concentration were found in the range of 6-42 ppm. The nitrate content of water bodies was found in the range of 0.57-4.65. The highest value of 4.65 ppm was recorded at station 1 while minimum at station 6 and it is observed that it is within the accepted limits of drinking Water standards (20 ppm-ICMR, 45 ppm-ISI). It shows that water

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contaminated and put serious effect on living body. Sodium and potassium in water are found in the range of 27-98 and 2-11.

The fluoride content in water is found in the range of 0.06- 0.42 ppm which is in limits. Arsenic content in water found in the range of 5-14.Also form the above data %Na was excellent in one station, good in one station, permissible in two stations and doubtful in six stations. Further unsuitable in one station. RSC values were unsuitable in all the stations. SAR values were excellent in two stations, good in five stations, doubtful in two stations and unsuitable in one station.

Table 1: Hydro Chemical Analysis of Ground Water of Sandesh Block.

ST.No	BOD	COD	DO	PH	EC	TH	Fe	Cl^-	F^-	TDS	Ca^{2+}	Mg^{2+}	SO_4^{2-}	CO_3^{2-}	HCO_3^-	Na^+	K^+	NO_3^-	As	TA
1	1.00	1.90	1.50	7.3	525	256	0.45	16	0.32	353	33	14	15	0	75	27	1.2	4.65	11	274
2	1.11	1.80	1.70	6.2	541	248	0.66	12	0.27	328	45	12	9	0	87	74	3.0	1.13	5	244
3	0.80	2.10	1.40	7.5	710	386	0.28	9	0.26	481	37	15	12	2	77	84	3.6	1.42	8	396
4	0.90	1.20	1.60	6.4	657	303	BDL	12	0.23	417	26	10	21	5	46	77	4.1	1.55	10	323
5	1.00	1.60	1.80	7.6	621	256	BDL	24	0.06	357	29	16	3	2	56	35	2.1	0.59	9	244
6	0.70	1.35	1.50	7.1	874	371	BDL	42	0.25	515	35	4	11	1	85	98	1.6	0.57	BDL	375
7	11.80	0.60	4.60	7.7	354	132	0.63	7	0.42	209	39	7	6	11	57	88	2.3	1.42	BDL	140
8	1.00	1.00	1.40	6.2	361	156	BDL	6	0.27	208	40	9	5	7	69	86	3.8	3.01	BDL	165
9	0.90	1.20	1.10	6.4	446	210	BDL	19	0.23	269	27	12	20	2	48	70	1.5	2.78	14	210
10	0.60	1.60	1.11	6.3	575	252	0.43	11	0.22	418	17	11	18	2	52	65	2.8	0.84	9	247

Table -2 Sodium Percent Water Class

SODIUM (%)	WATER CLASS	STATION SAMPLES VALUES
<20	Excellent	Nil
20-40	Good	1
40-60	Permissible	2
60-80	Doubtful	6
>80	Unsuitable	1

Table -3 Ground water quality based on Residual sodium carbonate (RSC)

RSC	REMARK ON QUALITY	STATION SAMPLE VALUES
<1.25	Good	Nil
1.25-2.5	Doubtful	Nil
>2.5	Unsuitable	10

Table-4 Sodium hazard classes based on USSL Classification

SODIUM HAZARD CLASS	SAR	REMARK ON QUALITY	STATION SAMPLE VALUES
S1	10	Excellent	2
S2	10-18	Good	5
S3	18-26	Doubtful	2
S4,S5	>26	Unsuitable	1

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