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Research Article

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Physico-chemical analysis of ground water taken from five blocks (Udwantnagar, Tarari, Charpokhar, Piro, Sahar) of southern Bhojpur (Bihar)

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ABSTRACT

The ground water quality is determined in five blocks (Udwantanagar, Tarari, Charpokhar, Piro and Sahar) that lays in southern parts of district Bhojpur district of Bihar, where from each block ten ground water samples are under studied for Physico- chemical status of ground water. In Physico-chemical analysis , various quality parameter are measured including pH, turbidity, electrical conductivity (EC), total dissolved solids (TDS),total hardness(TH),content of calcium (Ca^{2+}),magnesium (Mg^{2+}),chloride(Cl^-), sulphate ($S0_4^{2-}$), Iron (Fe), DO, BOD, COD, Total alkalinity (TA) and Nitrate (No_3^{2-}) concentration present in ground water. Also all parameters were compared with ICMR standards of water quality; also in present research paper classification of water samples of five blocks was investigation on the basis of TDS and TH.

Keywords: Ground water, physico-chemical analysis, TH, TDS, Five block of Southern Bhojpur.

INTRODUCTION

Water plays an essential role in human life**.** Although statistics, the WHO reports that approximately 36% of urban and 65% of rural Indian were without access to safe drinking water [1].Fresh water is one of the most important resources crucial for the survival of all the living beings. It is even more important for the human being as they depend upon it for food production, industrial and waste disposal, as well as cultural requirement [2]. Human and ecological use of ground water depends upon ambient water quality. Human alteration of the landscape has an extensive influence on watershed hydrology [3]. Ground water plugs a vital role in human life .The consequences of urbanization and industrialization leads to spoil the water for agricultural purposes ground water is explored in rural especially in those areas where other sources of water like dam and river or a canal is not considerable. During last decade, this is observed that ground water get polluted drastically because of increased human activities .Consequently number of cases of water borne diseases has been seen which a cause of health hazards. An understanding of water chemistry is the bases of the knowledge of the multidimensional aspect of aquatic environmental chemistry which involves the source, composition, reactions and transportation of water. The quality of water is of vital concern for the mankind since it is directly linked with human welfare .It is a matter of history that facial pollution of drinking water caused water-borne diseases which wiped out entire population of the studied

area [4].The present work is an attempt to measure the water quality of various water sources of five blocks of southern Bhojpur district, Bihar, India.

EXPERIMENTAL SECTION

STUDY AREA

Study area comprises of Bhojpur district of Bihar state. Bhojpur district is one of the Thirty eight districts of Bihar state and their administrative head quarters are located in Ara town. 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 3395 sq/Km. The district has three sub divisions of Ara Sadar, Jagdishpur and Piro. The block of the district include Ara Sadar, Udwantnagar, Jagdishpur, Koilwan, Sahar, Barhara, Sandesh, Shahpur, Charpokhri, Piro, Tarari, Bihia, Agiawon and Garhami.In our present research paper physico-chemical analysis was carried out for five blocks of southern Bhojpur.

WATER SAMPLING

In present investigation fifty water samples ie, ten from each block from five blocks were 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 [5]. The analysis of water was done using procedure of standard methods.

Figure1 - Location of Bihar in India

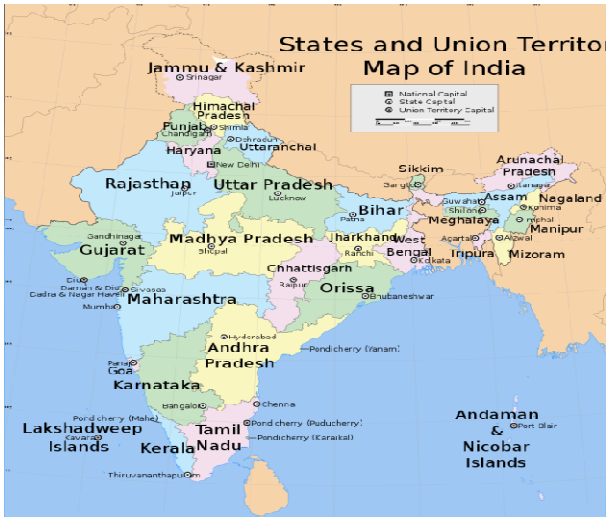
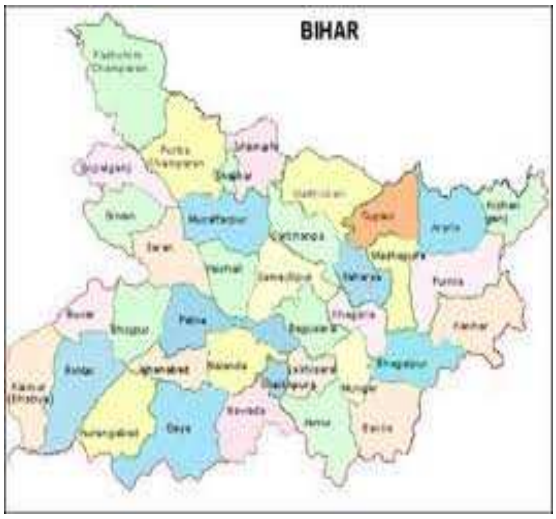


Figure 2- Location of Bhojpur in Bihar



METHODOLOGY

The pH and EC was measured by using Eutech-cybernetics PH meter and EC Scan meter [6].Total hardness, calcium, magnesium were measured by EDTA titration methods. [7] Total alkalinity was determined by volumetrically by silver nitrate titrametric methods using potassium chromate as indicator. [8]. Sulphate was determined nepthalometrically using ELICO-52 Nepthalometer. [9] Fluoride content in water was measured by ELICO-52 Spectrophotometer. The Physico-chemical analysis was carried out according to standards methods. [10, 11, 12] Turbidity and TDS were observed with the help of digital water kit. [13] Iron was determined by spectrophotometer. [14] Nitrate was determined by Phenol Disulfonic method [15] DO, BOD, COD were determine by standards methods given by NEERI [16].

Figure 3- Location of Five Blocks (Udwantnagar, Tarari, Charpokhar, Piro, Sahar) in Bhojpur district (Bihar)

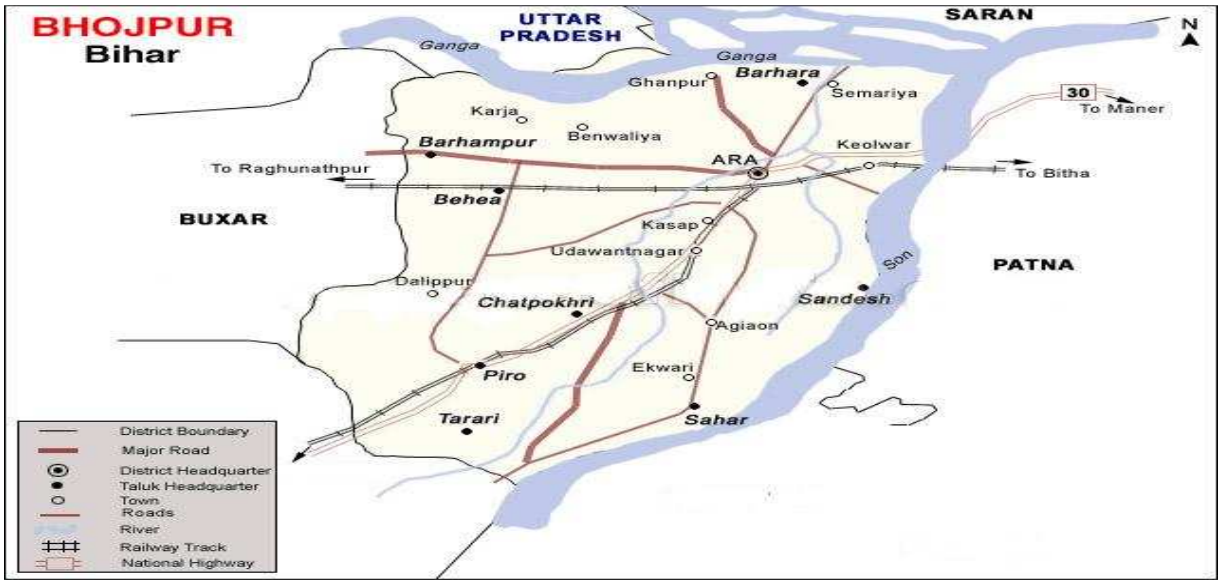


TABLE 1- PHYSICO-CHEMICAL ANALYSIS OF GROUND WATER OF UDWANTNAGAR BLOCK

Sr. No.	pH	Turbidity	EC	TH	TA	TDS	F^-	DO	BOD	COD	Ca^{2+}	Mg^{2+}	Cl^-	So_4^{2-}	No_3^-	Fe
1	7.2	7	375	356	347	503	2.48	1.00	1.40	2.20	100	26	42	6	1.42	0.70
2	7.5	BDL	475	192	190	260	0.17	1.50	3.40	7.40	63	8	13	9	2.03	0.80
3	7.2	BDL	432	195	195	300	0.15	1.60	1.10	2.40	68	7	27	BDL	2.96	0.34
4	7.6	BDL	529	263	294	410	0.24	1.80	1.00	2.20	83	13	21	BDL	11.48	0.40
5	6.4	BDL	105	290	319	390	0.56	2.10	1.00	2.10	86	18	16	11	7.12	BDL
6	6.7	BDL	487	264	300	384	0.46	2.00	1.00	1.80	95	11	19	9	1.29	0.72
7	7.7	10	583	280	296	418	0.87	1.00	0.80	1.80	90	14	24	5	12.71	0.28
8	7.7	BDL	258	283	277	427	0.72	1.50	1.00	1.90	91	8	9	20	6.33	0.58
9	6.5	BDL	484	235	226	385	0.26	1.50	0.50	16.50	72	13	31	7	2.15	0.31
10	7.2	BDL	327	185	183	274	0.20	1.00	1.40	2.20	65	5	16	6	1.87	0.33

TABLE -2 PHYSICO-CHEMICALS ANALYSIS OF GROUND WATER OF PIRO BLOCK

Sr. No.	pH	Turbidity	EC	TH	TA	TDS	F^-	DO	BOD	COD	Ca^{2+}	Mg^{2+}	Cl^-	So_4^{2-}	No_3^-	Fe
1	7.4	BDL	489	226	206	281	0.31	1.80	0.60	2.20	78	7	9	7	2.26	0.54
2	7.8	BDL	653	258	252	395	2.53	2.10	0.80	1.90	79	15	26	6	1.18	0.26
3	7.4	BDL	710	252	275	431	0.60	1.80	1.10	1.80	74	16	57	8	3.51	0.36
4	6.2	BDL	562	220	232	276	0.27	1.90	0.70	1.90	75	8	7	9	1.25	0.20
5	6.5	BDL	754	212	236	318	0.22	2.10	1.60	2.10	74	6	34	20	12.32	0.71
6	7.1	8	451	236	226	453	0.25	1.90	1.10	1.90	63	19	29	14	1.06	0.21
7	7.0	BDL	701	166	168	270	BDL	2.10	1.20	1.80	58	5	15	13	3.35	BDL
8	6.7	BDL	701	245	251	389	0.13	2.40	1.60	1.80	85	8	15	19	0.84	0.13
9	6.6	BDL	505	293	301	379	0.40	1.80	1.50	1.60	97	12	18	18	1.53	0.40
10	6.2	BDL	546	221	239	318	BDL	1.22	1.80	1.30	77	7	31	6	0.61	BDL

RESULTS AND DISCUSSION

The water from the study area of has no colour, odour. Taste of the water of the water sample in most of the locations pleasant in taste. The result of the chemical analysis of water in the present study in Table-1,2,3,4,5 so it is necessary to a make a comparison of water given by WHO standards. Theses parameters showed in Table-6.The pH of water shows variation in its ranges. It indicates that they are in range of water quality parameter permissible limits. The EC of water samples shows wide variation in all five blocks. The Ca^{2+} was showed wide variation in all the accepted limits of all blocks. TA within the limits. Chloride content in water is low, the fluoride content in water

is low due to this no dental and Skelton problem arises in the study area. The value of DO, BOD, COD were in limits. Turbidity was higher in all the observed parameters of all blocks. Mg^{2+} values were within the limits. Chloride and sulphate data was low in all the blocks of southern Bhojpur. Also classification on the basis of Total hardness shows that maximum samples in all blocks contain higher values of hardness. TDS were low in all blocks.

TABLE – 3 PHYSICO-CHEMICALS ANALYSIS OF GROUND WATER OF CHARPOKHAR BLOCK

Sr. No.	pH	Turbidity	EC	TH	TA	TDS	F^-	DO	BOD	COD	Ca^{2+}	Mg^{2+}	Cl^-	So_4^{2-}	No_3^-	Fe
1	6.3	6	390	151	166	233	0.26	1.00	0.80	1.80	51	6	8	5	3.23	0.48
2	7.5	8	743	327	323	452	0.14	1.50	1.00	1.90	116	8	19	16	2.35	0.74
3	7.2	BDL	505	208	205	302	0.07	1.50	0.50	16.50	66	11	26	6	1.68	0.25
4	7.2	BDL	902	391	416	539	0.25	1.00	1.40	2.20	136	12	41	6	1.87	0.53
5	7.4	BDL	336	152	161	195	0.15	15.80	1.00	1.20	53	4	12	BDL	2.01	0.59
6	7.4	12	801	381	455	465	0.61	2.40	1.50	1.10	85	40	12	9	6.38	0.31
7	6.7	BDL	636	254	284	365	0.61	2.20	1.50	1.00	89	8	11	11	5.93	0.62
8	7.3	BDL	619	255	327	365	0.21	1.90	2.40	1.00	87	9	8	BDL	3.28	BDL
9	7.1	BDL	2380	575	579	1338	0.21	2.10	1.30	10.80	174	3	152	24	2.00	0.52
10	7.1	BDL	646	575	197	404	0.22	15.80	2.20	1.20	58	12	63	33	1.01	0.50

TABLE – 4 PHYSICO-CHEMICALS ANALYSIS OF GROUND WATER OF TARARI BLOCK

Sr. No.	pH	Turbidity	EC	TH	TA	TDS	F^-	DO	BOD	COD	Ca^{2+}	Mg^{2+}	Cl^-	So_4^{2-}	No_3^-	Fe
1	6.9	6	582	267	291	385	0.23	2.00	1.20	15.80	84	14	17	5	3.94	0.34
2	7.8	BDL	566	244	237	341	0.76	1.60	1.10	2.40	86	7	17	5	1.51	0.08
3	7.4	BDL	707	296	313	392	0.06	1.80	1.00	2.20	97	12	35	11	4.58	0.28
4	7.0	BDL	632	271	285	368	0.05	1.00	2.10	2.10	84	15	34	12	1.38	BDL
5	6.3	6	782	262	382	456	0.15	1.40	1.80	2.00	126	12	14	6	1.85	0.65
6	6.7	BDL	365	351	165	218	0.76	1.00	1.80	1.00	54	4	6	5	1.55	0.56
7	6.4	BDL	736	270	393	432	0.23	1.00	1.90	1.50	112	21	9	7	1.20	0.79
8	6.4	BDL	680	268	263	389	BDL	2.00	1.00	1.80	85	13	22	13	5.26	0.23
9	7.8	BDL	711	283	302	444	0.15	1.80	1.20	2.10	79	17	20	9	4.17	0.68
10	7.3	BDL	737	239	328	438	0.21	2.10	0.90	1.90	108	16	28	18	1.29	0.75

TABLE – 5 PHYSICO-CHEMICALS ANALYSIS OF GROUND WATER OF SAHAR BLOCK

Sr. No.	pH	Turbidity	EC	TH	TA	TDS	F^-	DO	BOD	COD	Ca^{2+}	Mg^{2+}	Cl^-	So_4^{2-}	No_3^-	Fe
1	7.2	7	321	117	139	198	0.58	1.20	2.20	4.60	39	5	13	BDL	13.10	0.81
2	7.7	BDL	602	201	197	265	0.45	1.50	1.90	1.60	46	21	26	47	10.41	BDL
3	7.6	14	858	423	468	495	0.64	1.60	1.80	1.40	98	43	12	10	2.51	0.45
4	6.8	BDL	838	345	354	523	0.15	0.20	1.90	1.10	73	40	11	9	2.42	0.51
5	7.6	BDL	486	189	186	281	0.17	0.50	2.10	2.10	65	6	29	6	2.06	0.83
6	7.3	6	516	209	185	218	0.15	2.60	1.90	1.50	50	13	15	BDL	8.76	0.65
7	7.3	BDL	531	225	256	231	0.38	1.30	3.80	3.20	77	8	26	BDL	1.92	0.49
8	7.8	9	792	289	239	456	0.05	1.80	2.10	3.10	60	33	29	28	1.07	0.44
9	7.6	BDL	485	190	275	283	0.21	2.80	1.00	1.20	57	12	29	12	2.18	0.35
10	6.7	BDL	345	115	211	197	0.43	3.60	1.50	1.23	36	6	26	8	13.81	0.47

CONCLUSION

This study shows that ground water is the only source for people in the study area, and the results of the chemical analyses of ground water indicate considerable variation. Most of the water samples do not comply with ICMR standards for drinking purpose. The water quality in the investigated area is found to be suitable for drinking only in few locations, while as out prior treatments. It must be noted that a regular chemical analysis must be done to insure that the quality of water in this area is not contaminated, in addition to research for new walls in the area in order to get additional water for the resident people.

Table 6- Comparison of ground water quality at the study areas with drinking water standards (ICMR)

Parameter	Minimum	Maximum	Mean	ICMR (Desirable Limits)
pH	6.2	7.8	7	7.0-8.5
EC	105	858	481.5	-
TDS	195	1338	766.5	500
TH	151	575	363	300
TA	139	579	359	600
Ca_2^+	39	174	106.5	75
Mg^{2+}	3	43	28	60
Turbidity	6	14	10	5NTU
Fe	0.08	0.83	0.45	0.1
No_3^-	0.61	13.81	7.21	20
F^-	0.05	2.48	1.26	1.0
Cl^-	3	57	30	200
So_4^{2-}	5	20	12.5	200
DO	1	15.80	8.4	-
BOD	0.5	3.8	2.15	-
COD	1.10	16.50	8.8	-

Table 7- Classification of the water samples in the study area on the basis of TDS

Sr. No.	Classification of Ground water	Total Dissolved solid (mg/l)	No. of Samples
1	**Non-saline**	<1000	49
2	**Slightly saline**	1000-3000	1
3	**Moderately saline**	3000-10,000	NIL
4	**Very saline**	>10000	NIL

Table 8 -Classification of the water samples in the study area on the basis of TH

Sr. No.	Description	Hardness(Mg/l)	No. of Samples
1	**Soft**	0-60	NIL
2	**Moderately hard**	61-120	2
3	**Hard**	121-180	3
4	**Very hard**	>180	45

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