An Overview On Assessment of Cauvery River Water Quality

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Abstract

In the global context water pollution is considered as a major issues pertaining to its pollution level from the anthropogenic activities. In this scenario the conservation strategies plays an important role in the conservation of water bodies as well as water quality. The quality of natural water in rivers, lakes and reservoirs and below the ground surface depends on a number of interrelated factors. Water has the ability to react with the minerals that occur in the soil and rocks and to dissolve a wide range of materials, so that its natural state is never pure. It always contains a variety of soluble inorganic, soluble organic and organic compounds. In addition to these, water can carry large amounts of insoluble materials that are held in suspension. Both the amounts and type of impurities found in natural water vary from place to place and by time of year and depends on a number of factors. In order to examine and evaluate the quality of Cauvery River, water samples were collected from different locations of the river basin. The results showed that the Cauvery river still in the purest water quality condition. Many research studies shown the water quality of the Cauvery River have become pollute and near to pollute, but in the present study it clearly indicates that the Cauvery river water sustains the normal quality form in the sampling location during the study period. It was observed that the impact and entering of human activity was very less in the sampling location of Kodagu District, India.

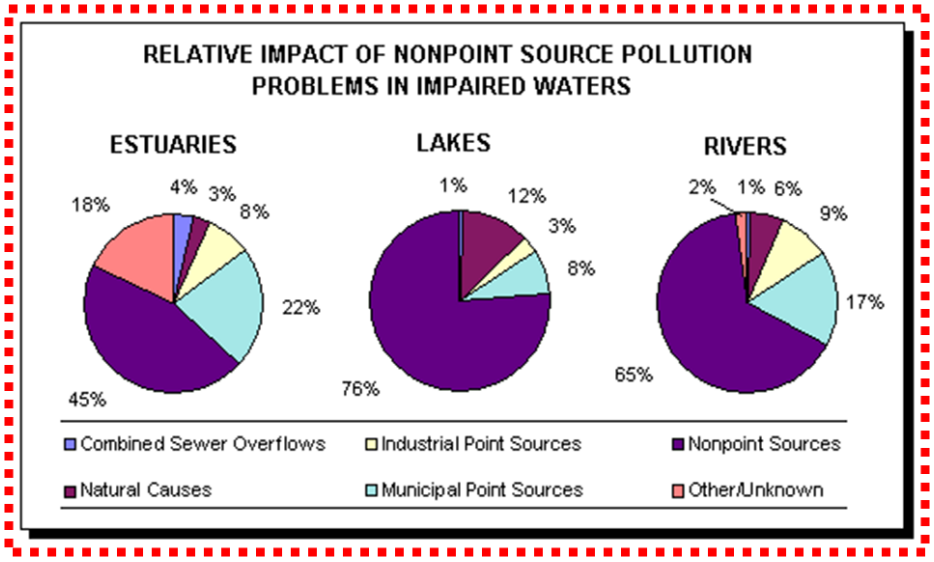
Keywords: Cauvery River, Water Quality, Water pollution, Organic matter.

I. INTRODUCTION

A river can be defined as a large natural stream of water emptying into an ocean, lake, or other body of water and usually fed along its course by converging tributaries. Moving water may dilute and decomposes the biodegradable pollutants more rapidly than stagnant water body, but many rivers and streams are significantly polluted all around the world even in the moving condition.

Water pollution is a major problem in the global context. It has been suggested that it is the leading worldwide cause of deaths and diseases, and that it accounts for the deaths of more than 14,000 people daily.

When harmful substances or toxic substances entered in to the water body, water will be treated as polluted water. Once these polluted water reach to the domestic sources without proper treatment it may causes severe health problems for the peoples. Suppose in the indirect way it may entered in to agricultural field and negatively affect on the growth of the plant and lead to diseases in the food chain. Pathogens are another type of pollution that proved very harmful for the living systems and quality of water. These micro organisms can cause many illnesses that range from typhoid and dysentery to minor respiratory and skin diseases. These pollutants enter river basin through untreated sewage, storm drains, septic tanks, runoff from farms, and boats that dump sewage



II. SOURCES OF POLLUTION

There are three major sources for the water pollution in the rivers stretch. Industry, Agriculture and Domestic sources are those three major sources of pollution towards contributing the pollutants. Throughout the world the industries and cities have historically been located along the rivers stretch because of the transportation of materials and have traditionally been a convenient place to discharge waste. Agricultural practices also have tended to be concentrated near the rivers, because river floodplains are exceptionally fertile due to the many nutrients that are deposited in the soil when the river overflows.

Farmers use the fertilizers and pesticides on their crops to increase the yield and protection of the yield. But these fertilizers and pesticides can be washed through the soil by rain, to end up in rivers. If large amounts of fertilizers or farm waste drain into a river the concentration of nitrate and phosphate in the water increases considerably. Algae use these substances to grow and multiply rapidly turning the water green. This massive growth of algae, called eutrophication, leads to pollution. When the algae die they are broken down by the action of the bacteria which quickly multiply, using up all the oxygen in the water which leads to the death of many animals.

Chemical waste products from industrial processes are sometimes accidentally discharged into rivers. Examples of such pollutants include cyanide, zinc, lead, copper, cadmium and mercury. These substances may enter the water in such high concentrations that fish and other animals are killed immediately. Sometimes the pollutants enter a food chain and accumulate until they reach toxic levels, eventually killing birds, fish and mammals.

In addition, the increasing growth of urbanization and industrialization as discharge of effluent, sewage and municipal wastes into water bodies have negative impacts on the water quality along with aquatic flora and fauna . In a broad term, water quality has always refers to the physical, biological, and chemical status of the water body of the particular period. Heavy metals gain access into aquatic bodies and soil through the natural geochemical processes and the discharge of treated, untreated wastewater into river water.

In the water body the main natural sources of heavy metals are considered as chemical leaching of bedrocks, water drainage basins and runoff from river banks. When coming to the anthropogenic discharges of the heavy metals, it includes the urban discharges and industrial waste water, combustion of fossil fuels, mining and smelting operations, processing and manufacturing industries, waste disposal including dumping, etc., are considered as major polluting sources (Klavins et *al*., 2000; Pardo *et al*., 1990; Yu *et al*. 2001; Upadhyay *et al*., 2006). Sediments are the mixture of several components of mineral species as well as organic debris, represent as an ultimate sink for heavy metals discharged into environment (Luoma and Bryan 1981; Bettinetti *et al*., 2003; Abbas *et al*., 2009). Sediment plays a major role in identifying the pollution load of the river systems by heavy metals (Lietz and Galling1989; Huang *et al*. 1994; Lapaquellerie *et al*., 1995; Wardas *et al*., 1996).

III. WATER QUALITY

Oxygen is the most established indicator to determine the water quality. Dissolved oxygen is an more essential for the survival of all aquatic organisms. Moreover, oxygen affects a vast number of other water indicators, such as like odour, turbidity and taste. Rivers in the developed countries have become steadily cleaner over the past decade due to the awareness among the public and measures taken from the local authorities. Rain water in urban areas is channelized into sewers and drain systems instead of filtering into the ground to raise the water table.

Rivers in the under developed countries have shown a substantial drop in the level of dissolved oxygen in the river water due to improper management of wastewater and unscientific disposal of sewage in to water body.

IV. STUDY AREA DESCRIPTION

Cauvery River originates at Talakavery in the Western Ghats in the State of Karnataka and flows generally south and east through Karnataka. The river has many tributaries. Before the dam, there is confluence of three main rivers namely, Cauvery, Hemavathi and Laxmanatheertha.

The study area (Figure 1) is situated at elevation about 600 meters above mean sea level (MSL) and lies between latitude 12°25′30"N and longitudes 76°34′34" W. River traverses through south of Karnataka and Tamil Nadu and its length is about 750 Km. It serves as a major source of domestic, irrigation and industrial water supply. Subsequently, it receives untreated domestic waste water.

V. SAMPLING

Water samples were collected as per standard method of sampling techniques in the six places of Kodagu district, Karnataka. Some of the sensitive parameters such as temperature, pH and electrical conductivity, were determined directly in the field and for DO the samples were preserved. For the subsequent laboratory analyses like Electrical Conductivity, pH, Turbidity, DO, COD, Total Alkalinity, Total Dissolved Solids, Hardness, Calcium, Magnesium, Phosphate and Sulfate, Sodium and Potassium. The water analyses were carried out as per the methods described by APHA (2006).

VI. RESULTS AND DISCUSSION

The summarized results are shown in Tables 1- 3. All parameters are clearly intimated about the water quality. To find out the anthropogenic interference and sewage entry in the study area DO and COD were determined to check the organic and inorganic pollution in water.

pH is an important parameter to distinguish between acidic and basic nature of water. pH was ranged from 6.5 at sampling station S5 during December to 7.26 in station 1. As per the WHO standards pH for aquatic life is in the range of 6.5-9.0 .Electrical conductivity (EC) is used as a basic index to select the suitability of water for agricultural purposes. In the present study EC was minimum of 40 µmhos/cm at S6 and maximum of 150µmhos/cm at S1 during December.Turbidity is caused due to presence of suspended matter, clay silt, colloidal organic particles, plankton and other microscopic organisms. In the present study turbidity found to be a minimum of 0.15 NTU at S5 in the month of November and S6 to a maximum of 2 NTU in S1 and S5 during October.

Total Dissolved Solids (TDS) is a measure of the solid materials dissolved in the water. This includes salts, some organic materials, and a wide range of other materials from nutrients to toxic materials. In the present study TDS ranged from minimum of 10 mg/l at S4 and S5 to a maximum of 25mg/l in S1. Alkalinity was ranged from 50-106 mg/l which was attributed to bicarbonate. Total hardness is determined as $CaCO_3$ mg/l. In the present study, minimum of 20 mg/l at S5 during October and November to a maximum of 87 mg/l at S4 in the month of November. This hardness shows the feature of less presence of calcium and magnesium. The magnesium concentration was found to be very less than detectable limit in some of the water samples whereas Calcium concentration was ranges from 4.2 mg/l to 15.5 mg/l at S5 and S1 in the month of November and December respectively.

Chloride level of water indicates the pollution degrading of water (Hasalam S. M., 1991). The presence of higher concentration of Chloride in water is hazardous/ toxic to living oranisms and creates health problems. During the present study it was varied from 18 mg/l at S5 to a maximum of 55 mg/l in S1. Phosphate (PO_4^{3-}) is readily taken by phytoplankton and it is necessary for plant and animal growth. Presence of high concentration of Phosphate in water body is due to the entry of agricultural runoff since river Cauvery is surrounded by the agricultural fields. It may enter into surface water from man-generated wastes and run-off. In this study phosphate was found a minimum of 4 mg/l at S4 to a maximum of 12 mg/l at S1. In the remaining sampling station phosphate concentration was very low. The Dissolved Oxygen (DO) test measures the amount of life sustaining oxygen in the dissolved form. The dissolved oxygen is available for fish, invertebrates, and all other aquatic animals in the water body. When there is addition of organic material in the form of nutrients, sewage to the water body dissolved oxygen may decreased due to the increased microbial activity, (Kataria,*et, al.*,1996). In the present study, DO was varied from 5.1 mg/l at S1 during the month of December to a maximum of 7.2mg/l at S4 in October. Since water sample have high amount of DO indicate the less presence of microbes and its activity.

Chemical Oxygen Demand (COD) was estimated to determine the presence of chemical component in the water samples. If the COD is high obviously the water may treated as polluted from the chemical components. During the present study, the water samples have shown a very less concentration of COD with the range of 4.5 mg/l to maximum of 15mg/l. The Sodium and Potassium concentration was ranged from 1.2 mg/l to 5.3 mg/l and 2mg/l respectively. For the Potassium concentration except two sampling station remaining samples showed zero concentration.

Sulfate is a substance that occurs naturally in drinking water. Health concerns regarding sulfate in drinking water have been raised because of reports that diarrhea may be associated with the ingestion of water containing high levels of sulfate. Sulfate gives a bitter or medicinal taste to water if it exceeds a concentration of 250 mg/l. This may make it unpleasant to drink the water. High sulfate levels may also be corrosive for plumbing, particularly copper piping. In areas with high sulfate levels, it is

common to use corrosion resistant plumbing materials, such as plastic pipe. In the present study the concentration of Sulfate was below 250mg/l. it was ranged from 2 mg/l to maximum of 25mg/l. In some of the samples it was not detected.

VII. CONCLUSION

During the present study the obtained data provides simple representation different characteristics such as physical, biological and chemical that reveals the overall water quality of Cauvery River for drinking purpose. It indicates that during monsoon few of the water quality parameters like Phosphate, Sulfate, EC, Total Hardness and TDS is comparatively low when compare to the other stations which were studied by earlier researcher in the different location of the river basin. Water is non-alkaline in nature and it is suitable for domestic uses when it comes to skin aspects of human beings. The concentration of nitrate, phosphate, sulphates and coli form are well within the standard limits. The water is transparent due to very less in turbidity level. Health concerns regarding sulfate in drinking water have been raised because of reports that diarrhea may be associated with the ingestion of water containing high levels of sulfate. High sulfate levels may also be corrosive for plumbing, particularly copper piping. In areas with high sulfate levels, it is common to use corrosion resistant plumbing materials, such as plastic pipe. But in this study the concentration was very less and water can be pass through the pipe line without making faster rate of corrosion. The above data on the water quality parameters of Cauvery River clearly showed that river water is safe for drinking water supply, fishery, irrigation, and industrial purposes, as most of the parameters are found within the permissible limits.

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Table - 1
Physico-Chemical Parameter of Cauvery River Water During The Month of October

	S 1	***S 2***	***S 3***	***S 4***	***S 5***	***S 6***
pH	*7.20*	*7.26*	*7.24*	*6.88*	*6.63*	*6.80*
EC(µs/cm)	*80*	*60*	*50*	*40*	*40*	*40*
Turbidity (NTU)	*2*	*0.3*	*1.5*	*0.2*	*2*	*0.2*
TDS	*25*	*17*	*10*	*10*	*12*	*15*
Alkalinity	*100*	*100*	*75*	*100*	*75*	*75*
Hardness	*80*	*60*	*50*	*40*	*20*	*40*
Calcium	*15*	*5*	*12*	*8*	*5*	*5*
Magnesium	*8*	*-*	*5*	*3*	*-*	*-*
Chloride	*55*	*30*	*38*	*20*	*20*	*30*
Phosphate	*12*	*-*	*8*	*-*	*-*	*-*
DO	*5.9*	*7*	*6.5*	*7.2*	*6.6*	*6.5*
COD	*15*	*9.8*	*10*	*9.3*	*10.2*	*10.3*
Sodium	*5*	*3*	*4*	*4*	*2*	*3*
Potassium	*2*	*-*	*2*	*-*	*-*	*-*
Sulfate	*25*	*10*	*20*	*-*	*-*	*-*
MPN / 100 ml coliform	*>1100*	*1100*	*462*	*1100*	*462*	*462*

Table - 2
Physico-Chemical Parameter of Cauvery River Water During The Month of November

	S 1	***S 2***	***S 3***	***S 4***	***S 5***	***S 6***
pH	*7.08*	*6.95*	*7.14*	*7.10*	*6.58*	*6.75*
EC(µs/cm)	*100*	*80*	*92*	*70*	*50*	*65*
Turbidity (NTU)	*1.2*	*0.5*	*1.8*	*0.75*	*0.15*	*0.25*
TDS	*20*	*16*	*16*	*12*	*14*	*16*
Alkalinity	*85*	*80*	*90*	*96*	*58*	*62*
Hardness	*80*	*60*	*72*	*87*	*20*	*40*
Calcium	*10.5*	*8.2*	*9.3*	*9.5*	*4.2*	*4.4*
Magnesium	*6.5*	*2.6*	*5.8*	*4.4*	*-*	*-*
Chloride	*38*	*19*	*32*	*26*	*16*	*20*
Phosphate	*8*	*-*	*5.5*	*-*	*-*	*-*
DO	*5.9*	*6.7*	*6.1*	*6.5*	*6.9*	*6.6*
COD	*10.8*	*6.8*	*8.5*	*8.9*	*5.5*	*7.2*
Sodium	*4.3*	*3*	*2.8*	*3.2*	*1.2*	*2.6*
Potassium	*2*	*-*	*2*	*-*	*-*	*-*
Sulphate	*10*	*-*	*8*	*-*	*-*	*-*
coliform MPN / 100 ml	*1100*	*460*	*210*	*460*	*210*	*460*

All parameters are expressed in mg/l except pH, EC and turbidity.

Table - 3
Physico-Chemical Parameter of Cauvery River Water During The Month of December

	S 1	***S 2***	***S 3***	***S 4***	***S 5***	***S 6***
pH	*7.25*	*7.08*	*7.2*	*7.15*	*6.55*	*6.8*
EC(µs/cm)	*150*	*88*	*110*	*90*	*70*	*86*
Turbidity (NTU)	*4.1*	*1.2*	*3.8*	*3.2*	*0.25*	*0.35*
TDS	*22*	*16*	*15*	*16*	*14*	*18*
Alkalinity	*106*	*72*	*88*	*90*	*50*	*58*
Hardness	*87*	*56*	*79*	*82*	*27*	*36*
Calcium	*15.5*	*10.2*	*12*	*12.5*	*5*	*5.8*
Magnesium	*7.8*	*3.6*	*6.2*	*6.6*	*-*	*-*
Chloride	*45*	*20*	*28*	*33*	*18*	*22*
Phosphate	*10*	*-*	*6.5*	*4*	*-*	*-*
DO	*5.1*	*6.2*	*5.3*	*5.5*	*6.6*	*6.3*
COD	*13.6*	*8.8*	*11.5*	*10.9*	*4.5*	*6.4*
Sodium	*5.3*	*2.3*	*3.4*	*3.7*	*1.6*	*2.2*
Potassium	*2*	*-*	*2*	*-*	*-*	*-*
Sulfate	*10.6*	*2*	*3.8*	*4*	*-*	*-*
coliform MPN / 100 ml	*>1100*	*150*	*460*	*460*	*93*	*240*

All parameters are expressed in mg/l except pH, EC and turbidity

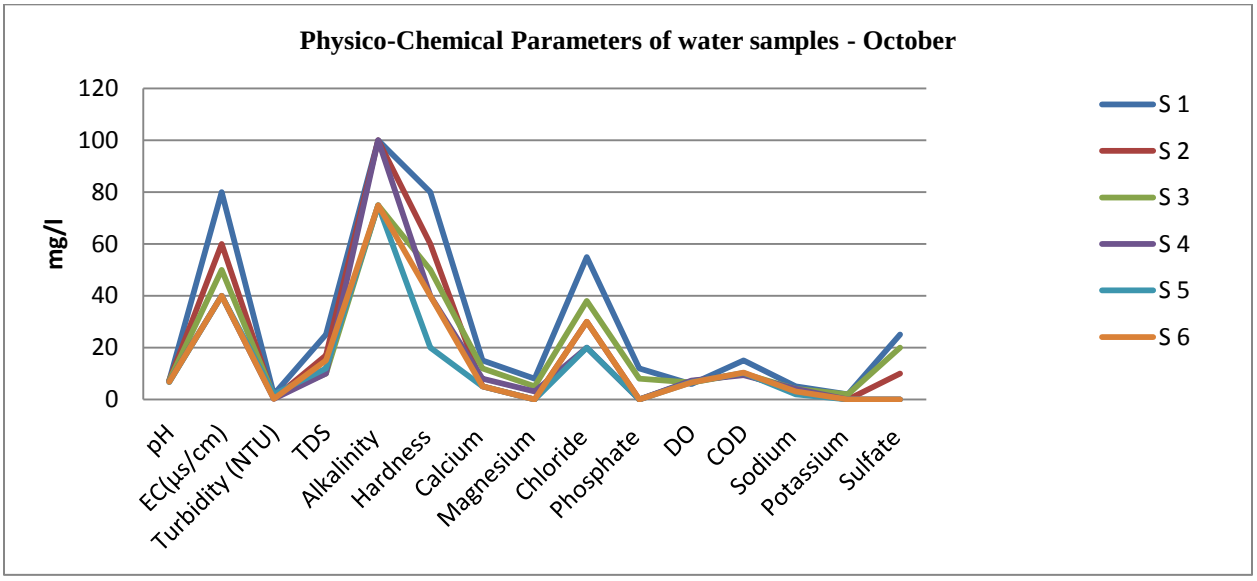

Fig. 1: Physico-Chemical Parameters of Water Sample

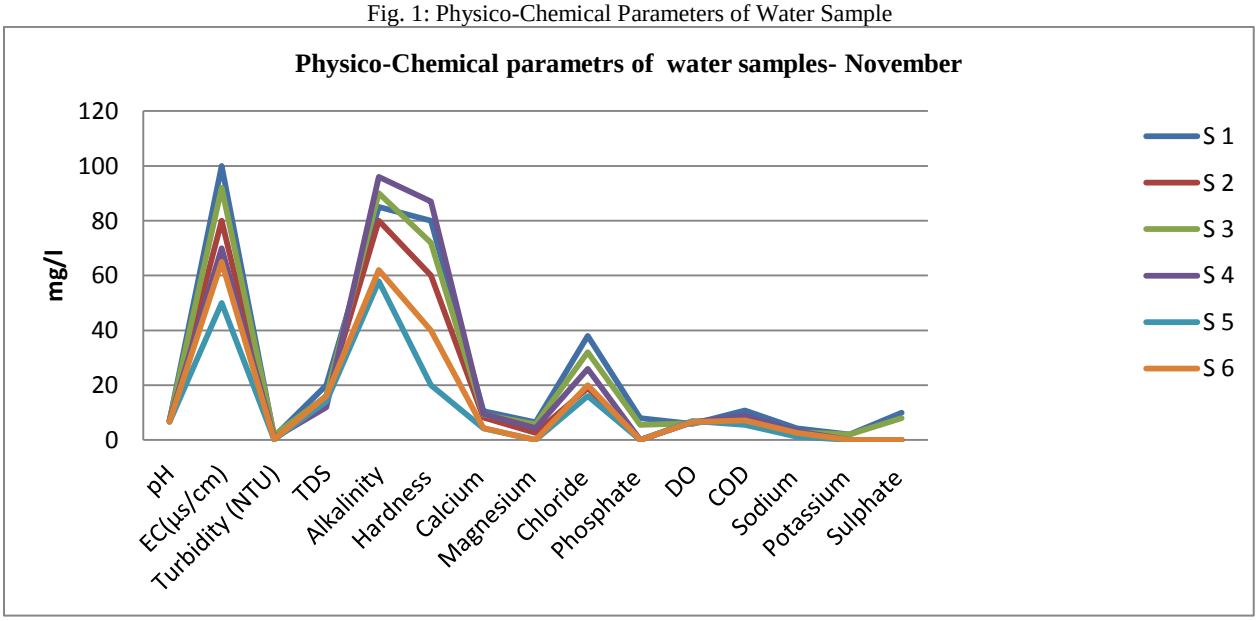

Fig. 2: Physico-Chemical Parameters of Water Sample

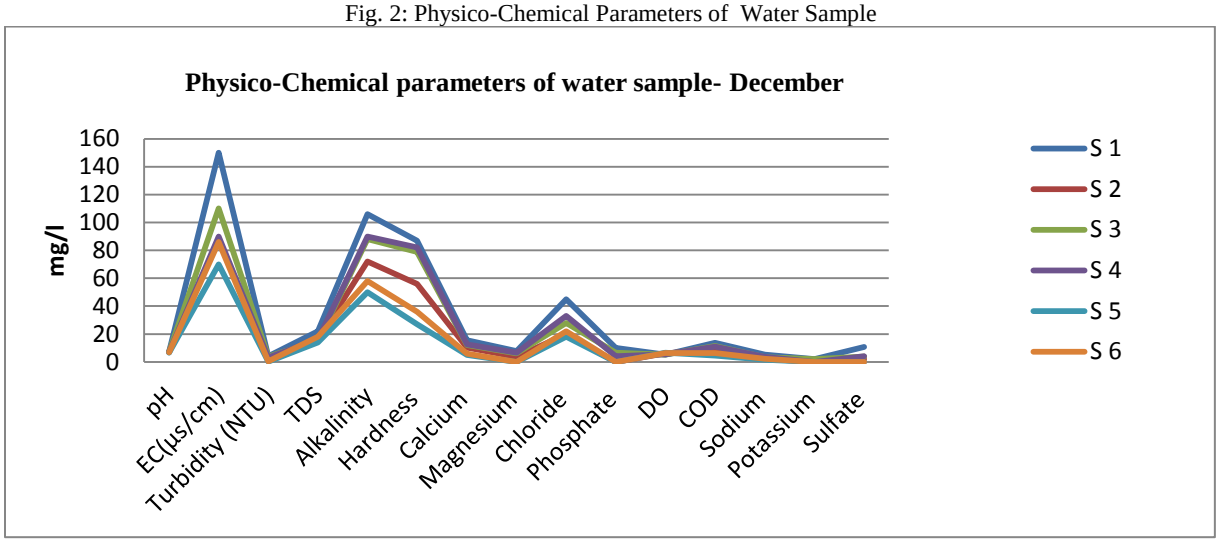

Fig. 3: Physico-Chemical Parameters of Water Sample