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A study on impact assessment of pollution in Sipcot, Perundurai

R Sowmiya[1], D Ambika[2], V Sampath Kumar[2]

[1]P.G. Student, Department of Civil Engineering, Kongu Engineering College, Erode, Tamil Nadu, India,
[2]Assistant Professor, Department of Civil Engineering, Kongu Engineering College, Erode, Tamil Nadu, India.

ABSTRACT

Water is a main source for the domestic purpose as well as the agricultural and industrial development. Life is profoundly influenced by water. Physical, chemical and biological characteristics of water describe the quality of water. Water is needed for a continually growing population. Now around 20% of the world meets water scarcity. Ground water is the main source for agriculture, industry and domestic use in Perundurai. SIPCOT is an industrial development centre developed by the Tamil Nadu state government in Perundurai. Usage of chemicals, fertilizers, pesticides and toxic substances in industries causes major pollution to the environment. This leads to the deteriorating of water quality. Human population suffers from various diseases; agriculture is depleting which is due to the usage of contaminated water. A survey and analysis has been conducted around the areas of SIPCOT. The qualities of water around SIPCOT have been tested from the results of the analysis. Testing for pH, Temperature, Nitrate, Phosphate, Sulphate, Chloride, Turbidity, Dissolved Oxygen, Salinity, Electrical conductivity and tests for heavy metals such as Arsenic, Cadmium, Nickel, Thallium, Lead, Chromium, Silver, Selenium, Mercury, Copper, Zinc for water to analyse the depth of penetration of heavy metals and chemicals and to arrive appropriate solution to the problem.

Keywords: Impact assessment, Environmental Impact, Ground water pollution, Water quality and Industrial Pollution.

INTRODUCTION

The industries and the technologies have been developing along with the rapidly increase in population. This creates a large quantity of waste disposal in the land area and the water body. SIPCOT (State Industries Promotion Corporation of Tamil Nadu) is established for the industrial development of Tamil Nadu in various districts. Perundurai is one of those industrial centres which have been established by Tamil Nadu state government. Perundurai city wholly depends on the ground water for agricultural domestic and industrial purposes. Perundurai SIPCOT was established in the year 2000. 2000 acres was first allocated by Tamil Nadu state government for 99 years lease period in the year 2000. Later in the year 2007 another 1600 acres has been acquired for the further expansion of industrial development. Now SIPCOT has a total land area of 3600 acres. Due to the consequent living standards and the rise in the consumption of industrial products, there has been an increase in the quantity of solid and liquid waste. Various industries which were classified under green, orange and red have been located in SIPCOT. Without any proper treatment these polluted wastes were dumped in nearby lands or discharged in nearby water bodies. These effluents are discharged from different sources which leads the ground water to contamination. 200 acres of palathozhuvu lake and palathozhuvu village has also been affected by SIPCOT which is 1 hour travel form SIPCOT. This

Author for correspondence:
Department of Civil Engineering, Kongu Engineering College, Erode, Tamil Nadu, India,

is due to the disposal of industrial wastes in the Palathozhuvu Lake. Due to this pollution cancer and other diseases have been spreading in erode district. Erode has been declared as the number 1 region for cancer. The aim is to identify and evaluate the presence of heavy metals and chemicals in the soil and water and to give a remediation.

The aim of the research

Disposal of inadequate and improper treatment of waste water causes environmental pollution.

i.) Identify the source
ii.) Analyse the degree of pollution caused by the heavy metals
iii.) Identify remedial measures
iv.) Reduce pollution

LITERATURE REVIEW

The industries and the technologies have been developing along with the rapidly increase in population. This creates a large quantity of waste disposal in the land area and the water bodies. Due to the consequent living standards and the rise in the consumption of industrial products, there has been an increase in the quantity of solid and liquid waste. Without any proper treatment these polluted wastes were dumped in nearby lands or discharged in nearby water bodies. Analysis was made on the effluent released from different sources and characteristics of soil and ground water nearer to the source of contamination. An area near a food industry and a septic tank was taken for research. Effluents, soil and ground water samples were taken for testing of parameters like pH, nitrate, sulphate and phosphate, BOD, COD and EC. This is due to the improper treatment process [1].

The presence of mutadenic azo dyes was evaluated using thin layer Chromatography in sediment samples of the Cristais River upstream and downstream of an azo dye processing plant discharge area. The dyes CI Disperse blue and orange as well as three other compounds were detected in the samples collected from the downstream. No dyes were found in the extracts of organisms. The exact situation of the environment is undetermined [2]. Underground septic tanks are used to collect domestic water. Groundwater pollution is a consequence of waste water discharge into permeable underground septic tanks. The groundwater samples were taken at the pumping level. Chemical analysis was carried out for water samples at different periods of time. Harmful effects of wastewater on the chemical compositions of groundwater were detected. Toxicity and chemistry of heavy metals were increased in groundwater [3].

Industrial discharge from Baotou City is discharged in the drainage basin of the yellow river. It has been found that the heavy metals were discharged in the yellow river. The pollutants transport mostly through carriers of suspended particles and sedimentation in the environment. The heavy metal contents in sediments with SQC-Acute and SQC-Chronic were compared [4].

Analysis has been made to the environmental condition around the Alluvial Plain of Hutuo River in order create awareness for the hygiene of the habitants around the area. Sampling, analysing and testing has been done; the result showed that the shallow groundwater has been affected by heavy metals around the area. Due to high toxicity, pollution has become unable to control. Steady improvement is needed since it has some flaws and uncertain factors [5].

Water samples were collected from 62 wells and are distributed across seven countries in the central Florida region. The samples were analysed at the Department of Health Laboratory in Tampa, Florida using the Microscopic Particulate Analysis. 13% samples were in high-risk while 29% of moderate and 58% of low risk range. Karst regions have higher risk than sandy areas, older wells have higher risk index [6].

Zooplankton samples were collected from the Messaieed marine areas, which is subjected to industrial and sewage discharge. The species diversity is also disturbed. The pollution stress changed the structure of Zooplankton. Oil pollution is reduced in the area of oxygen demanding wastes [7].

The groundwater polluted by uranium is purified with the help of indoor simulation test. The ground water can be purified by using the wall rocks with an advanced method and the uranium can also be absorbed. Uranium is absorbed with the ion exchange process and then the neutralizer

is used to stabilize the pH of waste water to 7. Low grade uranium is absorbed by sand and clay [8].

Recycled water from the paper industry can be effectively used as the water resource for the trees which are used for the paper production. Waste water from a paper industry near yellow river, at northwest china uses the recycled water from the industry for the trees, which is used for making paper. One part of the forest uses water from the yellow river entirely and the other part of the forest uses 1:1 ratio of recycled water and water from yellow river. The production rate in which the recycled water used is lesser when compared to the entire usage of yellow river water [9].

Heavy metals in ponds can be removed by physical, chemical and biological process. The sediments in the ponds create contamination of ground water. A 2 years research has been done to study the migration of sediments in 6 ponds. Sorption, molecular dispersion and pilot studies were conducted in the laboratory. Penetration of contaminants is low. It's been restrained at top 15 to 25 cm of ground level. By removing these contaminants at 25 years interval will minimize the pollution [10].

RESEARCH METHODOLOGY

From the extensive literature study it is clear that there are ways to reduce and remove the pollution when the components that are affects the water table has been identified. The cost for testing is too high, due to the economical problems few villages around the SIPCOT area have been selected for testing.

Questionnaire survey was conducted among the villagers around SIPCOT to identify the physical problems faced by the peoples or villagers around SIPCOT. Obtained data's will be analysed to find out the frequency of response for physical problems.

Samples will be collected from few villages and one of the industries in SIPCOT. Heavy metal tests along with common parameters for water. The data's obtained from the tests will be analysed for a remedial measure to reduce the pollution and use the potential water.

Preparation Questionner

Based on the literature and data collected from the articles, a Questionnaire was designed as a measurement of physical problems that arise in the research area. The Questionner consists of 22 questions relating to the physical problems and general profile of respondents were asked to rate their response according to the respective five point rating scale.

QUESTIONNER SURVEY AND ANALYSIS

Direct survey has been conducted in 10 villages (Vara Palayam, Kaspulam Palayam, Sengulam, Ingur, Chinna Vettu Palayam, Vaipadi, Nagappan Goundan Palayam, Kasilingamputhur, Vettukattuvalasu, and Elithingalpatti) around SIPCOT. 30 responses were collected from the villagers to assess the physical problems faced by the villagers due to the pollution.

Source of Water

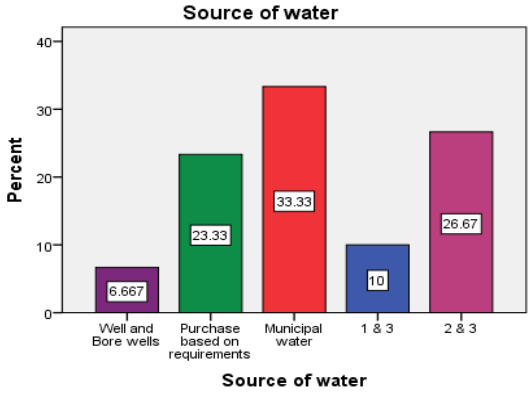

Fig 1 Source of water

From the responses it is observed that 33.33% feel that municipal water is used, 26.67% feel that both municipal and purchase based on requirements is followed, 23.33% feel that water purchase based on requirements is followed, 10% feel that wells, bore wells and municipal water is used, 6.67% feel that water from wells and bore wells have been used.

Hence it has been identified that municipal water and purchase based on requirements has been used by most of the respondents, which creates some economical problems even when there is an availability of water from wells and bore wells.

Purpose of Water Usage

From the responses it has been identified that 40% feel that water is used for agricultural, domestic and drinking purposes, 16.67% feel that water is used for agricultural purpose, 16.67% feel that water is used for drinking purpose, 13.33% feel that water is used for domestic purpose, 13.33% feel that water is used for both domestic and drinking purpose.

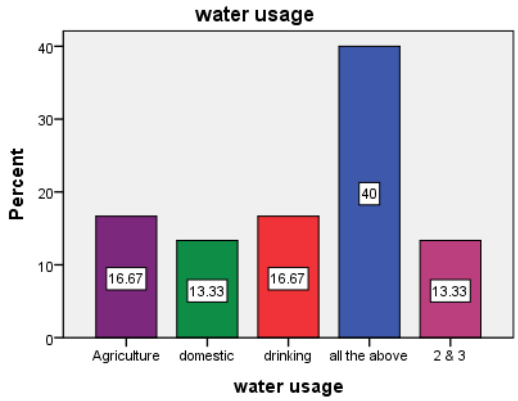

Fig 2 Water Usage

Hence it has been found that most of the water usage is for drinking and agricultural purpose.

Turbidity Level

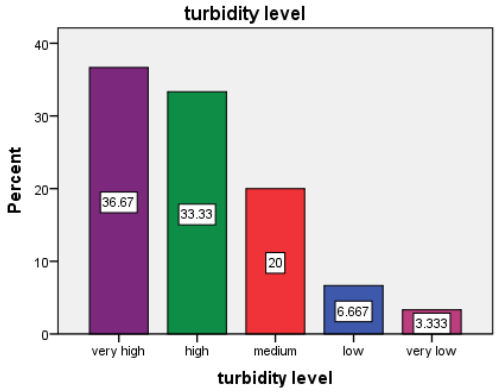

Fig 3 Turbidity Level

From the responses it is observed that 36.67%feel that water has very high turbidity level (very high change in colour), 33.33% feel that water has high turbidity level (high colour change), 20% feel that water has medium turbidity level (medium level colour change), 6.67% feel that water has low turbidity level (low level of colour change), 3.33% feel that water has a very low turbidity level (very low level of colour change).

Hence it has been identified that the turbidity level of water from all the study area has been affected by pollution which cause a change in turbidity level. Most of the study area has been affected highly which is not fitted to be used for drinking, domestic and agricultural purposes.

Ill Effects

From the responses it is identified that 30% feel that they are affected from health issues, poor cultivation and monetary value, 30% feel that they are affected by health issues and poor cultivation, 16.67% feel that they are affected from health issues, 16.67% feel that they are affected by poor cultivation, 6.67% feel that they are affected from monetary value.

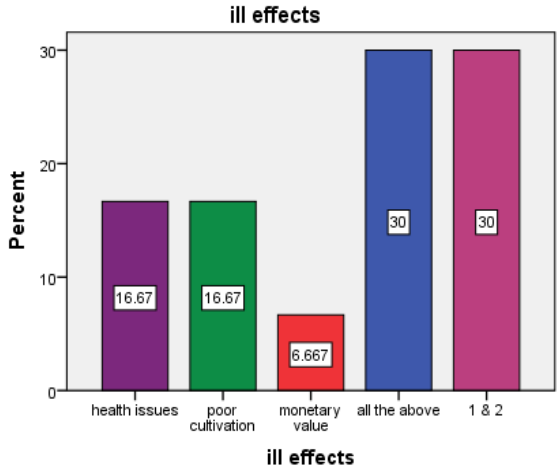

Fig 4 Ill Effects

Hence it has been found that the entire study area has been suffering from some ill effects.

Health Issues

From the responses it is observed that 30% feel that they suffer from cancer, kidney problems, fertility rate, birth of disabled children, unhygenic and skin diseases, 26.67% feel that they suffer from cancer, 16.67% feel that they suffer from skin and unhygenic diseases, 13.33% feel that they suffer from low fertility rate and birth of dis abled children, 13.33% suffer from low fertility rate, birth of disabled children, unhygenic condition and skin diseases.

Hence it has been found that most of the study area has been affected from health issues, most of them are deadly, which should be taken with remedial measures.

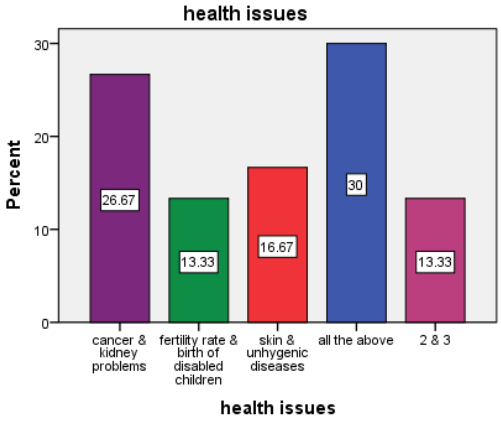

Fig 5 Health Issues

SUMMERY

From the responses it has been identified that the water table has been disturbed, which might lead to the ill effects. Remedial measures can only be taken when the source of the problems have been identified

Testing Water Samples

As per the datas gathered from the Questionner survey, Sengulam and Vettukattuvalasu are the only villages with open well. These open wells contain water to a depth of about 50 ft to 100 ft. these waters are not being used due to some physical problems faced by the villagers. The sources to the problems were to be identified through testing of samples from the wells. A sample from an industry is taken for comparison.

Tests such as pH, temperature, electrical conductivity, turbidity, nitrate, sulphate, chloride, phosphate, dissolved oxygen, salinity, arsenic, cadmium, nickel, lead, chromium, silver, selenium, mercury, copper, zinc are performed to identify the contaminants in water.

RESULT AND DISCUSSION

Sample 1 is the waste water collected from an industry in SIPCOT, Perundurai. This waste water sample is treated by the industry before disposal.

WHO standards for water quality have been mentioned in table 1 and table 3 is for comparison of samples. From table 1 it has been observed that pH, electrical conductivity, are within WHO standards. Temperature, turbidity, nitrate, dissolved oxygen and salinity are little higher than the WHO standards for water. Sulphate, chloride and phosphate values were very high which cause health issues.

Table 1 Normal parameter results for Sample 1

Parameters	Units	Standard	Sample 1
pH	-	7	7.63
Electrical Conductivity	µmho/m	800	193
Temperature	°C	22 - 25	26.3
Turbidity	NTU	< 0.1	1.7
Nitrate	mg/L	< 0.5	1.1
Sulphate	mg/L	59.5	71
Chloride	mg/L	0.2	15
Phosphate	mg/L	0.5	18.1
Dissolved Oxygen	mg/L	1	2
Salinity	ppt	< 0.01	0.06

From table 2 it has been observed that Arsenic, Lead, Chromium and Copper satisfy WHO standards. Presence of Zinc and Selenium were a little above WHO standards which might not cause any immediate health issues.

Table 2: Heavy Metal results for Sample 1

Parameters	Units	Standard	Sample 1
Arsenic	mg/L	0.05	0.01
Cadmium	mg/L	0.005	0.01
Nickel	mg/L	0.01	0.05
Lead	mg/L	0.05	0.05
Chromium	mg/L	0.05	0.02
Silver	mg/L	0.01	0.05
Selenium	mg/L	0.01	0.02
Mercury	mg/L	0.001	0.02
Copper	mg/L	0.05	0.05
Zinc	mg/L	0.05	0.06

Presence of Cadmium, Nickel, Silver and Mercury are too high which might cause any immediate health issues it might even create cancer, fertility, disabled child birth problems in cause of continues intake of water.

This proves that the waste water from the industry has not been treated properly. From table 3 it has been observed that pH, Temperature, turbidity, dissolved oxygen and salinity are little higher than the WHO standards for water.

Electrical conductivity, Nitrate, Sulphate, chloride and phosphate values were very high which cause health issues.

Table 3 Normal parameter results of Sample 2 & 3

Parameters	Units	Sample 2	Sample 3
pH	-	7.87	7.31
Electrical Conductivity	µmho/m	3100	3700
Temperature	°C	26.7	26.6
Turbidity	NTU	0.9	0.7
Nitrate	mg/L	29.6	29.7
Sulphate	mg/L	811	730
Chloride	mg/L	330	780

Phosphate	mg/L	4.61	6.42
Dissolved Oxygen	mg/L	2	2.1
Salinity	ppt	0.93	1.41

Electrical conductivity, Nitrate, Chloride, Phosphate, Dissolved oxygen and salinity of sample 3 are higher than that of sample 2. pH, Temperature, Turbidity and Sulphate of sample 2 are higher than that 0f sample 3.

Table 4 Heavy Metals result for Samples 2 & 3

Parameters	Units	Sample 2	Sample 3
Arsenic	mg/L	0.01	0.01
Cadmium	mg/L	0.01	0.01
Nickel	mg/L	0.05	0.05
Lead	mg/L	0.05	0.05
Chromium	mg/L	0.02	0.02
Silver	mg/L	0.05	0.05
Selenium	mg/L	0.02	0.02
Mercury	mg/L	0.02	0.02
Copper	mg/L	0.05	0.05
Zinc	mg/L	0.096	0.15

From table 4 it has been observed that Arsenic, Lead, Chromium, and copper satisfy the WHO standards for water.

Cadmium, Nickel, Lead, Silver, Selenium, Mercury and Zinc values were very high which will cause health issues.

Zinc content from sample 3 is higher than that of sample 2. All the other components of sample 2 and sample 3 have the same level of heavy metal contents.

CONCLUSION

Inadequate treatment and improper disposal of wastes from the industries has been affecting the water table around the areas of SIPCOT. There is a presence of heavy metals and other components in water which are harmful to human health. These heavy metals were all above the level of WHO standards of water quality. These components were responsible for the improper growth of crops, crop decay, skin problems, cancer, low fertility rate, birth of disabled children and unhygenic conditions. In order to overcome these ill effects some remedial measures should be taken by the Tamil Nadu State Government. Until the environmental condition stabilizes the government should provide alternate water source to the residents. Further study will be conducted to reduce or neutralize the excess amount of heavy metals present in water.

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