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Study of Ground Water Quality In Industrial Zone Of Visakhapatnam.

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ABSTRACT

This paper presents quality of water samples from bore wells as well as open wells in and around the industrial zone of Visakhapatnam in order to find out the magnitude of health problems in industrial areas. The natural quality of ground water tends to be degraded by human activities. Ten groundwater samples collected from the study area were measured and mentioned. The study revealed that the water was slightly alkaline (PH: 6.5 – 8.5), moderately hard (TH: 64 – 292), and TDS values ranged from 380 – 1600 mg/l). The study was reported some other important parameters which exceeded the permissible limit and it is unsuitable for drinking purposes.

Key Words: Industrial area, Water samples and water quality.

INTRODUCTION

Visakhapatnam has been home for a number of large and medium industries such as the Hindustan Petroleum Corporation, Vishakapatnam Steel plant, Bharat Heavy Plates and Vessels, Hindustan Polymers and Coromandal Fertilizers. Relatively ore recently, the Visakhapatnam Export processing zone has come up and there are indications of the city emerging as a booming industrial metropolis. Commensurate with the growth of industrial and allied activities in and around the city, its area grew from 30 Sq.Km. in 1960 to over 80 Sq.Km. presently. The city's population according to 2001 census is about 1.33 million.

The topography of the city, with hills on three sides and sea on the fourth giving it much beauty, seems to increase the possibility of it falling a victim to pollution. The meteorological conditions-stagnant of pollutants in the valley and could be affecting the health status of the people adversely. The problem is further exacerbated since most of the polluting industries are located in the upwind direction of the city- a gross violation there is the contribution of smoke and emissions from the over growing residences railway yards, automobiles and the burning of garbage by the civic authorities.

Water supply has always been inadequate in this city with the crisis growing along with the cities progress. Today's water requirement is 360 million gallons per day. The only viable solution is to transport water from Godavari. Apart from the municipal supply the population also depends upon the ground water reservoirs.

The growing competition for water and declining fresh water resources, the utilisation of marginal quality water for agriculture has posed a new challenge for environmental management. In water scarce areas there are competing demands from different sectors on the limited available water resources. [1]

Though industrial use of water is very low as compared to agricultural use, the disposal of industrial effluents on land and/or on surface water bodies make water (ground and surface) resources unsuitable for other uses. Industry is a small user of water in terms of quantity, but has a significant impact on quality.

Over three-fourth of fresh water draw by the domestic and industrial sector, return as domestic sewage and industrial effluents which inevitably end up in surface water bodies or in the groundwater, affecting water quality. The "marginal quality water" could potentially be used for other uses like irrigation.

The beginning of the earth there was no pollution but rapid urbanization and industrialization have culminated into water, air and land pollution [2]. Today water pollution is the biggest problem for human beings characterization by deterioration of the water quality as a result of various human activities which makes water unfit for drinking and domestic use purposes. The main sources of water pollution are chemical fertilizers and pesticides getting in an untreated sewage and industrial effluents into rivers and streams running close to the cities and to the low lands.

Many dangerous diseases are also caused by the use of polluted water [3] in reducing the incidence of many water-borne communicable diseases. The diseases associated with contaminated water, however, remain serious public health problems in India [4]. The common sources of water are wells (open / tube wells) in villages, and various routes such as effluents from different industries, discharge of drainage systems in natural water reservoirs, different human activities (washing & bathing) domestic and municipal waste washing from salt pans etc. may contaminate these natural sources. Our study was lead to the deterioration of ground water quality significantly besides impoverishing the environment. Physico- Chemical Characteristics of ground water of different parts of countries studied by many authors [5].

MATERIALS AND METHODS

The study area experiences a semi-arid climate, with temperature in the range of 14–38°C. The annual average rainfall is 910 mm. Rainfall is the main natural replenishable recharge source of groundwater. Groundwater occurs in the weathered and fractured rock portions. The depth to groundwater level ranges from 2 to 11 m below ground level (Bgl). Shallow groundwater level less than 3 m bgl was observed at topographic-lows (downstream), while deep groundwater level more than 9 m bgl was found at elevated ground (upstream; Figure 1). The general slope of the area was towards the salt marsh land from all the directions. Hence, the direction of the groundwater flow followed the topography of the area.

The Physico –chemical characteristics of the ground water in Visakhapatnam city and its surrounding area are analysed by standard methods [4]. There is a wide variation in the quality of water from point, which is reflected by the related parameters.

Hydro-geochemical studies were carried out in industrial area to assess the ground water quality ground water samples from 10 bore wells.

RESULTS AND DISCUSSION

The population in the area has increased more than three-fold within a span of two decades, because of the rapid growth in industrial activity. Groundwater is the prime source of drinking water and its quality is getting degraded due to increasing industrialization. The present communication was focused on the study of temporal changes in the groundwater quality to assess the intensity of pollution activity on it in the different industrial surrounding areas.

The observed pH value ranging from 6.4 to 8.5 shows that quality of water samples were slightly alkaline (Table-1). These values are maximum permissible limit prescribes WHO standards. If pH increases the permissible level it may promote corrosion of plumbing systems and fixtures. Study area it was observed that chloride content exceed than the permissible limit. The site points exceeded were S_6 Sample area (290 mg/l), S_4 Sample area (400 mg/l) S_2 Sample area (318 mg/l).

When chloride concentration of 250mg/l is present along with sodium ions, a salty taste can observed [6]. The salty taste may be absent in waters in absence of sodium ions, even concentration of chlorides is high as 1000mg/l. Chloride is present in all natural water at greatly varying concentrations depend on the geo-chemical conditions. Chlorides in natural waters can be attributed to leaching of chloride containing rock and soil , discharges of effluents from chemical industries ,ice creams plant effluents, edible oil mill operations , sewage disposal , irrigation drainage, contamination, from refuge leachates and sea water intrusion in coastal regions.

As per the analysis report it was observed that hardness was exceeding the limits. Such areas are S_6 Sample area (234 mg/l), S_4 Sample area (191mg/l), S_2 Sample area(188mg/l), S_7 Sample area (290mg/l), S_8 Sample area (193 mg/l), S_6 Sample area (292mg/l). Hardness is measure of the ability of water to cause precipitation of insoluble calcium and magnesium salts of higher fatty acids from soap solutions, the principle hardness causing cations are

calcium, magnesium, ferrous ion, manganese ion associated with bicarbonates, carbonates , chlorides, and sulphates [7].

Suspended solids or matter in surface water may consist in inorganic or organic matter [8]. These materials are after natural contaminants resulting from erosive action of water flowing over land surface. Ground water contains negligible quantity of suspended solids and these being filtered out by soil start a through mechanical straining action.

The amount of total solids in surface water ``increase with input of natural and man made contamination. As per the analysis report it was observed that, suspended solids were exceeded the limits range from 1180 mg/l -2300 mg/l (table-1)

As per the study report it was observed that Nitrates exceeded the limits (2.6 mg – 7.9 mg/l) [6]. If the nitrates concentration will increases than the permissible level water may get poisonous to pregnant woman or nursing woman. It has also been known to cause infant cyanosis (blue-baby) in children under the age of six months.

The assessment was reported that the concentration of sulphates also exceeded the permissible limits range from6 mg/l- 36 mg/l (table-1). High level of sulphates in water can cause dehydration and diarrhoea and may also cause corrosion effect on plumbing.

As per the study report it was observed that Iron concentration exceeded the limit which is very unhealthy for human health. (3.8 mg/l- 8.4 mg/l) (table-1).

Iron is mostly a naturally derived metallic pollutant which areas its origin in waters mainly to the sources derived from soil and crocks. The corrosion of pipes, pumps and other such structures can also raise the concentration of iron in the distribution systems. Large quantities of iron can leach out from soil by run-off especially in acidic conditions such and associated with acid mine drainage and degradation of excessive organic matter accumulated in the soil.

Iron in ground water remains mostly as a predominate from due to general lack of oxygen, but such iron rich ground waters when brought to the surface , the ferrous is quickly converted I to ferric resulting in the formation of ferric in the presence of iron is substantial quantities render the water unsuitable for food processing making beverages, dying bleaching , manufacturing ice and many other items, the limit of iron in drinking water (0.1mg/l) is not because of the health consideration but due to its aesthetic and taste significance [8]

The dissolved oxygen of the water samples were in permissible limit, range from 5.5 mg/l -7.1 mg/l.

CONCLUSIONS

This study emphasizes the need for regular groundwater quality monitoring to assess pollution activity from time to time for taking appropriate management measures in time to mitigate the intensity of pollution activity.

- The quantity of water in around the industrial belt reached already alarming stage causing health effects as per the analysis report.
- The major industries nearby sampling point should supply protected drinking water to the people surrounded by industries or they have to rehabilitate people from that point since they are mainly responsible for creation of pollution.
- The groundwater quality problems are mainly due to i) contamination by geogenic and man-made sources; and ii) sea water intrusion due to over-abstraction of groundwater along the coasts.
- A large number of industrial activities are taking place in urban areas, especially in congested, populated areas. The wastes generated by industrial activities in urban areas get mixed with domestic wastes and pollute the groundwater.

TABLE-1 WATER QUALITY ANALYSIS IN INDUSRIAL AREAS OF VISAKHAPATNAM

S.no	Parameter	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Sample 6	Sample 7	Sample 8	Sample 9	Sample 10
1	pH	8.5	7.9	7.1	7.71	7.6	7.1	7.1	6.4	7.4	8.4
2	Chlorides	177	318	99.6	400	115	290	149	110	180	150
3	Total hardness	155	188	111	191	64	234	290	193	165	292
4	Calicium hardness	138	118	102	169	31	141	155	149	98	126
5	Magnesium hardness	22	71	12	25	35	97	153	45	63	167
6	Total solids	2300	1580	1180	1200	1600	2000	2300	1600	2000	1200
7	Total dissolved solids	900	380	400	380	800	1200	1300	400	1600	800
8	Total suspended solids	930	1150	800	800	790	800	1200	1200	400	400
9	Nitrates	4.6	2.6	7.9	3.5	4.02	2.7	3.3	3.8	3.1	2.7
10	Sulphates	36.0	24.4	25	6	36.0	9	31	24	35	31
11	Dissolved Oxygen	6.2	6.4	5.6	6.1	7.1	6.9	6.1	6.1	6.4	6.6

Except PH all unites in mg/l

SAMPLE LOCATIONS:

S1 = SINDEA,
S2 = MALKAPURAM,
S3 = SRIHARIPURAM,
S4 = OLD GAJUWAKA,
S5 = NEW GAJUWAKA,
S6 = HINDUSTAN ZINC AREA,
S7 = MINDHI, S10= SHEELA NAGAR
S8= BHPV,
S9= AUTONAGAR,

DRINKING WATER QUALITY STANDARDS

		Indian Stds		ICMR		WHO	
		P	E	P	E	P	E
PHISICAL							
1	Colour	10	50	5	25	5	20
2	Taste & Odour	Unobjectionable		Unobjectionable		Unobjectionable	
3	Turbidity	10	25	5	25	5	25
4	PH	6.5-8.5	6.5-9.2	7-8.5	6.5-9.2	7-8.5	6.5-9.2
CHEMICAL(Mg/L or PPM)							
5	Total Solids	-	-	-	-	500	1500
6	Total Hardness	300	600	300	600	-	-
7	Calcium	75	200	75	200	75	200
8	Magnesium	30	100	50	150	50	150
9	Copper	0.05	1.5	1.0	3.0	1.0	1.5
10	Iron	0.3	1.0	0.3	1.0	0.3	1.0
11	Manganese	0.1	0.5	0.1	0.5	0.1	0.5
12	Chlorides	250	1000	250	1000	200	600
13	Sulphates	150	400	200	400	200	400
14	Nitrate	45	-	20	50	-	50-100
15	Fluoride	0.6-1.2	-	1.0	2.0	0.5	1.0-1.5
16	Phenolic Substances	0.001	0.002	0.001	0.002	0.001	0.002
TOXIC							
17	Arsenic	0.05	-	-	0.2	-	0.2
18	Cadmium	0.05	-	-	0.05	-	0.05
19	Cyanide	0.05	-	-	0.01	-	0.01
20	Lead	0.1	-	-	0.1	-	0.1
21	Selenium	0.01	-	-	0.05	-	0.01
22	Zinc	5.0	10	-	-	-	-
23	Mercury	0.01	-	-	-	-	-
24	Bacteriological	100ml Coli form	100ml/ Coli form	100ml/ Coli form	100ml Coli form	100ml Coli form	100ml/ Coli form
RADIOACTIVITY							
25	Alpha emitters	10^{-8}			10^{-9}		10^{-9}
26	Beta Emitters	10^{-7}			10^{-8}		10^{-8}

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