RESEARCH ARTICLE

Ground water quality assessment and its impact with special reference to Chhindwara District of Madhya Pradesh, India

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ABSTRACT

The Earth is full of natural resource needed for the development of mankind. The day by day increased demand has developed new methods of water quality assessment and management. The study was carried out for the ground water quality assessment of 9 Tahsil/Blocks of Chhindwara district. Water is the basic resource for sustaining all human activities, so its provision in desire quantity and quality is most important. For assessment of water quality of the district were selected Junnardeo, Chhindwara, Chourai, Tamia and Pandhurna. Samples of ground water were collected from 5 blocks of the affected area and analyzed for physico chemical parameters like pH, Electrical conductivity, alkalinity, total hardness, fluoride ion were analyzed. Some water sample show higher fluoride ion concentration, higher turbidity. Over all some parts of bore well/tube well water and hand pump water needed treatment for drinking purpose due to hardness and fluoride are present in desirable limit. The present study is focused on measuring the quality of ground water in rural areas of Chhindwara district and its effect on human health. The sample were found to have high pH, indicating alkalinity, high fluoride concentration is mainly found in Tamia, Chhindwara, Jamai, Pandhurna and Chaurai on the contrary these findings, majority of people living in these areas were suffering from fluoride related disease, so the study argues about the need of proper analysis and importance of water treatment and management system in current times

Keywords: Water quality, Fluorides, Diseases, Assessment, Parameters.

INTRODUCTION

Water is an essential resource for all life on the planet. Water covers over 71% of the earth's surface and is a very important natural resource for people. Only three percent of it is fresh and two-thirds of the fresh water locked up in ice caps and glaciers. It is the fundamental right of every individual to get pollution free water, Juneja and Chaudhary (2013). Water plays an essential role in human life. Although statistics, the WHO reports that approximately 36% of urban and 65% of rural Indian were

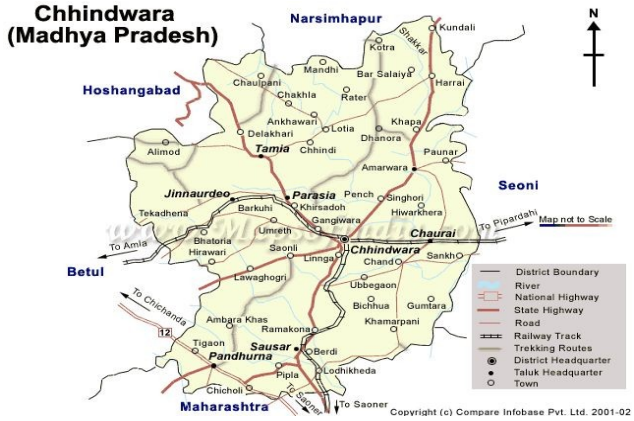
without access to safe drinking water. Fresh water is one of the most important resources crucial for the survival of all the living beings. It is even more important for the human being as they depend upon it for food production, industrial and waste disposal, as well as cultural requirement. Human and ecological use of ground water depends upon ambient water quality. Human alteration of the landscape has an extensive influence on watershed hydrology. 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, Neeraja et al. (2012).

The major part of the district is occupied by Deccan Trap. The coal bearing places are lower Gondwanas in parts of Jamai, Jamai blocks and Parasia. There are Pench and Kanhan rivers which flow in this trap. Ground water occurs under phreatic and semi-confined to confined condition. The entire district, command and Non Command areas, falls under safe Category, where stage of ground water development is 89.42%. The net annual ground water availability in the district is 1101.50 MCM and draft from all uses is 558.96 MCM, Rao (2001, 2002, 2003).

Chhindwara district is located on the Southwest region of 'Satpura Range of Mountains'. The district is spread over an area of 11,850 Sq. km and is located at the southern boundary of the state, laying between North Latitudes 21^0 28' and 22^0 50' and East longitudes 78^0 15' and 79^0 25' falls under the Survey of India Topo Sheet No. 55 J, K, N, & O. The district is bounded by Narsinghpur and Hoshangabad district in the north, Seoni district in the east, Betul district in the west and by Maharashtra state in the south, DGWB (2007).

Study Area

The District is divided into 9 Tahsils/Blocks (Chhindwara, Tamia, Parasia, Jamai, Chourai, Amarwara, Sausar, Bichhua and Pandhurna). There are 1984 villages in the district, out of which 1906 villages are habitated.



Map 1:Map of Chhindwara District

As per Census 2011, the total population of the district is 20, 90, 922 out of which 76.90% belong to rural areas. The Scheduled Caste and Scheduled Tribes population is 2, 14,201 and 6, 41,421 respectively.

The district lies in parts of the Narmada and the Godavari basin, Wainganga sub basins. The total catchments areas of the Narmada & the Wainganga rivers falling in the district are 3,555 and 8,295 Sq. km respectively. The major tributaries of the Godavari River are Kanhan, Pench and Wardha, while Sakkar, Sitarewa, Dudh are tributaries of Narmada River

MATERIALS AND METHODS

In present investigation that fifty water samples ie ten from each blocks from five blocks were collected. For assessment of water quality of the Kanan valley coal mines 10 villages were selected area of the affected area. Samples of ground water were collected from 10-10 villages of each block. These samples of ground water were chemically analyzed. The studies were carried out in the affected area. Ground water is the main source for drinking water supply both in rural and urban areas and is supplementing the surface water supply schemes. A total number of 10,326 shallow tube wells fitted with hand pumps are operational to provide drinking water to as many as 4482 inhabited villages, (PHED Chhndwara).

Parameters

Physico chemical parameters like pH, Electrical Conductivity, Salinity, Total Hardness, Fluoride ion, Iron and Turbidity were analyzed by help of PHE Department Chhindwara.

RESULTS AND DISCUSSION

The result of the chemical analysis of water in the present study in Table-1,2,3,4,5 so it is necessary to make a comparison of water given by WHO standards. The pH of water shows variation in its ranges. It indicates that they are in range of water quality parameter permissible limits. The pH value of water samples of 35 stations ranges between 7.35 and 7.93 values were of alkaline in nature and 15 stations values were of acidic in nature. The EC of water samples shows wide variation in all five blocks. The electrical conductivity (EC) values were found to be in the range of 332 and 1722 µS/cm. The EC values exceeding limit, 1000 µS/cm, were noticed at three villages, Viz., Chhindi (1005 µS/cm), Silwani (highest 1722 µS/cm) and Chhindwara (1132 µS/cm). The high EC values of these villages may be attributed to the primary minerals of earth's crust dissolved in water samples. The concentration of fluoride ion is higher in deeper levels and appears increasing with depth and also from recharge areas to discharge areas as revealed by the fact that the number of villages with high fluoride concentration is located on either side of Pench River. The high value of fluoride ion, 19.90 mg/l, has been recorded in deep ground water in at Rajakho village. Occurrence of high fluoride is mainly found in parts of Jamai, Chhindwara, Chourai, Bichhua and Pandhurna blocks. It is also noticed that the comparatively high fluoride concentration is found in the hand pumps located near and intersection of lineaments e.g. Sevajpani village (13.7 mg/l), Maduadhana(16.5 mg/l), Khatkar(10.4 mg/l), Hivarkhedi(15.75 mg/l) Ghat Parasia, (13.00 mg/l) etc.

Table-1: Ground water analysis of different villages of Junnardeo block

Sr. No.	Name of village	Volume	Source	Fluoride 1.00/1.50	Salinity 200/1000	Iron 0.10/1.00	Turbidity 2.50/10.00	pH 6.50/8.60	EC	Hardness 200/600
1	Panara	100ml each	Hand pump	8.00	578.82	1.76	10.03	7.9	432	644
2	Dungariya	" "	" "	1.24	278.69	0.82	20.41	7.9	334	392
3	Jamba kiradi	" "	" "	3.90	121.48	0.43	19.02	7.7	765	376
4	Chikhalmau	" "	" "	1.78	1357.74	0.51	7.24	8.5	1000	588
5	Moyari	" "	" "	1.28	1350.06	0.92	10.20	10.5	905	136
6	Karan pipariya	" "	" "	1.37	39.29	0.73	8.96	9.6	607	32
7	Gorakhghat	" "	" "	3.40	164.35	0.46	13.96	7.8	343	284
8	Kohliya	" "	" "	2.80	282.26	0.56	26.83	8.1	532	536
9	Purainakhalsa	" "	" "	1.01	364.44	0.64	13.24	7.9	389	756
10	Pipariya manu	" "	" "	3.20	150.06	0.21	7.12	7.5	865	452

Source- P.H.E. Department Chhindwara.

Table 2: Ground water analysis of different villages of Tamia block

Sr. No.	Name of village	Volume	Source	Fluoride 1.00/1.50	Salinity 200/1000	Iron 0.10/1.00	Turbidity 2.50/10.00	pH 6.50/8.60	EC	Hardness 200/600
1	Tamia	100ml each	Hand pump	0.38	778.82	.39	12.00	7.83	709	544
2	Chhindi	" "	" "	1.48	378.69	0.92	20.41	7.84	005	492
3	Delakhari	" "	" "	0.90	221.48	0.53	19.02	7.8	777	306
4	Lahgudna	" "	" "	1.78	357.74	0.41	7.24	7.86	779	528
5	Patalcot	" "	" "	1.48	550.06	0.82	10.20	8.5	1009	236
6	Rated	" "	" "	1.87	639.29	0.93	8.96	9.6	345	320
7	Jatachapar	" "	" "	1.37	347.0	0.64	11.7	11.2	845	586
8	Gorakhnath	" "	" "	3.90	1164.35	0.46	13.96	7.8	756	384
9	Kolya	" "	" "	2.40	882.26	0.56	26.83	8.1	365	236
10	Sangakheda	" "	" "	0.65	414.38	0.72	13.37	7.8	567	396

Source- P.H.E. Department Chhindwara.

Table 3: Ground water analysis of different villages of Chhindwara block

Sr. No.	Name of village	Volume	Source	Fluoride 1.00/1.50	Salinity 200/1000	Iron 0.10/1.00	Turbidity 2.50/10.00	pH 6.50/8.60	EC	Hardness 200/600
1	Chhindwara	100ml each	Hand pump	0.30	678.82	1.39	10.33	7.38	1132	745
2	Ghatparasia	" "	" "	1.58	478.69	0.82	9.41	7.84	1006	392
3	Khajri	" "	" "	4.10	229.48	0.43	10.02	7.8	877	376
4	Rajakho	" "	" "	19.90	857.74	0.51	7.94	7.86	789	588
5	Sarna	" "	" "	6.48	540.06	0.92	6.20	7.5	809	136
6	Rohnakala	" "	" "	5.87	739.29	0.73	8.96	9.6	348	322
7	Bohna	" "	" "	4.37	447.0	0.94	1.7	7.2	745	786
8	Bangoan	" "	" "	9.0	264.35	0.56	11.96	7.66	798	284
9	Linga	" "	" "	2.40	802.26	0.76	6.83	7.6	643	431
10	Silwani	" "	" "	0.39	474.38	0.82	3.37	7.35	1722	596

Source- P.H.E. Department Chhindwara.

Table 4: Ground water analysis of different villages of Pandhurna block

Sr. No.	Name of village	Volume	Source	Fluoride 1.00/1.50	Salinity 200/1000	Iron 0.10/1.00	Turbidity 2.50/10.00	pH 6.50/8.60	EC	Hardness 200/600
1	Sawajpani	100ml each	Hand pump	13.70	778.82	0.39	10.03	7.9	709	744
2	Mundidana	"	" "	11.48	378.69	0.85	20.41	7.84	805	362
3	Salai	" '	"	9.10	221.48	0.47	11.02	7.8	707	396
4	Siratha	" '	" '	10.0	357.74	0.56	8.24	7.86	979	568
5	Badchicholi	" "	" "	5.0	550.06	0.90	10.20	10.5	1009	536
6	Bangaon	" "	" "	5.5	639.29	0.78	8.96	9.6	349	389
7	Gujerkhedi	" "	" "	4.70	347.0	0.99	11.7	11.2	845	686
8	Pither Raiyt	" "	" "	10.4	1164.35	0.41	13.96	7.8	759	387
9	Pandhurna	" "	" "	0.36	882.26	0.50	26.83	7.83	446	536
10	Biroli	" "	" "	4.50	414.38	0.79	13.37	7.6	667	396

Source- P.H.E. Department Chhindwara.

Table 5: Ground water analysis of different villages of Churai block

Sr. No.	Name of village	Volume	Source	Fluoride 1.00/1.50	Salinity 200/1000	Iron 0.10/1.00	Turbidity 2.50/10.00	pH 6.50/8.60	EC	Hardness 200/600
1	Sitapar	100ml each	Hand pump	2.24	768.82	0.76	7.03	7.93	332	644
2	Dawazir	"	" "	5.45	388.69	0.85	2.41	7.84	1005	362
3	Bichhwa	"	"	11.40	281.48	0.49	9.02	7.7	779	476
4	Sihoramal	"	"	12.20	257.74	0.55	7.24	7.6	679	508
5	Moari	" "	" "	9.0	450.06	0.92	8.20	8.5	909	736
6	Kewlari	" "	" "	15.70	669.29	0.73	8.96	9.9	341	329
7	Hiwarkhedi	" "	" "	15.75	337.0	0.94	10.72	7.4	885	746
8	Pindrai saraf	" "	" "	15.07	764.35	0.46	3.96	7.64	726	384
9	Maduadhana	" "	" "	16.05	892.26	0.56	6.93	8.5	365	556
10	Khatkar	" "	" "	10.4	614.38	0.72	3.38	7.8	567	390

Source- P.H.E. Department Chhindwara.

One of the main trace elements in groundwater is fluoride which generally occurs as a natural constituent. Bedrock containing fluoride minerals is generally responsible for high concentration of this ion in groundwater. Fluoride normally accumulates in the bones, teeth and other calcified tissues of the human body. Excess of fluoride in water causes serious damage to the teeth and bones of the human body, which shows the symptoms of disintegration and decay, diseases called dental fluorosis, muscular

fluorosis and skeletal fluorosis. Higher intake of fluoride may change the metabolic activities of soft tissues (brain, liver, kidney, thyroid and reproductive organs). The permissible limit of fluoride in drinking water is 1.5 mg/l as per BIS standards. According to UNESCO specifications, water containing more than 1.5 mg/l of fluoride cause mottled tooth enamel in children and are not suitable for drinking purpose.

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