

A review on quality of drinking water in different areas of India

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Abstract - In present study, a review is done to analyze the several physico-chemical and biological parameters such as pH, TDS, TH, Mg+2, Ca+2 and Cl- present in ground water reported in different areas of India. Determined parameters were used to evaluate the suitability of ground water for domestic purposes in various parts of India. This review highlights the cities having good quality of water on the basis of comparison with Indian Drinking Water standard (IS: 10500, 1993).

keywords - Water quality, physico-chemical parameters, drinking water, pH, TDS.

I. INTRODUCTION

Water is an inorganic, crystal clear, unsavory, fragrance-free and nearly colorless chemical substance, which is the chief ingredient of Earth's hydrosphere and the fluids of most living organisms. Water is a vital resource for human life and it covers 3/4th part of earth surface. It is an essential need for human survival and for all developmental activities. Due to fast increase of population, unplanned urbanization, speedup industrialization and vast use of pesticides and fertilizers in agriculture the quality of ground water has been degraded. The ground water pollution is very hazardous as it is very tough, time taking and expensive to clean it up and may remain polluted for decades. To check water quality for various purposes, the ground water chemistry was utilised. To demarcating the ground water quality, the water quality index technique was considered. Water pollution has been increased due to insufficient environmental protection measures in coal mines and related industries as well as the presence of waste dumps and fertilizers. Ground water pollution distinct from others is very hazardous, as once an aquifer becomes polluted, it is very complicated, costly and time consuming issue to clean it up and may stay unusable for several years.

The factors which influence ground water quality are atmospheric precipitation, recharged water and inland surface water. Polluted water is a big threat for human health, social prosperity and economical development. For better civilization and water resources development approach, it is inevitable to evaluate the ground water quality and quantity.

II. WATER QUALITY INDEX

It is defined as a method of rating that provides the combined influence of individual water quality characteristics on the overall quality of water for human utilization. It is the significant tool to correspond information on the quality of water. It is a mathematical equation utilizes to alter large amount of water quality into a single number.

III. MATERIAL INVESTIGATED

pH (hydrogen ion concentration)

To express the intensity of acidic or alkaline conditions, the unit less term pH is used. pH is an important parameter in evaluating the quality of water. Acceptable pH value of pure water is 7.0 at room temperature (25°C), which is neither acidic nor basic. The range of pH goes from 0 to 14 (<07 acidic, >07 basic).

TDS (Total dissolve solids)

It is a measure of all dissolved organic and inorganic substances present in the liquid. Sources of TDS in water are agricultural runoff, residential runoff, leaching of soil contamination, clay rich mountain water and sewage treatment plant.

TH (Total hardness)

In ground water hardness is primarily supplied by bicarbonates, carbonates, sulphates and chlorides of calcium and magnesium. So, the major TH generating ions are calcium and magnesium. The passable limit of TH is 200 mg/l.

Calcium & Magnesium:

If Ca and Mg+2 are present in high concentration, than this indicates to encrustation in water supply arrangement and adversely change the use of water. Durfor and Becker (1964) have divided water as soft, moderate, hard and very hard. On the basis of this classification it has been observed that no water samples are soft, 23% are moderately hard, 73% are hard in nature.

Chloride:

It is an anion found in variable amount in ground water. Presence of chloride in water is due to leaching of sedimentary rocks, weathering and infiltration of sea water etc.

IV. RESULT AND DISCUSSIONS

The ground water quality has been reviewed in some part of India including Jaipur (Ankita et al. 2015), Coimbatore (Jothivenkatachalam et al. 2010), Alappuzha (Prasanth et al. 2012), Ambala (Rout et al. 2011) and Rourkela (Das et al. 2015). The standard concentration of various water parameters according to different councils are given in table no1.

TABLE 1 Standard data of various parameters given by Indian Drinking Water standard (IS: 10500, 1993), Indian Council of Medical Research and World Health Organisation

Parameters	Indian Drinking Water standard (IS: 10500, 1993)	Indian Council of Medical Research	World Health Organisation
<i>pH</i>	7.5	6.5-8.5	6.5-9.2
<i>TDS (mg/l)</i>	500	500-1500	500
<i>Total Hardness (mg/l)</i>	300	300	100
<i>Ca⁺² (mg/l)</i>	75.0	75	75
<i>Mg⁺² (mg/l)</i>	30	50	50
<i>Cl⁻ (mg/l)</i>	250	250	200

Concentration of various water parameters in ground water samples of different areas in India are given in table no. 2.

Table 2 Concentration of various water parameters in ground water samples of different areas

Parameters	Jaipur, Rajasthan	Coimbatore, Tamil Nadu	Alappuzha, Kerala	Ambala, Haryana	Rourkela, Odissa
<i>pH</i>	7.72	7.1	5.69	7.22	6.42
<i>TDS</i>	611.5	1461.43	284	310.45	241
<i>Total Hardness</i>	175.15	1351	544	116.6	50
<i>Ca⁺²</i>	14.03	649.42	42.4	19.62	14
<i>Mg⁺²</i>	34.05	650.28	106.4	10.64	3.65
<i>Cl⁻</i>	204.94	368.70	52	17.46	39.63

Studied data of Jaipur (Rajasthan) having variation of water quality parameters with Indian Drinking Water Standard (IS: 10500, 1993) are given below in table no.3.

Table 3 Concentration of various parameters in ground water samples of Jaipur (Rajasthan)

Parameters	Indian Drinking Water standard (IS: 10500, 1993)	Jaipur, Rajasthan	Variation with IDWS
<i>pH</i>	7.5	7.72	-0.22
<i>TDS (mg/l)</i>	500	611.5	-111.5
<i>Total Hardness (mg/l)</i>	300	175.15	124.85
<i>Ca⁺² (mg/l)</i>	75	14.03	60.97
<i>Mg⁺² (mg/l)</i>	30	34.05	-4.05
<i>Cl⁻ (mg/l)</i>	250	204.94	45.06

Studied data of Coimbatore (Tamil Nadu) having variation of water quality parameters with Indian Drinking Water standard (IS: 10500, 1993) are given below in table no.4.

Table 4 Concentration of various parameters in ground water samples of Coimbatore (Tamil Nadu)

Parameters	Indian Drinking Water standard (IS: 10500, 1993)	Coimbatore, Tamil Nadu	Variation with IDWS
<i>pH</i>	7.5	7.1	0.4
<i>TDS (mg/l)</i>	500	1461.43	-961.43
<i>Total Hardness (mg/l)</i>	300	1351	-1051
<i>Ca⁺² (mg/l)</i>	75	649.42	-574.42
<i>Mg⁺² (mg/l)</i>	30	650.28	-620.28
<i>Cl⁻ (mg/l)</i>	250	368.7	-118.7

Studied data of Alappuzha (Kerala) having variation of water quality parameters with Indian Drinking Water standard (IS: 10500, 1993) are given below in table no.5.

Table 5 Concentration of various parameters in ground water samples of Alappuzha (Kerala)

Parameters	Indian Drinking Water standard (IS: 10500, 1993)	Alappuzha, Kerala	Variation with IDWS
<i>pH</i>	7.5	5.69	1.81
<i>TDS (mg/l)</i>	500	284	216
<i>Total Hardness (mg/l)</i>	300	544	-244
<i>Ca⁺² (mg/l)</i>	75	42.4	32.6
<i>Mg⁺² (mg/l)</i>	30	106.4	-76.4
<i>Cl⁻ (mg/l)</i>	250	52	198

Studied data of Ambala (Haryana) having variation of water quality parameters with Indian Drinking Water standard (IS: 10500, 1993) are given below in table no.6.

Table 6 Concentration of various parameters in ground water samples of Ambala (Haryana)

Parameters	Indian Drinking Water standard (IS: 10500, 1993)	Ambala, Haryana	Variation with IDWS
<i>pH</i>	7.5	7.22	0.28
<i>TDS (mg/l)</i>	500	310.45	189.55
<i>Total Hardness (mg/l)</i>	300	116.6	183.4
<i>Ca⁺² (mg/l)</i>	75	19.62	55.38
<i>Mg⁺² (mg/l)</i>	30	10.64	19.36
<i>Cl⁻ (mg/l)</i>	250	17.46	232.54

Studied data of Rourkela (Odisha) having variation of water quality parameters with Indian Drinking Water standard (IS: 10500, 1993) are given below in table no.7.

Table 7 Concentration of various parameters in ground water samples of Rourkela (Orissa)

Parameters	Indian Drinking Water standard (IS: 10500, 1993)	Rourkela, Odissa	Variation with IDWS
<i>pH</i>	7.5	6.42	1.08
<i>TDS (mg/l)</i>	500	241	259
<i>Total Hardness (mg/l)</i>	300	50	250
<i>Ca⁺² (mg/l)</i>	75	14	61
<i>Mg⁺² (mg/l)</i>	30	3.65	26.35
<i>Cl⁻ (mg/l)</i>	250	39.63	210.37

CONCLUSION

In this study, the characterization of various physico-chemical parameters of ground water derived from five different cities has been reviewed. To assess the quality of ground water each parameter was compared with Indian Drinking Water standard (IS: 10500, 1993). From this study it has been concluded that ground water of Orissa is safe for drink purpose from the point of view of label of pH, TDS, TA, Ca⁺², Mg⁺² and Cl⁻.

pH: The pH of Alappuzha, Kerala has been observed 5.69 among pH values of water sample in different areas, which is more acidic according to the value prescribed by Indian Drinking Water standard (IS: 10500, 1993). So this water is unfit for drinking purposes.

TDS: The TDS of Coimbatore (Tamil Nadu) has been observed 1461.43 mg/l among TDS values of water sample in different areas, which is very high according to the value prescribed.

Total Hardness: The total hardness of Coimbatore (Tamil Nadu) has been observed 1351 mg/l, which is very high on the basis of comparative study on water quality among different areas.

Ca⁺²: The presence of Ca⁺² ions of Coimbatore have been found 649.42 mg/l, which is much more than standard permissible value.

Mg⁺²: The concentration of Mg⁺² ions in water sample of Coimbatore (Tamil Nadu) has been observed 650.28 mg/l, which is not acceptable for healthy human society.

Cl⁻: The concentration of Cl⁻ ions in ground water sample of Coimbatore (Tamil Nadu) has been found 368.70 mg/l, which is very high.

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