Analysis of Drinking Water Quality and its Impact on Human Health in Chandragiri, Near Tirupati, India

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(Received: 03 February 2012; accepted: 25 March 2012)

Drinking water samples were collected from different locations of Chandragiri, near Tirupati, Andhra Pradesh, India and analyzed to assess physicochemical parameters and suitability of water for drinking purpose. Physicochemical parameters such as pH, hardness, alkalinity, calcium, magnesium, iron, nitrates, chlorides, sulphates, electrical conductivity, total solids (TS), total dissolved solids (TDS), total suspended solids (TSS), dissolved oxygen (DO), chemical oxygen demand (COD) and bio chemical oxygen demand (BOD) were determined. The found values were compared with the World Health Organisation water quality standards. Interpretation of data shows that drinking water of some of the areas was polluted and not suitable for drinking purpose. Thus the ground water of these areas needs purification before drinking.

Key words: Ground water, Physicochemical parameters, Alkalinity, Electrical conductivity, Dissolved oxygen, Bio chemical oxygen demand.

Drinking water is one of the most important constituents for healthy living of human society. Tirupati is located in the Chittoor district, Andhra Pradesh state, India. Most of the people in rural areas of Tirupati depend upon ground water for drinking and other domestic needs. The objective of the present work is to assess the drinking water quality parameters in this area and to study their effect on human health.

EXPERIMENTAL

The study was carried out during the period from June 2010 to June 2011 at Chandragiri area near Tirupati. The drinking water samples were collected from 40 different locations in clean and dry polythene bottles. Each sample was filtered using whatmann no.42 filter paper and stored. Electrical conductivity values were measured using Elico CM 180 conductivity ridge. Total alkalinity was evaluated by titration with standard 0.1M HCl using methyl orange and phenolphthalein as indicators¹. Standard procedures² involving spectrophotometry, flame photometry and volumetry were used for the determination of hardness, total dissolved solids (TDS), sulphate, chloride, nitrate, calcium, magnesium iron etc., All the chemicals used were of AR grade.

RESULTS AND DISCUSSION

PH value in the studied area varied between 6.4-8.4. All the sampling points showed pH values within the prescribed limit by WHO. Abnormal values of pH causes bitter taste to water,

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affects mucous membrane, causes corrosion and also affests aquatic life.

deterioration of the quality of clothes, scale formation and skin irritation

Hardness value in the studied area varied between 412-534 mg/L. 6 sampling points showed higher hardness values than the prescribed limit by WHO. Exceeding the permissible limit of hardness causes poor lathering with soap, Various ionic species that contribute to the alkalinity include hydroxide, carbonates, bicarbonates and organic acids. Alkalinity value in the studied domestic area varied between 195-561 mg/L. 30 sampling points showed higher

Sampling Point	pН	Hardness (mg/L)	Alkalinity (mg/L)	Ca ²⁺ (mg/L)	Mg ²⁺ (mg/L)	Fe ²⁺ (mg/L)	NO ₃ ⁻ (mg/L)	Cl ⁻ (mg/L)	SO ₄ ²⁻ (mg/L)
S2	6.8	420	214	107	57	0.44	13.5	252	170
S2 S3	7.8	436	403	155	58	0.41	13.5	263	152
SJ	7.6	472	405	145	50	0.53	11.6	260	233
S 1 S5	6.8	534	368	110	62	0.55	16.4	200	151
55	0.0	400	500	200	65	0.39	10.4	201	101
50	0.5 Q 1	490	297	178	05	0.23	15.0	291	191
57	0.1	412 516	505	170	70 80	0.44	25.0	2/1	103
50	0	505	503	172	80 50	0.43	23.9	202	105
59	0	303	324	1/5	59	0.39	14.2	209	140
S10	0.4	430	220	01	50	0.5	/.1	231	180
511	0.5	429	215	08 50	50	0.5	19.4	240	1/1
512	0.4	428	210	59	57	0.03	10.5	250	219
513	0.0	442	397	99	60	0.73	18	251	155
S14	6.7	443	348	105	66	0.54	5.4	252	166
\$15	6.4	431	195	64	50	0.47	14	235	199
S16	6.5	419	212	65	57	0.52	17.3	238	217
S17	8.1	461	418	185	64	0.33	3.9	279	196
S18	7.8	513	471	158	66	0.29	19.5	263	187
S19	7.9	527	512	160	69	0.47	4.6	266	163
S20	8.2	506	491	254	67	0.38	15.5	285	189
S21	8.3	456	298	275	73	0.46	28.4	289	184
S22	8.3	483	501	287	68	0.34	3.4	289	184
S23	8.1	488	561	189	71	0.31	27.2	282	171
S24	8.2	451	359	200	77	0.27	15.6	283	145
S25	6.9	442	352	118	63	0.53	15.1	257	168
S26	6.5	434	225	70	54	0.43	16.3	241	172
S27	6.8	446	310	108	68	0.51	15.4	252	180
S28	6.5	437	219	72	57	0.36	4.6	243	198
S29	7.3	460	279	143	60	0.45	3.4	260	191
S30	6.9	451	482	125	65	0.34	3.8	259	172
S31	7	434	410	125	70	0.59	16	259	180
S32	7.1	453	413	140	70	0.23	7.5	260	181
S33	8.4	472	541	301	79	0.33	11.4	330	223
S34	8	431	373	170	68	0.4	27.5	266	178
S35	6.6	430	444	87	64	0.18	9.5	247	180
S36	6.4	412	277	56	56	0.4	3.2	215	192
S37	6.6	434	210	88	58	0.5	7.7	250	171
S38	8.1	416	378	178	83	0.42	13.4	273	178
S39	6.4	434	199	62	58	0.52	25.4	234	218
S40	6.5	469	296	185	63	0.37	16.8	221	194
WHO	6.5-8.5	500	250	75	50	0.3	45	250	200

 Table 1. Average results of chemical parameters of ground water

alkalinity values than the prescribed limit by WHO.

Calcium value in the studied area varied between 56-3014 mg/L. 30 sampling points showed higher calcium values than the limit prescribed by WHO. If calcium is present beyond the maximum acceptable limit, it causes incrustation of pipes, poor lathering and deterioration of the quality of clothes.

Magnesium value in the studied area varied between 50-83 mg/L. 39 sampling points showed higher magnesium values than the limit prescribed by WHO. Too high magnesium will adversely affect crop yields as the soils become more alkaline.

Iron value in the studied area varied between 0.18-0.73 mg/L. 35 sampling points showed higher iron values than the prescribed limit by WHO. The excess amount of iron causes slight toxicity, gives stringent taste to water and can cause staining laundry and porcelain.

Groundwater contains nitrate due to leaching of nitrate with the percolating water and by sewage and other wastes rich in nitrates. Nitrate value in the studied area varied between 3.2-28.4 mg/L. All sampling points showed nitrate values within the prescribed limit by WHO.

Sulphate content in drinking water exceeding the 400 mg/L impart bitter taste and may cause gastro-intestine irritation and cantharsis³. Sulphate value in the studied area varied between 145-233 mg/L. 15 sampling points showed higher sulphate values than the prescribed limit by WHO. Ingestion of water with high sulphates cause laxative effect and gastro-intestinal irritation.

DO value in the studied area varied between 2.3-5.9 mg/L. 11 sampling points showed higher DO values higher than the prescribed limit by WHO. High amount of DO imparts good taste to water.

BOD value in the studied area varied between 1.6-3.5 mg/L. All sampling points showed BOD values within the prescribed limit by WHO. Ground water with high value of BOD is due to microbial activities related to the dumpsites.

Electrical conductivity (EC) of water is a direct function of its total dissolved salts⁴. Hence

it is an index to represent the total concentration of soluble salts in water⁵. Conductivity value in the studied area varied between 992-2492 μ S/cm. 14 sampling points showed higher conductivity than the prescribed limit by WHO. If drinking water has high conductivity, it indicates the presence of high amount of dissolved inorganic substances in ionized form.

CONCLUSIONS

Over exploitation of resources and improper waste disposal practices affected the drinking water quality. According to WHO, nearly 80% of all the diseases in human beings are caused by water^{6,7}. Based on the results obtained for physicochemical analysis of ground water samples collected from different locations in the studied Chandragiri area, near Tirupati, it can be concluded that in some samples water quality parameters were beyond the permissible limit prescribed by WHO. Hence, drinking water in the studied area requires precautionary measures before drinking so as to protect human beings from adverse health effects.

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