River Water Pollution:A Case Study on Tunga River At Shimoga-Karnataka

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***Abstract*— Tunga River has been one of the most prominent and important river of Karnataka in Shimoga District. Unfortunately, certain stretches of River Tunga are much polluted. Various urban centers are located on the banks of Tunga River, draw fresh river water for various activities. In almost the entire wastewater generated by these centers is disposed off into the river. The objective of the monitoring studies undertaken for water body is to assess variation in water quality with time. Four sampling stations were selected along the river for sampling purpose from August 2013 to August 2014.Water samples were analyzed in terms of physico-chemical water quality parameters.**

Keywords*— *Thunga River, water quality, point pollution, Physico-chemical parameters

1. INTRODUCTION

In nature, water is the essential fluid from which all life begins. All living things need water to maintain their life too. In domesticity, it is very useful, such as for washing and cleaning. In industry, it is the common solvent for Paper and water, textile and electroplating. Besides, the generation of electricity also requires water. It has many uses. However, it can be easily polluted. Pollutants deteriorate the quality of the water and render it unfit for its intended uses [1]. The pollution of rivers and streams with chemical contaminants has become one of the most critical environmental problems of the century. It is estimated that each year 10 million people die from drinking contaminated water. Water is one of the most common and precious resources on the earth without there would be no life on earth [2]. Pollution is a serious problem as almost 70% of India's surface water resources and a growing number of its groundwater reserves have been contaminated The quality of water is described by its physical, chemical and microbiological characteristics. Therefore a regular monitoring of river water quality not only prevents outbreak of diseases and checks water from further deterioration, but also provides a scope to assess the current investments for pollution prevention and control. In this study, seasonal variations of physico-chemical and bacteriological characteristics of water quality in Tunga river was assessed in Shimoga town in Karnataka.

2.MATERIALS AND METHODS

A. Study Area

Shimoga is town, situated between the North and South branches of river Tunga. It is located on the Bangalore – Honnavar highway.Though it is a town of medium population, the temples and historically significant monuments of this town attracts a large number of tourist people resulting in a very high floating population. Because of this reason the river Tunga along Shimoga town stretch is prone to anthropogenic activities such as bathing, washing and disposal of wastes. The ground level in the town slopes towards river so that most of the storm and sewerage drains discharge into river Tunga. There are two stream monitoring stations and 15 drains located in this town stretch

B. Monitoring Stations

Station - S1
Station S1 is located on the north side of the river, near the Shimoga – Thirthahalli new bridge. It is an upstream station and near this station water is being drawn for supply to the town.
Station - S2
This station is about 300 m downstream of station S1.The station S2 is located on a drain that enters the river from the industrial town areas. The flow in the drain is mainly comprised of industrial waste.
Station - S3
The station S3 is an most affected station and is positioned near the Vinayaka temple(Ramanna shetty park). It is downstream of the sewage disposal point from the station S3. A bathing ghat exists near this Station.
Station – S4
Station S4 is located on the south side of the river, near the Shimoga – Bhadravathi new bridge. Two number of sewage drains dispose city sewage water in to the river directly.

C. Data Preparation

The data sets of 4 water quality monitoring stations which comprised of 10 water quality parameters monitored monthly over 2 years (2013-2014) are used for this study. The data is obtained from the water Quality Monitoring work of Tunga River Basin in Shimoga District,

Karnataka State Although there are more water quality parameters in these stations, only 10 most important parameters are chosen because of their continuity in measurement through the 12 years. The 10 selected water quality parameters include Dissolved Oxygen (DO), Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Chlorides (Cl), Total Dissolved Solids (TDS), Conductivity, Temperature and pH.

D. Analysis of samples

The water samples were collected from each of the five selected stat ions according to the standard sampling methods (IS: 2488, 1966; APHA, 1998).Samples for estimating dissolved oxygen (DO) and biochemical oxy gen demand (BOD) were collected separately in BOD(glass) bottles. Water temperature was recorded on the spot using thermometers.

3. RESULT AND DISCUSSION

Temperature was found to be ranged between 14 ^{0}C (minimum) to 28^{0}C (maximum) with average value of 21^0+9.9^{0}C from all the sites. Impinging solar radiation and the atmospheric temperature brings interesting spatial and temporal changes in natural waters. The rise in temperature of water accelerates chemical reactions, reduces solubility of gases, amplifies taste and odour and elevates metabolic activity of organisms (Usharani et al., 2010).

pH of the aquatic system is an important indicator of the water quality and the extent pollution in the watershed areas. pH was recorded to be varying from 6.43 (minimum) to 9.13 (maximum) with an average value of 7.78+1.91 from all the sites (Jonnalagadda et al.,2001). It has been mentioned that the increasing pH appear to be associated with increasing use of alkaline detergents in residential areas and alkaline material from wastewater in industrial areas (Chang, H., 2008)

Conductivity is a good and rapid method to measure the total dissolved ions and is directly related to total solids. Higher the value of dissolved solids, greater the amount of ions in water (Bhatt.,1999). The range of Electrical conductivity from all the sites was recorded as 340.00 µmhos (minimum) to 734.00 µmhos (maximum) with an average value of 537.00+278.60 µmhos

The value of Dissolved Oxygen is remarkable in determining the water quality criteria of an aquatic system. In the system where the rates of respiration and organic decomposition are high, the DO values usually remain lower than those of the system, where the rate of photosynthesis is high (Mishra et al., 2009). During the study period DO was found to be ranging between 4.90 mg/l (minimum) to 8.50 mg/l (maximum) from all the sites with an average value of 6.70+2.55 mg/l.

Biochemical Oxygen Demand is a measure of the oxygen in the water that is required by the aerobic organisms. The biodegradation of organic materials exerts oxygen tension in the water and increases the biochemical oxygen demand (Abida, 2008).BOD has been a fair measure of cleanliness of any water on the basis that values less than 1-2 mg/l are considered clean, 3 mg/l fairly clean, 5 mg/l doubtful and 10 mg/l definitely. During the study period BOD varied from 3.00 mg/l (minimum) to 8.00 mg/l (maximum) with an average value of 5.50+3.54 mg/l at all the sites.

Chemical Oxygen Demand is a measure of the oxidation of reduced chemicals in water. It is commonly used to indirectly measure the amount of organic compounds in water. The measure of COD determines the quantities of organic matter

found in water. This makes COD useful as an indicator of organic pollution in surface water (King et al., 2003).COD pointing to a deterioration of the water quality likely caused by the discharge of municipal waste water (Mamais et al., 1993). In the present study COD was found to be ranging from 11 mg/l (minimum) to 24 mg/l (maximum) with average value of 17.50+9.19 at all the sites.

Alkalinity of water is a measure of weak acid present. Total alkalinity of water is due to presence of mineral salt present in it. Alkalinity was ranged between 123.00 mg/l (minimum) to 240.00 (maximum) mg/l with average value of 181.50+82.73 mg/l from all the sites.

Total hardness is the parameter of water quality used to describe the effect of dissolved minerals (mostly Ca and Mg), determining suitability of water for domestic, industrial and drinking purpose attributed to presence of bicarbonates, sulphates, chloride and nitrates of calcium and magnesium (Taylor, 1949). The variation in Total hardness during study period at all the sites was recorded as 230.00 mg/l to 475.00 mg/l with average value of 352.50+173.24 mg/l

Chlorides occur naturally in all types of water. High concentration of chloride is considered to be the indicators of pollution due to organic wastes of animal or industrial origin. Chlorides are troublesome in irrigation water and also harmful to aquatic life (Rajkumar, 2004). The levels of chloride in the present study were ranging from 18.00 mg/l (minimum) to 32.00 mg/l (maximum) with an average value of 25.00±9.90 mg/l at all the sites.

Fluoride concentration is an important aspect of hydrogeochmistry, because of its impact on human health. The recommended concentration of Fluoride in drinking water is 1.50 mg/l. The values recorded in this study was ranged between 0.40 mg/l (minimum) to 1.20 (maximum) mg/l with an average value of 0.80±0.57 mg/l from all the sites.

Table 1: Physico-chemical qualities of river water

Parameter	Minimum	Maximum	Average
Temperature (^{0}C)	14	28	21
pH	6.43	9.13	7.78
Conductivity (mg/l)	340	743	537
D.O. (mg/l)	4.9	8.5	6.7
BOD (mg/l)	3.0	8.0	5.5
COD (mg/l)	11.0	24.0	17.5
Alkalinity (mg/l)	123.0	240.0	181.5
TH (mg/l)	230	475	352.5
Chloride (mg/l)	18	32	25
Fluoride (mg/l)	.4	1.20	0.8

Where D.O.= Dissolved Oxygen, BOD= Biochemical Oxygen Demand, COD= Chemical Oxygen Demand, TH= Total Hardness.

4.CONCLUSION

The present study concluded that river water of study area was moderately polluted in respect to analyzed parameters. pH, total hardness, chloride and fluoride were found within permissible limit but the higher values of BOD and COD in present study attributed river water was not fit for drinking purpose. It needs to aware local villagers to safeguard the precious river and its surrounding

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