Groundwater Quality Analysis

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Abstract: **Availability of clean drinking water is of utmost importance. Owing to the shortage of clean drinking water in recent years, identifying areas of deteriorating groundwater quality is of great importance. This realization has been the reason for the study of groundwater quality near the industrial estate of Aroor Gram Panchayat in Alappuzha district of Kerala.**
The chosen area shows a decline in groundwater quality over the past few decades. Discharge of industrial effluents, unhygienic sewerage with improper methods of toilet waste disposal has contributed to a raising alarm on the quality of groundwater.

Keywords— Groundwater quality; aroor gram panchayat; water quality parameters

I. INTRODUCTION

The recent boom in the population has increased the stress on water demand. When the surface water is not an available option, an alternative would be ground water. Neglecting the need to conserve our sources can lead to a drastic situation that can render us with not a drop of clean water for drinking. Thus the need arises for evaluating the present quality of groundwater to create awareness about the situation and to take necessary measures for the same.

The aim of this study is to evaluate the water quality level by collecting samples from selected wards in the Aroor Gram Pancahayat, near the industrial area. The water quality for drinking purposes shall be determined by assessing some of the important quality parameters, making it possible to identify problems which may need immediate intervention.

II. LOCATION OF STUDY

Aroor is a census town in Alappuzha district and it is a suburb of Kochi in the state of Kerala, India. It is a seafood related industrial area at the south of Kochi and the industril hub of Alappuzha district.

Aroor is the northern most edge of Alappuzha district and lies on the National Highway 47 (India) next to Chandiroor.

III. SAMPLING AND TESTING

15 samples have been collected from bore wells in the selected locations around the area during the month of January 2016. The samples have been collected in 2 litres of polyethylene cans and for the bacteriological tests the sample was collected in pre-sterilized glass bottles. The samples were tested for the chemical parameters pH, turbidity, hardness, chloride, alkalinity, acidity, dissolved oxygen, iron and biological parameter E.coli.

IV. GROUND WATER QUALITY PARAMETERS

The following Groundwater quality parameters were tested for the samples collected from the site selected.

A. pH

pH is the degree of how acidic/basic water is. The range goes from 0 - 14, with 7 being neutral. pH of less than 7 denote acidity, whereas a pH of greater than 7 denotes a base. pH is really a measure of the relative amount of free hydrogen and hydroxyl ions in the water. As pH can be affected by chemicals in the water, pH is an important indicator of water that is changing chemically.

B . Hardness

Hardness is induced by compounds of calcium and magnesium, and by a variety of other metals. Hard water is formed when water oozes through deposits of limestone and chalk which are largely made up of calcium and magnesium carbonates.

General instruction for categorizing water are: 0 to 60 mg/L (milligrams per liter) as calcium carbonate is classified as soft; 61 to 120 mg/L as reasonably hard; 121 to 180 mg/L as hard; and more than 180 mg/L as very hard.

C. Turbidity

Turbidity is the measure of relative transparency of a liquid. It is an optical characteristic of water and is an expression of the amount of light that is diffused by material in the water when a light is shined through the water sample. The higher the magnitude of scattered light, the higher the turbidity. Material that causes water to be turbid includes clay, silt, lightly divided inorganic and organic matter, algae, soluble colored organic compounds, and plankton and other atomic organisms.

Excessive turbidity, or cloudiness, in drinking water is aesthetically unappealing, and may also represent a health concern. Therefore it is essential to determine the turbidity of water.

D. Acidity

Acidity of water is its quantitative capacity to neutralize a strong base to a designated pH.

Acidity contributes corrosiveness to water and influences certain chemical and biological processes. Acidity due to carbon dioxide is practically important in the field of public water supplies. It can be measured by titrating the sample with standard solution of alkaline reagents. Results are reported in terms of phenolphthalein acidity or total acidity expressed as $CaCO_3$.

E. Alkalinity

It is a measure of capacity to neutralize acids. It is primarily due to the salts of weak acids although weak or strong bases may also contribute. Alkalinity is an important parameter involved in corrosion control and in determining the soda ash requirements in softening water by precipitation method. Alkalinity is measured volumetrically by titration with 0.02N H_2SO_4 or HCl. It is expressed in terms of total alkalinity as $CaCO_3$.

F. Chloride

In potable water the salty taste is produced by chlorides. High chloride content is harmful to metallic pipes and agriculture crops. It is an important consideration in selection of supplies for human use, where brackish water must be used for domestic purpose for determining the type of desalting apparatus to be used. Chloride is measured volumetrically by titration with silver nitrate solution. It is expressed in mg/L.

G . Iron

Iron is one of the most important parameter of groundwater quality. Excessive concentration of iron in water leads to bitter and astringent taste of water. Also causes scaling of boliers and bacterial promotion in service mains.

According to Bureau of Indian standards the desirable limit of iron in drinking water is 0.3mg/litre.

H . Total coliform

Coliforms are harmful bacteria whose presence in water can lead to serious health issues. It should not be present in water used for consumption purposes.

V. RESULTS AND DISCUSSIONS

The test results for the analysed samples are shown in table II. On comparing the obtained results with the IS 10500-2012, it was seen that iron, turbidity and hardness values of most of the samples are greater than its desirable limits. Many of the samples also shows the presence of coliforms in the bacteriological examination thus making it unfit for drinking.

TABLE I. DESIRABLE LIMITS AS PER IS 10500:2012

CHARACTERISTICS	UNIT	DESIRABLE LIMITS
pH		6.5-8.5
Total Hardness as $CaCO_3$	mg/l	200
Turbidity	NTU	1
Alkalinity	mg/l	200
Acidity	mg/l	-
Chloride	mg/l	250
Iron	mg/l	0.3

I. CONCLUSIONS

From the 15 samples collected and tested it was found that most of the test parameters were beyond the permissible limit and were not fit for drinking purposes. The source of contamination may be septic tanks too close to the well and the continuous disposal of industrial effluents. Ground water quality surrounding the industrial areas has deteriorated, and the application of polluted groundwater for portability has resulted in increased salt content of soils. However, if the pollution continues unabated it could cause serious problems in the future. Therefore, this study can offer the requisite information for the authority to pursue the sustainable approaches on groundwater management and contamination prevention.

The results obtained helps in making the public, local administrator and the government to be aware of the dilemma of poor groundwater quality prevailing in these areas. Since, in the future the groundwater will have the major share of water supply schemes, plans for the protection of groundwater quality is needed. Hence, our research plays an experimental work on ground water quality assessment in the nearby industrial area of Aroor in Alappuzha district of Kerala.

TABLE II. TEST RESULTS FOR SAMPLES ANALYSED

SAMPLE NO	WARD NAME	pH	HARDNESS (mg/l)	TURBIDITY	ALKALINITY (mg/l)	ACIDITY (mg/l)	CHLORIDE (mg/l)	IRON (mg/l)	TOTAL COLIFORM IN 100 ml SAMPLE
1	Puthanaghadi	7.26	598	16	138	274	734	0.10	NIL
2	Puthanaghadi	7.04	224	7.40	92	30	93.97	0.70	1600
3	Gov. Fisheries school	6.70	122	20.10	40	24	22	0.36	NIL
4	Gov. Fisheries school	7.50	594	12.80	212	692	267	0.28	NIL
5	Kottapuram	7.16	380	14.40	174	632	49	0.34	NIL
6	Ammaneyam	7.05	496	11.50	224	78	214	0.25	70
7	Ammaneyam	6.98	304	10.60	160	51	56	1.1	NIL
8	Gov. Hospital	7.18	536	26.60	354	376	189	1.1	14
9	Gov. Hospital	7.45	468	24.20	162	134	162	0.60	NIL
10	HSS	7.63	550	6.70	56	592	42	0.20	23
11	HSS	7.02	248	21.80	82	624	46	1.0	NIL
12	Convent	7.60	672	12.50	120	128	41	0.80	1600
13	Convent	6.76	580	7.70	244	80	158	0.6	23
14	Project Colony	6.96	240	16.6	252	358	33	0.80	140
15	Project Colony	7.23	534	23	246	228	142	0.20	14

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