



A physical and chemical study of ground water and Heavy metal analysis of estuarine area in Chennai

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Abstract : An attempt has been made to study the impact of untreated sewage and industrial effluent in the sea at Chennai coastal area. In fact the sanitary wastes water comprises about 99.9 percent of water along with microorganisms. Once the sea water was used for bathing, washing and also for agricultural purposes, but at present the sea has become the place for collection of sewage water from the houses in an around the sea at a distance of 10km. Hence the water is completely polluted beyond purification.

In the present study it is observed that a high degree of sea water pollution due to high values of TDS, conductivity, chloride, ammonia and Turbidity. The ground water is affected at an alarming rate with high degree of water pollutants. Water quality results are above the permissible limit. Hence the water is rejected for domestic use.

estuarine area, especially marina beach and near by coastal area those who are enjoying with beach water they causes skin diseases, like itching and scabies and many of the aquatic living things also highly affected by the sewage water mixed sea water.

Environmental pollutant means any solid, liquid or gaseous substance present in such concentration as may be, or tend to be, injurious to environment. Environmental pollution area severe in the study area Environmental pollution means the presence ' in the environment of any environmental pollutant. Hazardous substance means any substance or preparation which, by reason of its chemical or physico-chemical properties or handling, is liable to cause harm to human beings, other living creatures, Micro-organism and property of the environment.

The problem of pollution of estuarine area and streams has assumed considerable importance and urgency to urbanization. It is therefore, essential to ensure that the domestic sewage water are not allowed to discharge into the watercourses without adequate treatment since the discharges would render the water unsuitable as source of drinking water as well as for supporting human life . Pollution of sea and streams also causes increasing damage to the country's economy.

Keywords: ground water and Heavy metal analysis, estuarine area, Chennai.

Introduction

The waterways of Chennai are not perennial in nature and receive flood discharge only during monsoon season. Groundwater is an important source of drinking water for many people around the world. The resource in several places becomes contaminated from natural source or numerous Human activities. Residential, municipal, commercial, industrial and agricultural activities affect groundwater quality. Contamination of groundwater results in poor drinking water quality, loss of water supply, high cleanup costs, high costs alternative water supplies and potential health problems. This study is related to both water quality and quantity, which is becoming more serious due to population explosion, increasing agriculture and improved standard of living, especially in developing countries. A few statistics illustrate the scale of the problem that waste water (chemicals washed down drains and discharged from factories) can cause. Around half of all ocean pollution is caused by sewage and waste water. Each year, the world generates 400 billion tons of industrial waste, much of which is pumped untreated into seas, oceans, and other waterways. In the United States alone, around 400,000 factories take clean water from seas, and many pump polluted waters back in their place. However, there have been major improvements in waste water treatment recently¹⁻¹⁰.

Factories are point sources of water pollution, but quite a lot of water is polluted by ordinary people from nonpoint sources; this is how ordinary water becomes waste water in the first place. Virtually everyone pours chemicals of one sort or another down their drains or toilets. Even detergents used in washing machines and dishwashers eventually end up in our seas and oceans. So do the pesticides we use on our gardens. A lot of toxic pollution also enters waste water from highway runoff. Highways are typically covered with a cocktail of toxic chemicals everything from spilled fuel and brake fluids to bits of worn tyres (themselves made from chemical additives) and exhaust emissions. When it rains, these chemicals wash into drains and seas. It is not unusual for heavy summer rainstorms to wash toxic chemicals into seas in such concentrations that they kill large numbers of fish overnight. It has been estimated that, in one year, the highway runoff from a single large city leaks as much oil into our water environment as a typical tanker spill. Some highway runoff runs away into drains; others can pollute groundwater or accumulate in the land next to a road, making it increasingly toxic as the years go¹⁻¹⁰.

Effects of Water Pollution

The effects of water pollution are numerous (as seen above). Some water pollution effects are recognized immediately, whereas others don't show up for months or years.

- The food chain is damaged
- Diseases can spread via polluted water
- Pollutants in the water will alter the overall chemistry of the water
- Marine food sources are contaminated

Need for Study¹⁻¹⁰

In order to evaluate the water quality parameters, the water samples from the Chennaisea and also from the wells and bore wells from the residence located and around the Chennaisea and also on the banks of Chennaisea in Chennai coastal area near Loyola college were collected and Analyzed.

Based on the survey it is concluded the sewage water must be treated before discharge. The Presence of any organized industrial and sewage disposal system in community wastes often find their way to the nearbycoastal area Nevertheless, the problem needs to be addressed from a public health and aesthetic point of view. Sources, mainly industrial wastes and potentially harmful. Sewage caused water pollution instances of pollution. Some instances of pollution from sewage water and industrial effluent have been reported from many researchers with varying degrees of impact on environment and biotic communities.

On any account the sewage water should not be discharged to the sea water, which causes sea water pollution and ground water pollution. In long run the water becomes unfit for domestic and human consumption. At present the ground water is hard and cannot be used for domestic purpose. Since there is no proper drainage of sewage and industrial effluent.

The environmental damage caused by water pollution by the discharge of sewage water and industrial effluents in coastal area in Chennai and other cities.

Objectives of the Study¹⁻¹⁰

In our study area the sewage water is discharged in to the right bank of seaChennai. Sewage water contaminates the surface and ground water on the banks of the sea.

The number of sewage water discharge into the Chennai is increasing day by day. The absence of treatment plant to treat the sewage water may lead to spoilage of environment.

Objectives:

1. To evaluate the physic-Chemical constituents of the Study area.
2. To study the impact of sewage water on the Study area..
3. To study the ground water quality in the wells and Bore wells on the near Chennaicostal area
4. To recommend a suitable remedial measures for the treatment of ground water on the nearby coastal area.

S 1	Sewage water before mixing in Sea
S 2	Marina beach sea water collection (after sewage water mixing)
S 3	Bore well Water Near by the estuarine area
S 4	Bore well water far from the estuarine area
S5	Sea water

Meterials and Methods¹⁻¹⁰



Chennai coastal area and sewage water

Sample collection area

Methods:

S.no	Water quality parameter	Methods of analysis
1	Colour	Visual comparison
2	Turbidity	By Nephelometric method
3	Total dissolved solids	By Conductivity meter
4	electrical conductivity	By Conductivity meter
5	P ^H	By Digital P ^H meter
6	Total hardness CaCO ₃	By EDTA method
7	Alkalinity	By Titration method
8	Calcium	By ETDA method
9	Magnesium	By EDTA method
10	Iron	By Calorimetrically
11	Manganese	By Spectrophotometer
12	Ammonia	By Nesslerization method
13	Nitrite	By Spectrophotometer
14	Nitrate	By Spectrophotometer
15	Sodium and potassium	By Flame photometer
16	Chloride	By Argentometric method
17	Fluoride	By Calorimetrically
18	Sulphate	By Gravimetric method
19	Phosphate	By Calorimetrically

Result and Discussion

Parameters	CPHEEO	S1	S2	S3	S4	S5
Appearance		Clearless	Clear less	Clear	Clear	Clear
Odour		Bad	Bad	None	Bad	Bad
Colour		Un objectionable	Blakish	Colourless	Colourless	Slightly
Turbidity NT units	5	21	25	7	19	21
Total Dissolved Solids mg/L	500	1420	1551	1303	1376	1432
Electrical Conductivity mcs/cm		2110	2260	1569	2005	2121
pH	6.5	6.38	8.18	8.06	7.59	8.29
Alkanity-pH as CaCO ₃		----	-----	-----	-----	-----
Alkanity Total as CaCO ₃	200	412	436	399	414	436
Total Hardness as CaCO ₃	300	512	506	420	425	506
Calcium as Ca	75	140	112	118	123	112
Magnesium as Mg	30	28	30	35	29	30
Sodium as Na		234	215	238	251	215
Pottasium as K		69	54	51	59	54
Iron as Fe	0.1	1.22	1.24	0.39	0.35	1.24
Manganese as Mn	0.05	0	0	0	0	0
Free Ammonia as NH ₃		1.32	1.56	0.25	0.19	1.56
Nitrite as NO ₂		1.06	1.12	0.21	0.28	1.12
Nitrate as NO ₃	45	58	51	49	57	24

Chloride as Cl	200	561	564	335	369	564
Fluoride as F	1	0.512	0.159	0.2	0.31	0.59
Sulphate as SO ₄	200	100	100	88	83	100
Phosphate as PO ₄		2.12	2.15	0.15	0.23	2.15
Tidys Test 4 hrs O ₂		1.36	1.45	0.29	0.31	1.45
Bacterological Examination		NT	NT	NT	NT	NT
Fecal Coliform/100ml		NT	NT	NT	NT	NT

CPHEEO: Central Public Health Engineering and Environmental Organization

CPHEEO STD A – Acceptable limit

Discussion

The result of the sample water from the sea and the ground water in and around the sea for the various physico-chemical analysis from the

The variation in the various physico-chemical parameters of the sea waters and the ground waters at different distance from the sea were measured. The level of various physico-chemical factors indicative of pollution were found to exceed the quality standards and affects the water quality and water utility pattern. The ground water was found to be of low quality near the seas and the level of pollutants found to decrease with increase in distance of the water source from the polluted sea. The results of various water quality parameters and the standard values from various samples are presented in the table (1-14).

a. Electrical Conductivity:

Electrical conductivity is an important parameter to find the dissolved electrolytes in water. The normal value of electrical conductivity is 1000 micromhos/cm. but the seas have the values of 1500 to 2200 micromhos/cm. these values are higher than the permissible limit. The higher values are recorded at ground water sources adjacent to the sea.

The electrical conductivity of water varies from minimum of 850 micromhos/cm to maximum of 1580 micromhos/cm. The higher value of Electrical conductivity due to the collection of industrial waste water from the residence located in and around the sea.

b. Total Dissolved Solids:

The total dissolved solids in water include all the dissolved solids. In the present study the total dissolved solids ranges from 113mg/l and 307mg/l. but the acceptable limit as per ISI (1991) is 500mg/l. hence the pond water as well as the ground waters have the higher values of TDS, so it is unfit for the any domestic purposes. The higher values may be due to low water level and various kinds of polluted ions present in the industrial waste water.

c. Turbidity:

Turbidity means the finely suspended matter present in the water. The presence of suspended matter maybe due to the discharge of solid waste water in the areas of sea water. Turbidity of the sea water and some ground water sources varies from minimum of 1 NTU to maximum of 5 NTU. But the CPHEEO acceptable limit is 2.5NTU. But the above sea and sample have higher value than acceptable limit.

d. pH:

Physical and chemical parameters changes in water are depends on pH of the water. The chemical examination of the water samples shows that the pH value from 6.84 to 7.67. the permissible limit prescribed by WHO and ISO standards(1982) is 7.0 to 8.5. here the water is acceptable for human use. We can give consideration for other sensitive parameters also. Based on the parameters the water is unfit for human use.

The sea waters are mostly collected from the sources consist of industrial waste which are mostly alkaline in nature, so the pH value of sea water is higher than the other ground water sources.

e. Hardness:

Hardness is the measure of calcium and magnesium in the water. The highest desirable limit prescribed by ISI (1991) is 100mg/l for drinking water. But the hardness of the samples is higher than the permissible limit. It means the water is very hard. Products are available (such as calcium chloride) to decrease the hardness of the water.

f. Chloride:

According to ISI (1991) the highest acceptable chloride concentration is specified as 250mg/l for drinking purpose. In the present study the chloride values are lower than the permissible limit. Hence the water can be used for the domestic purposes. If increase the chloride vales in the water it becomes salty taste.

g. Calcium:

The increase of calcium in water contributes to hardness in water and thereby reducing the utility of water for domestic purposes. The normal acceptable limit prescribed by ISI(1991) is 75mg/l. in the present study the sea waters have the values of 75mg/l to 124mg/l. the excess value of calcium indicates that the ground water is unfit for the domestic purposes.

The increase in calcium value is due to discharge of domestic waste water from the residential area located near the sea. The waste water percolates into the ground water and affects the water and soil quality. The excess of calcium causes deterioration of cloths and skin irritation. In combination with chloride becomes corrosive and cause pitting of boilers.

h. Magnesium

The value of magnesium in ground water sources varied from 37mg/l to 95mg/l for drinking purposes. Chemical examination of ground water analysis shows, the magnesium level is lower than the acceptable limit. Hence the ground water is unfit for human consumption. The level of magnesium combined with calcium to increase the hardness of the water.

i. Nitrate:

Nitrate is produced by the autotrophic nitrobacter bacteria combining oxygen and nitrite in the bio-converter and to a lesser degree on the walls of the sea. According to the USPH standard the acceptable limit of nitrate in drinking water is 10mg/l but nitrate in ground water samples varies from 6mg/l to 10mg/l. due to high value of nitrate indicates the ground water is unfit for any domestic purposes.

Physic-chemical analysis of various water samples collected at the study area are having the higher value of sensitive parameters like TDS, calcium, Chloride, Magnesium, Nitrate, Fluoride, pH, Turbidity,. Hence the people cannot use this water for any domestic purposes. So the people have to bring the water from the municipal water supply.

Conclusion

In the present study it is observed a high degree of study area pollution due to high values of TDS, conductivity, chloride, ammonia and Turbidity.

Environmental includes water, air and land and the inter-relationship, which exists among and between water, air and land, and human beings, other living creatures, plants, microorganism and property.

The problem of pollution of sea and streams has assumed considerable importance and urgency to urbanization. It is therefore, essential to ensure that the domestic and industrial sewage water are not allowed to discharge into be watercourses without adequate treatment as such discharges would render the water

unsuitable as Aquatic life and human being. . This kind of Polluted water also causes increasing damage to the country's economy.

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