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## 13. A STUDY ON WATER QUALITY IN KANYAKUMARI DISTRICT, TAMIL NADU, INDIA

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### ABSTRACT

Analyses of physical and chemical examinations were undertaken for the river and pond water resources of Kanyakumari district, Tamil Nadu, India. The study has chosen two main rivers and four ponds in the study area mainly because these water sources are used by village people for drinking and bathing purposes. Water quality parameters viz., Turbidity, Total dissolved solids, Electrical conductivity, pH, Total Hardness, Nitrite, Sulphite, Phosphate, Bacteriological examinations, and Faecal Coliform were analysed as per the Bharat Indian Standard. The laboratory results of pH, Nitrate (NO<sub>3</sub>), Sulphate (SO<sub>4</sub>) and Faecal Coliform per 100 ml are within the standard permissible limits for all four tap water samples. In Villukuri, the values of Turbidity, Total Harness, Electrical conductivity, Total Hardness, Nitrate, Nitrite and Sulphate have shown the highest among the four stations viz., 6 NTU, 740 mg/L, 1112 micS/cm, 312 mg/L, 022 , 10, and 39 mg/L respectively. The Faecal coliform and the E. coli counts exceeding acceptable limits are indicative of pollution from domestic wastes from several informal settlements located along the riverbank. Water uses in the area were determined and were found to be mainly domestic and recreational. The gross pollution of the river exposes the local people who depend on it for their primary water source to serious health risk.

**KEYWORDS:** water quality, river, water, physico-chemical

### INTRODUCTION

Water pollution is an undesirable change in the state of water, contaminated with harmful substances. When toxic substances enter lakes, streams, rivers, oceans, and other water bodies, they get dissolved or lie suspended in water or get deposited in the bed. This results in the pollution of water whereby the quality of the water deteriorates, affects aquatic ecosystems. Pollutants can also seep down and affect the groundwater deposits. It is the second most important environmental issue next to air pollution.

Pollution of the water bodies disturbs the ecosystem as a whole. Polluted water is not only unsafe for drinking and other consumption purposes, but it is also unsuitable

for agricultural and industrial uses. The effects of water pollution are detrimental to human beings, plants, animals, fish and birds. Polluted water also contains virus, bacteria, intestinal parasites and other pathogenic microorganisms. Using it for drinking purpose is the prime cause for waterborne diseases such as diarrhoea, dysentery and typhoid

### SOURCES OF WATER POLLUTION

The important sources of water pollution are domestic wastes, industrial effluents and agricultural wastes. Other sources include oil spills, atmospheric deposition, marine dumping, radioactive waste, global warming and eutrophication. Among these, domestic waste (domestic sewage) and industrial waste generate maximum pollutants, which make their way to groundwater and surface water bodies.

Depending on the origin, the sources are classified as point source and non-point source. Point source pollution discharges the harmful waste directly into water bodies, for example, disposal through wastewater treatment plants. On the other hand, the main form of nonpoint source pollution is the polluted runoff that drains into streams, rivers, lakes and estuaries, Schulz and Howe (2003). Runoff occurs when rainwater or irrigation water does not soak into the ground but rather runs off the land or developed surfaces into a body of water. As runoff flows over surfaces of streets, parking lots, yards, construction sites, farms, and forests, it picks up the things in its path including fertilizers, loose soil (sediment), animal waste, leaking motor oil, chemicals such as pesticides and herbicides, oil, grease, metals, pathogens (bacteria and viruses) and trash. This runoff then drains either directly to a water body and carries with it the pollutants it has picked up, Dwivedi et al (2006).

### DISEASE BURDEN DUE TO WATER POLLUTION AT THE GLOBAL LEVEL

Polluted water, the root cause of most of the water borne diseases, is caused by human activities like rapid unplanned urbanization, industrialization, agricultural pollutants like pesticides and insecticides, improper waste management in the urban areas. Poor water quality continues to pose a major threat to human health. Diarrhoeal disease alone

amounts to an estimated 4.1 per cent of the total Disability Adjusted Life Years (DALYs) of global burden of disease and is responsible for the deaths of 1.8 million people every year (Battersby, 2013). It was estimated that 88 per cent of that burden is attributed to unsafe water supply, sanitation and hygiene and is mostly concentrated on children in developing countries.

### **DISEASE BURDEN DUE TO WATER POLLUTION IN INDIA**

The public health impact of water pollution in India is enormous. A number of diseases with high morbidity and mortality are wide spread in the communities specially living in unsuitable environmental conditions in urban slums and vast rural areas. The major diseases that are attributed to water pollution and poor drinking water supply are: diarrhoeal diseases, cholera, shigellosis, escherichia coli diarrhoea, poliomyelitis, typhoid, water borne viral hepatitis. Of these, diarrhoeal diseases alone causes more than 0.6 million deaths annually. In slum areas of major cities, diarrhoeal incidence is as high as 10.5 episodes per child per year (Selendy, 2011).

Diseases caused by faeco-orally transmitted enteric pathogens account for 10 per cent of total burden of disease in India. Statistics indicate that intestinal group of diseases claim about 5 million lives and about 50 million people suffer from these diseases every year. Apart from biological contaminants, chemical contaminants namely fluoride, arsenic and other heavy metals pose a very serious health hazard in the country. It is estimated that about 70 million people in 20 states are at risk due to excess fluoride and around 14 million people are at risk due to excess arsenic in ground water (Pathak, 2007). Apart from this, increase in the concentration of chloride, Total Dissolved Solids (TDS), nitrate, iron in ground water is of great concern for a sustainable drinking water programme. With over extraction of groundwater, the concentration of chemicals is increasing on a regular basis.

### **HEALTH EFFECTS OF WATER POLLUTION**

The effects of water pollution are not only devastating to people but also to animals, fish, and birds. Polluted water is unsuitable for drinking, recreation, agriculture, and industry. It diminishes the aesthetic quality of lakes and rivers. More seriously, contaminated water destroys aquatic life and reduces its reproductive ability. Eventually, it is a hazard to human health. Water-related diseases are infectious, spread primarily through contaminated water. Though these diseases

are spread either directly or through flies or filth, water is the chief medium in the spread of these diseases and hence they are termed as water-borne diseases.

Most intestinal (enteric) diseases are infectious and are transmitted through faecal waste. Pathogens, which include virus, bacteria, protozoa, and parasitic worms, are disease producing agents found in the faeces of infected persons. These diseases are more prevalent in areas with poor sanitary conditions. These pathogens travel through water sources and interfuses directly through persons handling food and water. Since these diseases are highly infectious, extreme care and hygiene should be maintained by people looking after an infected patient. Hepatitis, cholera, dysentery, and typhoid are the more common water-borne diseases that affect large populations in the tropical regions.

A large number of chemicals that either exist naturally in the land or added due to human activity dissolve in the water, thereby contaminating it and leading to various diseases. Exposure to polluted water can cause diarrhoea, skin irritation, respiratory problems, and other diseases, depending on the pollutant that is present in the water body. Stagnant water and other untreated water provide a habitat for mosquitoes and a host of other parasites and insects that cause a large number of diseases especially in the tropical regions. Among these, malaria is undoubtedly the most widely distributed disease that causes more damage to human health.

### **MATERIALS AND METHODS**

#### **Study Area**

Surface water is vital to the survival of not only humans but also aquatic life, and wildlife. Rivers, lakes, ponds and streams form surface sources. In Kanyakumari district, the surface water is traditionally used for fishing, drinking, swimming, domestic, and irrigation purposes. However, in spite of the fact that the district is industrially backward, water of the ponds, lakes and river are polluted mainly due to discharge of waste water from residential areas, sewage outlets, solid waste, agriculture run-off, dumping of garbage, hospital wastes, automobile and oil waste. In recent years, surface water sources lose their importance due to the introduction of bore-well technology and centralized water supply system. In rural areas, all the people do not get safe drinking water sources and so people make use of surface water sources also. Some households make use of both surface sources and piped water. Hence the investigator has collected water samples from rivers, ponds, and tap

water from different locations and given for testing in laboratory. Various physical and chemical parameters collected from different sources of water samples are presented below. Rivers in many parts of rural India are the main water source for agricultural, industrial and domestic purposes. The two major rivers in the district are Pazhayar (R1) and Tamirabarani (R2). The Pazhayar originates from the forested area of Surulacode, carries small streams from Mahendragiri peak and flows through Thovalai and Agastheeswaram taluks. The total length of the river is about 37 km and it passes through Boothapandi, Thazakudi, Putheri, Nagercoil, Suchindrum and finally joins the Arabian Sea. The sample collected from Pazhayar river is near Suchindrum bridge. The river Tamirabarani is locally known as Kuzhithuraiar. The origin of Tamirabarani is in the Western Ghats and the river confluences with Laccadive Sea near

Thengapattanam, about 56 kilometres west of Kanyakumari town. The sample collected from Tamirabarani river is near Marthandam bridge, which is at the end of the river. The quality of the river water is affected by various agents, which enters into the river on its way. The tested values are given in the following table. Kanyakumari district is also called as "The District of Ponds". A pond is a body of standing water, either natural or man-made, that is usually smaller than a lake. Ponds have been used since time immemorial as the traditional source of water source in this district. The investigator has collected water samples from four different ponds covering the entire district viz., Rettaikulam (P1), Kariyankulam (P2), Kakaiponkulam (P3) and Chenkulam (P4) to test the quality of water in ponds. The table 2 shows the test results of quality of four ponds in the study area.

## RESULTS AND DISCUSSIONS

### 3.1. Quality of River Water

The tested values of Total Dissolved Solids (TDS), pH, Total Hardness (CaCO<sub>3</sub>), Nitrate (NO<sub>3</sub>) and Sulphate (SO<sub>4</sub>) show that these values are recorded within the permissible limits, but the turbidity value of water samples varied from 17 to 18 Nephelometric Turbidity Units (NTUs) in Pazhayar and Kuzhithuraiar rivers respectively, these values exceed three times above the BIS standard of 5 NTU. Water should be free from turbidity because turbidity impedes efficient chlorination. Electrical conductivity (EC) values are higher than permissible limit of zero micS/cm, the values are 490 micS/cm and 122 micS/cm in Pazhayar and Kuzhithuraiar rivers respectively, indicating the presence of high amount of dissolved inorganic substances in ionized form.

**TABLE 1**  
**QUALITY OF RIVER WATER IN THE SURVEYED AREA**

Sl. No	Parameters	BIS	Range	R1	R2	Comparison with BIS Standard
1	Turbidity NTU	5	17-18	17	18	Exceed
2	Total dissolved Solids mg/L	500	81-323	323	81	within
3	Electrical conductivity micS/cm	0	122-490	490	122	Exceed
4	pH	6.5 to 8.5	7.15-7.84	7.84	7.15	within
5	Total Hardness as CaCO <sub>3</sub>	300	40-128	128	40	within
6	Nitrite as NO <sub>2</sub>	0	0.18-1.84	1.84	0.18	Within
(Except R1)						
7	Nitrate as NO <sub>3</sub>	45	2-3	3	2	within
8	Sulphate as SO <sub>4</sub>	200	3-17	17	3	within
9	Phosphate as PO <sub>4</sub>	0	0.8-1.85	1.85	0.8	Exceed
10	Bacteriological Organisms	0	25506-25664	25506	25664	Exceed
11	Fecal Coliform per 100mml.	0	630-780	630	780	Exceed

Source: Test Reports

A trace of Nitrate content is found in river water samples. It varies from 0.8-1.85 milligrams per litre (mg/l). Nitrate should be zero in potable waters, its presence indicates pollution of recent origin. Phosphate in surface water mainly originates from sewage effluents, which contain phosphate-based synthetic

detergents. The values of phosphates are highest in Pazhayar with 1.85 mg/l and lowest in Kuzhithuraiar with 0.8 mg/l. The low value indicates that decreased land drainage, sewage and fertilizer disposal from the surface run-off. The table 1 also shows a high presence of bacteriological and Faecal Coliform contents

in both the rivers, which means the water gets polluted while passing through its way.

**QUALITY OF POND WATER**

From the table 2 it is clear that, in all the four ponds, the tested results of Total Dissolved Solids, Total Hardness, Nitrite, Nitrate, and Sulphate are within the permissible limits. All other parameters are above the BIS standard. While, Chenkulam recorded the lowest values among other ponds for the parameters viz., Turbidity 4 NTUs, Total Hardness 98 mg/l and Nitrate 2 ppm, it has the highest bacteriological organisms of 25,738 and 2300 coliforms per 100 mml water.

**TABLE 2**

**QUALITY OF PONDS IN THE SURVEYED AREA**

No.	Parameters	BIS Standard	Range	P1	P2	P3	P4	Comparison with BIS Standard
1	Turbidity NTU	5	4-16	9	16	5	4	Exceed
2	Total dissolved Solids mg/L	500	98-398	160	398	341	98	within
3	Electrical conductivity micS/cm	0	148-603	243	603	517	148	Exceed
4	pH	6.5 to 8.5	7.29-9.24	9.24	7.68	7.49	7.29	Within
(Except P1)								
5	Total Hardness as CaCO3	300	40-152	48	140	152	40	within
6	Nitrite as NO2	0	0.16-0.24	0.18	0.24	0.16	0.18	Within
(Except P2)								
7	Nitrate as NO3	45	2-7	3	7	3	2	within
8	Sulphate as SO4	200	4-24	6	24	10	4	within
9	Phosphate as PO4	0	0.65-1.15	0.65	0.75	1.15	0.85	Exceed
10	Bacteriological Organisms	0	2 5 5 0 8 - 25738	25508	25666	25728	25738	Exceed
11	Fecal Coliform per 100mml.	0	60-2300	460	60	180	2300	Exceed

Source: Test Reports

It means Chenkulam is highly contaminated while compared with other ponds with domestic and agricultural wastes. Kariyankulam has the highest turbidity of 16 NTUs, electrical conductivity of 603 micS/cm, Nitrite of 0.24 mg/l due to decaying of plants and animals and Nitrate (NO3) of 7 mg/l. The pH value is highest in Rettikulam with 9.24 units, due to biological activity and inflow of cottage industries/ effluents and Total Hardness is highest in Kakaiponkulam with 152 units. From the results, all the four ponds are not fit for any domestic purpose other than bathing animals.

**CONCLUSION**

From the discussions carried out above, it is observed that, all the surface water sources tested are highly polluted. The finding is found to be within the framework of negative water externality theory. The laboratory results of pH, Nitrate (NO3), Sulphate (SO4) and Faecal Coliform per 100 ml are within the standard permissible limits for all four tap water

samples. In Villukuri, the values of Turbidity, Total Harness, Electrical conductivity, Total Hardness, Nitrate, Nitrite and Sulphate have shown the highest among the four stations viz., 6 NTU, 740 mg/L, 1112 micS/cm, 312 mg/L, 0.22, 10, and 39 mg/L respectively. People living nearby these surface water resources largely depend as a sources for drinking and domestic purpose. Numerous studies indicate a possible link between water pollution and human disease. The river water from these localities should be avoided totally for drinking and cooking purpose. Adopting proper collection, transporting, treatment, and disposal of waste water system for the adjoining habitations along the surface river and pond will give the solution in order to protect not only the surface water, but also to save the Kanyakumari District from the pollution.

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