ASSESSMENT OF DRINKING WATER OF QUALITY OF DIFFERENT SOURCES OF CHHINDWARA TOWN

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Abstract: Physico- Chemical parameters were analysed to evaluate the ground water quality of town chhindwara in Madhya Pradesh. Ground water had high pH, Alkalinity, Hardness, Total Dissolved Solid (TDS), Nitrate (NO_3), Iron (Fe), Sulphate (SO_4), Fluoride (F), Calcium (Ca), Magnesium (Mg) and Electrical Conductivity (EC) with reference to Indian standards. Ground water in majority of the constituents was found to be good in quality and fit for drinking and cooking.

Keywords: Ground Water, Public health, Physico-Chemical characteristic.

Introduction: Water is one of the prime necessities of life. In India the major sources of drinking water are rivers, ponds, wells and tube wells. Rivers and other such surface water bodies constitute major drinking water sources for the people residing in rural areas, were as in urban centers people mainly depend upon Municipal water supply. However in majority of towns and cities the drinking water often gets contaminated. Ground water generally considered being cleaner than surface water.

Available water on the Earth. Gupta *et al.*, [4] reported that only 4% of world's freshwater resources are available in India while India inhabitants 14% of the world population. This show Scarcity of water in India. Article 47 of Indian Constitution rests the responsibility of providing Safe drinking water to the public with the State Governments. According to one estimate 94% of rural population and 91% of the urban people have access to safe drinking water [3]. The availability of water to India is almost fixed due to limited resources. But, with growing Indian population the per capita avaibility of water is steadily reducing; and when this drops below 1700 m3 / person / year, India will be water stressed [5].

Keeping this into consideration, an attempt has been made to evaluate the physic-chemical characteristics of four major drinking water sources of Chhindwara town namely tube well water. The sampling points were – Site I Satpura Vihar colony, Site II Shiva Nagar, Site III Lalbag and Site IV Sankat Mochan Madir area arsingpur road.

Madhya Pradesh lies between Latitude 17º 48′ and 26º52′ North and Longitude 47º 2′ and 84º 24′ East. The location of Chhindwara town is 22º 3′ North and 27º 58′East at 670.58 in above M.S.L.

Material and Methods: Water samples from four sources of tube well water were collected in polythene bottle for the estimation of different chemical constituents in the laboratory. Water temperature was recorded by mercury centigrade thermometer; pH was determined by pH meter. Total alkalinity was determined by the methods suggested by Welch 1948[10], dissolve oxygen was determined by Winkler's method. Standard methods of APHA 1989[1] were followed for the estimation of other different chemical constituents. Temperature, pH, and DO were recorded on spot.

Results and discussion: The data of four different drinking water sources have been depicted in table I.

The water temperature was 32ºC, 31ºC, 26ºCand 25ºC in tube wells. Turbidity value was 01, 01, 02 and 01 NTU in the four different sources respectively which are below the upper limit of 05 NTU (WHO 2011) [12]. Conductivity values were 238, 210, 247, and 238 µmhos/cm. Water color of all sample were transparent.

TDS concentration was 124mg/l, 121mg/l, 118mg/l and 125mg/l. The desirable limit of TDS, which often leads to consumer complaints, as per IS [6] guidelines is 200mg/l. and all the four sources had TDS concentration below this level. pH was 7.4, 7.1, 7.3, and 7.5 respectively were all in alkaline range . The dissolve oxygen was 5.7, 5.6, 5.4 and 5.6. Alkalinity in sample I 396mg/l, in sample II is 404mg/l in sample III 289mg/l and in sample IV 254mg/l thus ground water of all samples exceed the desirable limit of IS[6]. Alkalinity make the taste of water unpleasant and thus has an impact on the user acceptant as potable water (WHO1984)[11].The total hardness value was 510mg/l, 406mg/l, 250mg/l and 254mg/l thus sample I and II was hard range. The highest desirable limit of total hardness as calcium carbonate ($CaCO_3$) in drinking water is 200mg/l .Hardness exceeding 300mg/l and above is generally not recommended as it may causes cardiac and kidney problems (Keller 1979)[7].

Table I: Physico-chemical characteristics of four different drinking water sources of Chhindwara Town

SR. No.	Parameter	Unit	Site I	Site II	Site III	Site IV	Desirable limit
1	Colour		Transparent	Transparent	Transparent	Transparent	
2	Odour		Unobjectionable	Unobjectionable	Unobjectionable	Unobjectionable	
3	Taste		Agreeable	Agreeable	Agreeable	Agreeable	
4	Temperature	^{o}C	32	31	26	25	
5	Turbidity	NTU	01	01	02	01	05
6	Conductivity	µmhos/cm	238	210	247	238	300
7	TDS	mg/l	124	121	118	125	200
8	pH		7.4	7.1	7.3	7.5	6.5 to 8.5
9	DO	Mg/l	5.7	5.6	5.4	5.6	6
10	Alkalinity	mg/l	396	404	289	256	200
11	Total Hardness	mg/l	510	406	250	254	300
12	Calcium Hardness	mg/l	358	212	179	156	75
13	Magnesium Hardness	mg/l	152	138	126	128	30
14	Chloride	mg/l	224	156	147	92	250
15	Nitrate	mg/l	10.1	15.8	11.5	9.7	50
16	Iron	mg/l	0.024	0.75	0.26	0.028	0.3
17	Fluoride	mg/l	0.75	0.289	0.80	1.34	1.5
18	Sulphate	mg/l	44.88	16.84	15.8	24.7	200

The concentration of Calcium was 358mg/l, 212mg/l, 179mg/l and156mg/l, which crosses the maximum permissible limit200mg/l IS [6] . In man hypocalcaemia causes coma and death is serum calcium level rises to 16mg/ 100ml (Kudesia) [8]. Magnesium was 152mg/l, 138mg/l, 126mg/l and 128mg/l, which crosses the maximum permissible limit100mg/l IS [6] in all four water sources. According to CPHEEO (1991) [2] the desirable and permissible limits of magnesium are 30mg/l and 100mg/l, respectively. Magnesium salts are cathartic and diuretic in nature and their excess concentration may cause laxative effects. Chloride served as a basis for detecting pollution of ground water by sewage before the development of bacteriological procedures (Sawyer 1960) [9]. Tube well I registered higher value of chloride 224mg/l tube well II 156mg/l , tube well III 147mg/l and tube well IV 92mg/l. Thus all samples are within desirable limit IS [6]. Nitrate concentration in all ground water samples were low, 10.1mg/l, 15.8mg/l, 11.5mg/l and 9.7mg/l, the permissible limit of nitrate is 50mg/l according to WHO(1984)[11]. Concentration of Iron exceeded the maximum permissible limit 0.3mg/l IS [6] in sample II.Excess of iron causes rapid increase in respiration, pulse rates, congesation of blood vessels, hypo tension and drowsiness(Kudesia)[8]. Fluoride analyzed in ground water of all samples, value of fluoride was wound between the range 0.75mg/l to 1.34mg/l within the permissible limit of 1.50mg/l (WHO, 2011)[12]. Concentration of sulphate was found to range between 15.8 mg/l to 44.88mg/l, which was within desirable range 200mg/l (IS) [6].

Conclusion: The major characteristic in chemical data are high alkalinity, high total hardness, and high iron content was recorded in the ground water of Chinawara town; however, seem to be attributable to geological regions. As these tube well water do not exceed the permissible limit, and there are no other sources of drinking water this is recommended for drinking.

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