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Physicochemical Analysis of Kollidam River, Tamil Nadu, India

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Abstract

The present study was conducted in the time period of one year (January 2011–December 2011) with an aim to find out the physicochemical nature of water at three different sites of Kollidam River in order to analysis the physical properties and chemical nature of its water and the impact of sites on their concentration. Three sites were selected for the study purpose and the samples were collected on monthly basis. The samples thus collected were processed for the detection of physicochemical with their relative concentrations following the standard methods. It was observed that the concentration of this physicochemical was varying with respect to the collection sites, so was the case with respect to its physical nature.

Keywords: *Physicochemical, water, concentration, Kollidam River*

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INTRODUCTION

Water quality is determined by the all physical, chemical and biological factors of water that influence the beneficial use of the water. Water quality is important in water supply, irrigation, fish production, recreation and other purposes to which the water must have been impounded. Water quality deterioration in reservoirs usually comes from excessive nutrient inputs, eutrophication, acidification, heavy metal contamination, organic pollution and obnoxious fishing practices [1]. The use of the physicochemical properties of water to assess water quality gives a good impression of the status, productivity and sustainability of such water body. The changes in physical characteristics like temperature, turbidity, total dissolved solids, electrical conductivity, pH, alkalinity, total alkalinity, total hardness, calcium, magnesium, iron, manganese, free ammonia, nitrite, nitrate, chloride, fluoride, sulphate and phosphate provide valuable information on the quality of the water, the sources of the variations and their impacts on the functions and biodiversity of the River. Rivers are the main inland water resources for domestic, industrial and irrigation purposes and often carry large municipal sewage, industrial waste water discharges and seasonal run-off from agricultural land to the coastal region. It is for this reason that the River water is mostly enriched in nutrients compared to other environments [2].

The spatial heterogeneity within the river, however, is due to existing local environmental conditions such as light, temperature, water discharge and flow velocity that change with time and differences in the lakes and river. Contrary to this, the coastal environments are highly economical, important and are significantly involved in the transport of terrestrial organic matter and associated nutrient elements to the river for their biogeochemical cycling [3]. The balance in the concentrations of biogeogenic elements in river water reflects the healthy status of water, while their excess supply as observed in the continental shelf and upwelling areas has been found to trigger high primary productivity. The present study was taken into consideration in which an attempt was made to access the water quality of Kollidam River. The study would be helpful in formulating control strategy in near future.

MATERIALS AND METHODS

The water samples from three sites of the Kollidam River were collected on monthly

basis and were analyzed for detection of concentration of inorganic substances followed by standard methods [4]. The samples were collected in plastic containers; which were cleaned with dilute nitric acid and rinsed several times with tap water, and finally rinsed once with sample water and finally collected from the habitat. The samples were stored in a refrigerator. Samples were preserved and analyzed by adopting the procedures outlined by standard methods for various parameters [4]. 2 l of water samples were collected in these containers and the physicochemical parameters were tested at Tamil Nadu Water Supply and Drainage Board (TWAD) Cuddalore.

RESULTS AND DISCUSSIONS

The present study determined the physicochemical properties of water at three different sites of Kollidam River from January 2011–December 2011. The present study shows the maximum level of temperature as 30°C in station 3 and minimum level of temperature 26°C was observed in the station 2 of Kollidam River. The average level of temperature 27°C was observed in the station 1 of Kollidam River. The clarity of natural body of water is an important determinant of its condition and productivity. Turbidity in water is caused by suspended and colloidal matter such as clay, silt, finely divided organic and inorganic matter, and plankton and other microscopic organisms. The present study shows the highest level of turbidity 4 NT units in the station 3 and lowest level of turbidity 2 NT units was observed in the station 2 of Kollidam River. The average level of Turbidity 3.5 NT units was observed in the station 1 of Kollidam River. The present study shows the highest level of total dissolved solids (TDS) 788 in the station 3 and lowest level of total dissolved solids (TDS) 315 was observed in the station 2 of Kollidam River. The average level of total dissolved solids (TDS) 504 was observed in the station 1 of Kollidam River.

Electrical conductivity is a measure of the ability of an aqueous solution to carry an electric current. This ability depends on the presence of ions on their total concentration, mobility and valence and on the temperature of measurement [5]. The present study shows the elevated level of electrical conductivity 1125 Mics/cm in the station 3 and minimum level of electrical conductivity 450 Mics/cm was observed in the station 2 of Kollidam River. The average level of electrical conductivity 720 Mics/cm was observed in the station 1 of Kollidam River.

pH is an important parameter which is important in evaluation the acid base balance of water. The present study shows that the maximum level of p^H 8 was recorded in the in the station 3 and minimum p^H 7 was observed in the station 2 of Kollidam River. The average level of p^H 7.8 was observed in the station 1 of Kollidam River.

The alkalinity of natural waters is primarily due to the salts of weak acids, although weak or strong bases may also contribute. Bicarbonate represents the major form of alkalinity with that carbonate and hydroxide alkalinity is also there. The present study shows that the maximum level of alkalinity 2 mg/l was observed in the in the station 3 and minimum level of alkalinity 0.02 mg/l was observed in the station 2 of Kollidam River. The average level of alkalinity 1 mg/l was observed in the station 1 of Kollidam River.

The present study shows the maximum level of total alkalinity 206 mg/l in the station 3 and minimum level of total alkalinity 73 mg/l was observed in the station 2 of Kollidam River. The average level of total alkalinity 116 mg/l was observed in the station 1 of Kollidam River.

Hardness of water is an important consideration in determining the suitability of water for domestic and industrial uses. Hardness is caused by multivalent metallic cations and with certain anions present in the water to form scale. The principal hardness-causing cations are the divalent calcium, magnesium, strontium, ferrous iron and manganese ions. The present study shows the maximum level of total hardness 200 mg/l in the station 3 and minimum level of total hardness 160 mg/l was observed in the station 2 of Kollidam River. The average level of total hardness 164 mg/l was observed in the station 1 of Kollidam River.

The present study shows the maximum level of calcium 53 mg/l in the station 3 and minimum level of calcium 40 mg/l was observed in the station 2 of Kollidam River. The average level of calcium 45 mg/l was observed in the station 1 of Kollidam River.

The present study shows the maximum level of magnesium 25 mg/l in the station 3 and minimum magnesium 16 mg/l was observed in the station 2 of Kollidam River. The average level of magnesium 21 mg/l was observed in the station 1 of Kollidam River.

The present study shows the maximum level of iron 0.40 mg/l in the station 3 and minimum iron 0.28 mg/l was observed in the station 2 of Kollidam River. The average level of iron 0.30 mg/l was observed in the station 1 of Kollidam River.

The present study shows the maximum level of manganese 0.04 mg/l in the station 3 and minimum manganese 0.02 mg/l was observed in the station 2 of Kollidam River. The average level of manganese 0.03 mg/l was observed in the station 1 of Kollidam River.

The present study shows the maximum level of ammonia 0.72 mg/l in the station 3 and minimum level of ammonia 0.02 mg/l was observed in the station 2 of Kollidam River. The average level of ammonia 0.45 mg/l was observed in the station 1 of Kollidam River.

The present study shows the maximum level of nitrite 0.56 mg/l in the station 3 and minimum nitrite 0.20 mg/l was observed in the station 2 of Kollidam River. The average level of nitrite 0.46 mg/l was observed in the station 1 of Kollidam River.

The present study shows the maximum level of nitrate 10 mg/l in the station 3 and minimum level of nitrate 3 mg/l was observed in the station 2 of Kollidam River. The average level of nitrate 8 mg/l was observed in the station 1 of Kollidam River.

Table 1: *Physicochemical Properties of Water at Three Different Sites of Kollidam River from January 2011 to December 2011.*

Parameters	Station 1 Average	Station 2 Minimum	Station 3 Maximum
Temperature (°C)	27	26	30
Turbidity (NT units)	3.5	2	4
Total dissolved solids (TDS)	504	315	788
Electrical conductivity Mics/cm	720	450	1125
p^H	7.8	7	8
Alkalinity (mg/l)	1	0.02	2
Total Alkalinity (mg/l)	116	73	206
Total hardness (mg/l)	164	160	200
Calcium (mg/l)	45	40	53
Magnesium (mg/l)	21	16	25
Iron (mg/l)	0.30	0.28	0.40
Manganese (mg/l)	0.03	0.02	0.04
Ammonia (mg/l)	0.45	0.26	0.73
Nitrite (mg/l)	0.46	0.20	0.56
Nitrate (mg/l)	8	3	10
Chloride (mg/l)	84	49	243
Fluoride (mg/l)	0.1	0.1	0.20
Sulphate (mg/l)	15	10	90
Phosphate (mg/l)	0.14	0.10	0.25

Chlorides occur naturally in all types of waters. High concentration of chlorides is considered to be the indicator of pollution due to organic wastes of animal or industrial origin. Chlorides are troublesome in irrigation water and also harmful to aquatic life [6]. The present study shows the maximum level of chloride 243 mg/l in the station 3 and minimum level of chloride 49 mg/l was observed in the station 2 of Kollidam River. The average level of chloride 84 mg/l was observed in the station 1 of Kollidam River.

Fluoride concentration is an important aspect of hydro geochemistry because of its impact on human health. The present study shows the maximum level of fluoride 0.20 mg/l in the station 3 and minimum level of chloride 0.1 mg/l was observed in the station 2 of Kollidam River. The average level of chloride 0.1 mg/l was observed in the station 1 of Kollidam River.

The high levels of physic-chemical parameter in the station 3 were due to industrial wastes, agricultural wastes, domestic wastes, human activities like heavy vehicle washing, clothing and bathing of cattle is high in the investigated area.

The sulphate content of natural waters is an important consideration in determining their suitability for public and industrial supplies. The present study shows the maximum level of sulphate 90 mg/l in the station 3 and minimum level of sulphate 10 mg/l was observed in the station 2 of Kollidam River. The average level of sulphate 15 mg/l was observed in the station 1 of Kollidam River.

Phosphate and nitrate determinations are important in assessing the potential biological productivity of surface waters. Increasing concentration of phosphorus and nitrogen compounds in rivers, lakes and reservoirs leads to eutrophication [7].

The present study shows the maximum level of phosphate 0.25 mg/l in the station 3 and minimum phosphate 0.10 mg/l was observed in the station 2 of Kollidam River. The average level of phosphate 0.14 mg/l was observed in the station 1 of Kollidam River. The reason for the prolonged effect was attributed to the washing of leachates into the river from unconfined spoil dumps [8].

Table 1 summarizes the physicochemical properties of water at three different sites of Kollidam River from January 2011 to December 2011.

CONCLUSION

From the present study it is clear that the water quality of Kollidam River has been degraded qualitatively and the concentration of some constituents has passed the permissible limits and this could pose a great threat to the all kinds of life directly or indirectly therefore steps must be taken to protect this rivers.

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