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Investigation of Water Contamination in Noyyal River in the Reach of Coimbatore City Limits

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Abstract : Assessment of water quality in Noyyal River was carried out in this study. Water samples were collected from the Noyyal River at a stretch of 20 km. The sampling locations have been fixed at every 2 km. The parameters were estimated such as dissolved oxygen (DO), pH, total dissolved solids (TDS), Sulphate, Chloride, total hardens, total alkalinity, etc. This study had two phases. In the first phase, the estimation of water quality parameters was carried out and in the second phase water quality index have been determined based on the existing standards. The effects of municipal sewage on river water quality have also been investigated. The depletion of DO concentration due to the simultaneous effect of water pollution, thus leads to more uncertainty about the survival of DO dependent aquatic species. From the study, it revealed that TDS, sulphate, chloride, and hardness were estimated to be high concentration at sampling location 10 (S). 10 Among the sample locations, in most of the places, high concentration of TDS, Hardness, sulphate and chloride and low level of DO were observed. Our findings highlighted the deterioration of water quality in the river and are due to human activities. This analysis reveals that the surface water needs some degree of treatment before consumption.

Keywords : TDS, Sulphate, DO, Hardness.

Introduction

“Pollution is the introduction of contaminants into a natural environment that causes instability, disorder, harm or discomfort to the ecosystem that is, physical systems or living organisms”. The term pollutant in a broad term refers to a wide range of compounds, from a superabundance of nutrients giving rise to the enrichment of ecosystems to toxic compounds that may be carcinogenic, mutagenic, or teratogenic. Pollutants can be divided into two major groups, namely, those that affect the physical environment and those that are directly toxic to organisms, including human beings. Rapid industrialization in the twentieth century had led to the generation of vast amounts of gas, liquid, and solid waste that were introduced into the environment without much thought by the manufacturers of that waste. This has affected the ecosystem and has caused health problems for the first habitants residing near the factories. Economical status of the country directly corresponded to the industrial growth. This is also reflected in the increase in rate of pollution. Study area Coimbatore is the one of the major cities in Tamil Nadu and it is well known for industrial activities. The textile industries in and around Coimbatore, disposes the waste into the Noyyal River. The quantity of the wastewater discharged into the river is also getting increased As a result, the quality of the river gets deteriorated. Hence the Noyyal River has been chosen as the study area. The Noyyal River rises from the Vellingiri hills in the Western Ghats in Tamil Nadu,

southeastern India and drains into the Kaveri River. The river basin is 180 km long and 25 km wide and covers a total area of 3,500 km². Cultivated land in the basin amounts to 1,800 km² while the population density is 120 people per km² in the countryside, and 1000 people per km² in the cities (Lenin and Saseetharan, 2008). The area is known for its scanty rainfall and the development of the Noyyal River Tanks System holding any overflow from the rains plus the water in the Northeast and Southwest monsoon season been ecologically important. The 173 km long tributary of the Kaveri River filled 32 tanks. As like the many other hazardous changes due to the lifestyle changes and change in culture, the Noyyal is also down the way to death. The deterioration in various water quality characteristics clearly indicates the possibilities of pollution due to industrial activities such as coffee vegetables oils, leather tanning, textiles and foundries in and around Coimbatore city. The population of Coimbatore has also a strong impact on the Noyyal River with regard to pollution and due to this Noyyal River acts as a carrier for the pollution. During the non-flow period of the river, water can be stagnated and the pollution may enter into the ground water. So the ground water quality also gets depleted.

Sample Collection in Different Localities in the Reach of Coimbatore City Limits



Figure-1 Townhall (S1)



Figure-2 Ramanathapuram (S2)



Figure-3 Singanallur (S3)



Figure-4 Irugur (S4)

pH Test

pH is one of the most important measurements commonly carried out in natural waters. pH of water is greatly dependent on the biological activity and temperature changes of the ambient atmosphere. pH value fluctuated between 7 to 7.35 during the study period. In the present study the pH was not beyond the permissible limit. If pH exceeds the permissible limit it will affect the mucus membrane of the cells.

$$\text{pH} = -\log[\text{H}^+]$$

Electrical Conductivity Test

An electrical conductivity meter (EC meter) measures the electrical conductivity in a solution. It is commonly used in hydroponics, aquaculture and freshwater systems to monitor the amount of nutrients, salts or impurities in the water.

Turbidity

Turbidity is the amount of cloudiness in the water. This can vary from a river full of mud and silt where it would be impossible to see through the water (high turbidity), to spring water which appears to be completely clear (low turbidity).

It is very important to measure the turbidity of domestic water supplies, as these supplies often undergo some type of water treatment which can be affected by turbidity. For example, during the rainy season when mud and silt are washed into rivers and streams, high turbidity can quickly block filters and stop them from working effectively. High turbidity will also fill tanks and pipes with mud and silt, and can damage valves and taps. Where chlorination of water is practiced, even quite low turbidity will prevent the chlorine killing the germs in the water efficiently.

Determination of Solids

The term total dissolved solids refer to materials that are completely dissolved in water. These solids are filterable in nature. It is defined as residue upon evaporation of filterable sample. The term total suspended solids can be referred to materials which are not dissolved in water and are non filterable in nature. It is defined as residue upon evaporation of non filterable sample on a filter paper.

Determination of Hardness

Hardness is expressed as the equivalent amount of calcium carbonate in parts per million (mg/l). It can also be expressed in degrees. Hardness is a measure of how resistant solid matter is to various kinds of permanent shape change when a force is applied. There are different measurements of hardness: scratch hardness, indentation hardness, and rebound hardness.

Determination of Chlorides

The presence of chlorides, e.g. in seawater, significantly aggravates the conditions for pitting corrosion of most metals (including stainless steels and high-alloyed materials) by enhancing the formation and growth of the pits through an autocatalytic process. Silver chloride is a chemical compound with the chemical formula AgCl. This white crystalline solid is well known for its low solubility in water (this behavior being reminiscent of the chlorides of Tl^+ and Pb^{2+}). Upon illumination or heating, silver chloride converts to silver (and chlorine), which is signaled by greyish or purplish coloration to some samples. AgCl occurs naturally as a mineral chlorargyrite.

Determination of Sulphates:

Sulphate is a naturally occurring substance that contains sulphur and oxygen. It is present in various mineral salts that are found in soil. Sulphate forms salts with a variety of elements including barium, calcium, magnesium, potassium and sodium. Sulphate should not be confused with sulphite. Sulphite also contains sulphur and oxygen. Sulphate may be leached from the soil and is commonly found in most water supplies. Magnesium, potassium and sodium sulphate salts are all soluble in water. There are several other sources of sulphate in water. Decaying plant and animal matter may release sulphate into water. Numerous chemical products including ammonium sulphate fertilizers contain sulphate in a variety of forms. The treatment of water with aluminum sulphate (alum) or copper sulphate also introduces sulphate into a water supply. Human activities such as the combustion of fossil fuels and sour gas processing release sulphur oxides to the atmosphere, some of which is converted to sulphate

Physical chemical parameters	Water Limit			Samples			
	IS 10500:2012		WHO	S1	S2	S3	S4
	(A)	(B)					
Colour	-	-	-	CL	CL	CL	SG
Odour	Agreeable	Agreeable	-	O	O	E	O
Turbidity (NTU)	1	10	15	73	84	72	80
TDS(mg/L)	500	2000	-	80	10	20	30
EC	-	-	-	3.5	0.32	1.22	0.25
pH	6.5	6.5	6.5-8.5	7.82	8.13	7.65	7.56
TA(ppm)	200	600	-	420	370	340	210
TH(mg/L)	200	600	150-500	575	175	490	220
Cl(mg/L)	250	1000	250	415.7	261	13.99	283.86
SO ₄ ²⁻ (mg/L)	200	400	500	567	6.4	69.5	35.33
DO(mg/L)	-	-	-	2.4	2.6	3.3	3
BOD	-	-	-	2	1.6	4.4	2

The physical properties of our sample show reasonable results as compared to normal water quality standards. So that not much treatment process is required for physical properties. But the chemical parameters like Chloride, Sulphates, Fluorides exceeds tolerable limit. So that the treatment is essential to enhance the quality of water for utilization of Domestic and other purposes.

Conclusion

The most effective approach for cleaning up contaminated surface water is to prevent further discharges from contaminated sources and enable natural biological, chemical, and physical processes to break down the existing contamination. A significant source of surface water contamination may be contaminated sediments. Contaminated sediments generally contain persistent contaminants and are difficult to clean up. Three main approaches to cleaning up contaminated sediments are: Remove them by dredging; Place a cover over them to prevent contact with the surface water; and Allow natural processes to cover them or break them down over time. For contamination that does not mix with surface water and floats on the surface, such as that encountered during an oil spill, contamination can be removed by skimming it.

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