Analysis of ground water from surrounding areas of sewage treatment plant at Mayiladuthurai, Nagapattinam District

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ABSTRACT

The paper reports the analysis of ground water from different sources and characteristics of ground water nearer to the sewage treatment plant in Mannampandal. The people around this region are mainly depend upon the ground water resources for their domestic, agricultural and industrial needs. A detailed study has been carried out by collecting the samples about four direction of 20 samples at a distance of 1Km, 2Km, 3Km, 4Km, and 5Km of samples were collected from the study area, and the samples are analyzed for various physical, chemical and biological parameters such as pH, TDS, alkalinity, turbidity etc.., The standard of samples are compared with BIS and WHO standard.

INTRODUCTION

Groundwater is the water present beneath Earth's surface in soil pore spaces and in the fractures of rock formations. A unit of rock or an unconsolidated deposit is called an aquifer when it can yield a usable quantity of water. The depth at which spoil pore spaces or fractures and voids in rock become completely saturated with water is called the water table. Groundwater is recharged from, and eventually flows to, the surface naturally; natural discharge often occurs at springs and seeps, and can form oases or wetlands. Groundwater is also often withdrawn for agricultural, municipal and industrial use by constructing and operating extraction wells. The study of the distribution and movement of groundwater is hydrogeology, also called ground water hydrology.

Typically, groundwater is thought of as water flowing through shallow aquifers, but, in the technical sense, it can also contain soil moisture, permafrost (frozen soil), immobile water in very low permeability bedrock, and deep geothermal or oil formation water. Groundwater is hypothesized to provide lubrication that can possibly influence the movements of faults. It is likely that much of Earth's subsurface contains some water, which may be mixed with other fluids in some instances. Groundwater may not be confined only to Earth. The formation of some of the landforms observed on Mars may have been influenced by groundwater. There is also evidence that liquid water may also exist in the subsurface of Jupiter's moon Europa.

Groundwater is often cheaper, more convenient and less vulnerable to pollution than surface water. Therefore, it is commonly used for public water supplies. For example, groundwater provides the largest source of usable water storage in the United States, and California annually withdraws the largest amount of groundwater of all the states. Underground reservoirs contain far more water than the capacity of all surface reservoirs and lakes in the US, including the Great Lakes. Many municipal water supplies are derived solely from groundwater.

Polluted groundwater is less visible, but more difficult to clean up, than pollution in rivers and lakes. Groundwater pollution most often results from improper disposal of wastes on land. Major sources include industrial and household chemicals and garbage landfills, excessive fertilizers and pesticides used in agriculture, industrial waste lagoons, tailings and process wastewater from mines, industrial fracking, oil field brine pits, leaking underground oil storage tanks and pipelines, sewage sludge and septic systems.

WASTE WATER

The waste water is generated from the cities/towns due to the domestic, industrial, etc. They are also known as the waste water or sullage water or grey water. Refuse from local council operation like washing, bathing sewage refused water may also be considered as waste water that is aside for street and home collection.

COMPOSITION

The urban waste water are generally contains up to 20% of recyclable contents, whereas they may contains around 40 – 50% the rest being stones, dust etc. A part of these waters are coming from the hospitals and certain industries are hazardous nature.

STUDY AREA

Sewage treatment is the process of removing contaminants from wastewater, primarily from household sewage. Physical, chemical and biological processes are used to remove contaminants and produce treated wastewater (or treated effluent) that is safer for the environment. A by-product of sewage treatment is usually a semi-solid waste or slurry, called sewage sludge. The sludge has to undergo further treatment before being suitable for disposal or application to land.

Sewage treatment may also be referred to as wastewater treatment. However, the latter is a broader term which can also refer to industrial wastewater. For most cities, the sewer system will also carry a proportion of industrial effluent to the sewage treatment plant which has usually received pre-treatment at the factories themselves to reduce the pollutant load.

If the sewer system is a combined sewer then it will also carry urban runoff (stormwater) to the sewage treatment plant. Sewage water can travel towards treatment plants via piping and in a flow aided by gravity and pumps. The first part of filtration of sewage typically includes a bar screen to filter solids and large objects which are then collect in dumpsters and disposed of in landfills. Fat and grease is also removed before the primary treatment of sewage.

MATERIALS AND METHODS

Samples of groundwater were collected from respective study areas.

Groundwater samples were analyzed for parameters like pH, Turbidity, DO, TDS, TSS, EC, Total Hardness, Chloride, etc,…values are measured in ppm and was measured in millimhos/cm and faecal coliform in E.coli

Map Shownig – Location of Treatment pond

PHYSICO – CHEMICAL ANALYSIS

All the samples were analyzed for the following physicochemical parameters; pH, Turbidity, Electrical Conductivity (EC), Total

Dissolved Solid (TDS), Total Suspended Solid (TSS), Total Solids (TS), Total Alkalinity (TA), Chloride, Total Hardness (TH), Ca hardness, Mg hardness, Dissolved Oxygen (DO) and Sulphate.

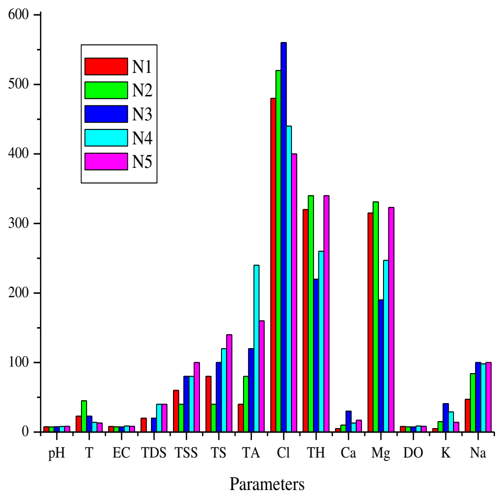
The physicochemical analysis of water samples were carried out in accordance to standard analytical methods.

Results and Discussion

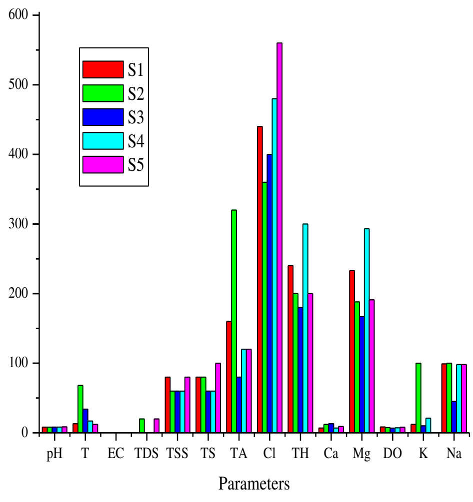
The results of analysis are subsequently discussed and also shown in below

S.N.	Parameters	North Direction	South Direction	East Direction	West Direction
1.	pH	7.50 – 8.27	8.10 – 8.51	7.55 – 8.27	8.02 – 8.63
2.	Turbidity (NTU)	13 – 45	12 – 68	13 – 95	13 – 37
3.	EC (µs/cm)	0.079 – 0.196	0.070 – 0.074	0.067 – 0.085	0.056 – 0.173
4.	TDS (mg/L)	0 – 40	0 – 20	0 – 20	0 – 60
5.	TSS (mg/L)	40 – 100	60 – 80	40 – 60	60 – 100
6.	TS (mg/L)	40 – 140	60 – 100	40 – 80	60 – 140
7.	TA (mg/L)	40 - 240	80 – 320	120 – 280	200 – 360
8.	Cl (mg/L)	400 – 560	360 – 560	400 – 560	360 – 480
9.	TH (mg/L)	220 – 340	180 – 300	220 – 360	240 – 360
10.	Ca (mg/L)	5 – 30	7 – 13	5 – 13	5 – 10
11.	Mg (mg/L)	190 – 331	167 – 293	207 – 295	230 – 351
12.	DO (mg/L)	7.5 – 8.7	6.8 – 8.5	7.1 – 9.3	7.2 – 9.3
13.	K (mg/L)	5 – 41	02 – 100	05 – 11	02 – 24
14.	Na (mg/L)	47 – 100	45 – 100	40 – 100	35 – 86

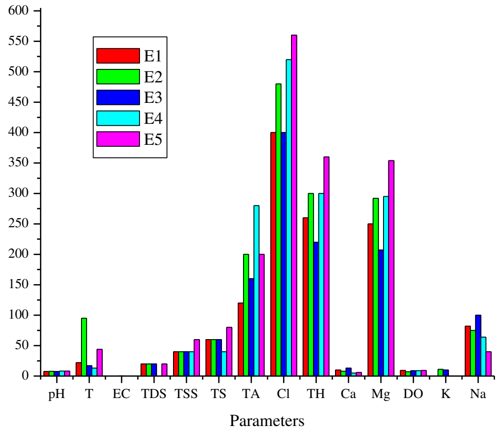
North Directions



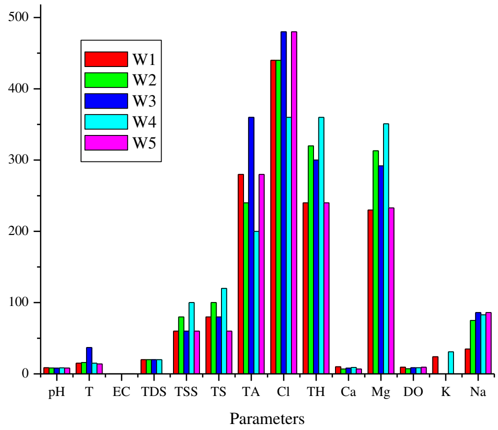
South Directions



East Directions



West Directions



pH

The pH of the groundwater samples were about neutral, the ranged from 7.50 to 8.63.

Turbidity

Turbidity of groundwater samples obtained from 12 to 95.

EC

EC is a measure of total salt content in water. It's a determination of levels of inorganic constituents in water. EC ranged between 0.056µs/cm to 0.196 µs/cm.

TDS

Total dissolved solids are a measure of total inorganic substances dissolved in water. TDS indicates the general nature of water quality or salinity. During the study TDS is found between ranged 0 to 60 mg/l. The TDS concentration was found to be above the permissible limit may be due to the leaching of various pollutants into the ground

Dissolved Oxygen

water which can decrease the potability and may cause gastrointestinal in human and may also have laxative effect particularly upon transits.

TSS

In sample the minimum value was found 40 mg/l and maximum value 100 mg/l respectively might be due to the presence of several suspended particles. The total suspended solids are composed of carbonates, Bicarbonates, Chlorides, Phosphates and Nitrates of Ca, Mg, Na, K, Mn organic matter, salt and other matter. When the concentration of suspended solids is high it may be aesthetically unsatisfactory for bathing.

TS

The value of TS in this study was found minimum 40 mg/l and maximum 160 mg/l respectively.

Alkalinity

The total alkalinity was found to be in the range of 40 to 160 mg/l in ground water samples which are caused mainly due to OH, CO3, HCO3 icons.

Chlorides

The value of chloride obtained 360 to 560 mg/l as presented in table which is further compared with the standard values 250 mg/l. Department of National Health and Welfare, Canada reported that chloride in ground water may results both natural and Anthropogenic sources such as run – off containing salts, the use of inorganic fertilizers, landfill leachates, septic tank effluents, animal feeds, industrial effluents, irrigation drainage and seawater intrusion in coastal areas. Chlorides is not harmful to human at low concentration but could alter the taste of water at concentration above 250 mg/l.

Total Hardness

The total hardness of ground water samples were found in the range of 180 up to 360 mg/l which is further compared with the standard value ranged 300 mg/l. Water hardness is usually due to the multivalent metal ions, which comes from minerals dissolved in the water.

Calcium and Magnesium Hardness

Calcium and Magnesium hardness of groundwater samples were found maximum value 30 mg/l and 351 mg/l and minimum value 5 mg/l and 167 mg/l and respectively which are further compared with the standard value of WHO and BIS.

DO of ground water samples were found in the range of 6.8 to 9.3 mg/l. due to the capacity of water to hold oxygen.

CONCLUSION

From the above results, it is concluded that east direction of treatment plant is more polluted due to the sewage action of waste water and is not portable, but the pollution is reduced with distance.

In other direction pollution is more up to 1000 m and less at 2000 m particularly in south direction pollution is extended up to 1000 m only. The pollution is more in east, because the area of lagooning pond is more in this direction. So special care is required in the east direction water and it is must allowed into treatment process before drinking.

The remedial measure suggested is proper lining of oxidation pond with rich mortar. Special admixtures should be added with concrete for leakage proof of lining.

Every year during north – east monsoon we are receiving more rainfall. To reduce the run off water to provide farm pond or percolation pond. Where the land is available. It will give water to recharge and reduce the ground water pollution.

Another method is provide recharge shaft. Where ever necessary to save the excess run off water, it also reduce the ground water pollution.

Plantation process can be applied. Best example banana tree.

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