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A STUDY ON RECENT PHYSICO-CHEMICAL PARAMERERS OF MUSI RIVER WATER AND THEIR IMPACT ON HUMAN LIFE

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Abstract: *Musi river is in the state of Telangana, India and it is a tributary to Krishna river and it is one of the most polluted rivers in the country. The revitalization of Musi river is an ambitious project of the Telangana state government. Musi river flows through Hyderabad and many other villages and small towns across the state. Hyderabad and surrounding areas are main contributors for pollution of Musi river water through sewage and effluents from many industries especially pharmaceutical industries. In present study, an investigation of physico-chemical parameters of Musi river water at three different points along the Musi river bed is carried out. Water samples were collected in the first week of August 2022, after recent heavy flows into Musi river due to heavy rains in the month of July in catchment areas. The river water samples collected at three different points were investigated for Colour, Odour, pH, Electrical Conductance (EC), TDS, Turbidity, CO_3^{2-}, HCO_3^{2-}, Cl^-, F^-, NO_3^-, SO_4^{2-}, Na^+, K^+, Ca^{2+}, Mg^{2+}, Total Hardness (TH), BOD and COD.*

Index Terms: **Musi river water, pollution, TDS, BOD, and COD**

I. INTRODUCTION

World Water Forum II in Den Hang in March 2000 has predicted that clean[1] water services for communities are still difficult to implement and India is one of the countries where for much of the population regular supply of safe drinking water is still far from reality. Musi river originates in Ananthagiri hills near Vikarabad which is around 90 kilometers from Hyderabad in the state of Telangana, India. It flows through Hyderabad and many villages and small towns before merging into Krishna river at Vadapally in Nalgonda district of Telangana state. A dam is built across Musi river at Solipet in Suryapet district of Telangana state. This medium sized Musi reservoir provides water for irrigation to many near by villages. The reservoir also acts as source of drinking water by filling water bodies and lakes in the near by villages.

In the recent past the main factors polluting the water bodies are produce of waste water due to increased population, urbanization, domestic, industrial and commercial sectors[2-6]. Day by day as world population increases, the demand for food production, industrial activities and domestic purposes grow resulting in heavier withdrawals of the water from limited renewable fresh water resources[7-9]. The industrial wastage as well as domestic sewage/wastage are disposed in the rivers and release of wastes containing wide variety of organic and inorganic pollutants including solvents, oils, grease, plastics, plasticizers, phenols, heavy metals, pesticides and suspended solids are hazardous substance into rivers which lead to environmental disturbance[10-12]. Nearly all water bodies are effected by pollution including ground water. In many developed countries, water pollution is a major problem and many river basins have been found to show high organic matter concentration. Polluted water loses its economic and aesthetic value. Over the years, water pollution has emerged as an important issue in India as most of the rivers are polluted, which are having substantial negative impact on human health and aquatic life.

Hyderabad is fifth largest city in India consisting of twin cities of Hyderabad and Secunderabad with a population of around 12 million. With this huge population Hyderabad city and surrounding areas generate large amount of domestic sewerage on daily basis[13]. The twin cities of Hyderabad and Secunderabad and the surrounding areas are spread over

approximately 7,000 square kilometers and Hyderabad city itself discharges around 600 million liters per day of untreated sewerage into Musi river[14,15]. In addition to this the city and its surrounding areas also have massive establishments of industries, the bulk of them are pharmaceutical industries, which have an impact on water quality due to irresponsible disposal of waste water and effluents. The city has no outlet for sewage and waste water disposal other than Musi river. Thus, river in the city has changed into a sewage canal, presents very grave river ecology, and is a source of contamination for even the ground water in the areas around of Musi river.

II MATERIALS AND METHODS

Sample Collection

River water samples were collected at three different locations.

Location 1: Vikarabad, which is near to Ananthagiri hills, the origin point of the Musi river (Fig. 1).

Figure 1: Ananthagiri hills near Vikarabad the origin point of Musi river

Location 2: Nagole, which is to east of Hyderabad city, by which point most of Hyderabad city sewage enters into the river body (Fig. 2).

Figure 2: Nagole to the east of Hyderabad

Location 3: Musi reservoir, located in Suryapet district of Telangana state, India (Fig. 3)

Figure 3: Musi reservoir

Methodology

The physical and chemical properties of water samples were analysed by using the following standard methodologies for water quality assessment.

Colour: Colour in the water is due to dissolved extracts from metals in rock, from organic matter in soil and plants and from industrial products. Colour identified by visual methods.

Odour: odour is not a direct significance but it indicates the quality of water or pollution. Dark colour water usually gives unobjectable odour.

pH (Hydrogen Ion Concentration): pH of water samples was determined by using pH meter of the range 0 to 14.

Electrical Conductivity (EC): Electrical conductivity is a measure of water's capability to pass electrical flow which\h\ \is directly related to concentration of ions in water. These conductive ions come from dissolved salts and inorganic material such as alkali, chlorides, sulphate and carbonate compounds. Electrical conductivity of water samples was measured by using standard conductivity meter and expressed as µmho/cm.

Total Dissolved Solids(TDS): TDS concentration is expressed as mg/L. The water samples were filtered to remove any suspended particles. A dry evaporating dish was taken and its weight was determined. The filtrate of water sample was taken in the weighed dry evaporating dish and heated to evaporate water completely. Then the left out solids along with dish were brought to room temperature and weighed. The empty dish weight was subtracted from this weight to know the weight of dissolved impurities[16].

Turbidity: Turbidity is due to mud and some minerals. It represents the water quality. Turbidity is estimated by using Nephelometer.

Alkalinity: Alkalinity is mainly due to presence of hydroxide (OH^-), carbonate (CO_3^{2-}) and bicarbonate (HCO_3^{2-}) compounds. In present study it is mainly due to carbonate and bicarbonate compounds of sodium, potassium, magnesium and calcium ions. Alkalinity was estimated by titration and expressed as $CaCO_3$mg/L.

Chloride (Cl^-): Chloride ion concentration was estimated by AgNO3 titration method and expressed as mg/L.

Fluoride (F^-): Fluoride content was measured by Ion meter and expressed as mg/L.

Nitrate (NO_3^-): Nitrate content was estimated by using UV spectrophotometer at standard wavelengths and water sample were diluted to facilitate the absorbance in the standard wavelengths[17].

Sulphate (SO_4^{2-}): Sulphate concentration was estimated with the help of Nephelometer by using standard solutions as control and expressed in Nephelometer turbidity units(NTU)[18-19].

Total Hardness (TH): The harness in water is due to carbonates, bicarbonates, chlorides and sulphates of calcium and magnesium ions. The total hardness determines the total concentration of calcium and magnesium ions reported as calciumcarbonate. The total harness in the water samples was estimated by Ethylene Diamine Tetra Acetate (EDTA) complexo-metric titration method and expressed as mg/L of $CaCO_3$.

Biological Oxygen Demand (BOD): BOD is amount of oxygen consumed by microorganisms while stabilizing or degrading, carbonaceous and nitrogenous compounds under aerobic conditions. The BOD test is used to indicate the strength of wastes in the water and is used to to protect aquatic life from oxygen tendency. If the amount of organic matter in sewage is more, the more oxygen will be utilized by bacteria to degrade it. Domestic and industrial dumping in river water leads to more digestion of organic matter which results into more percentage of BOD. In the present study the BOD in water samples was estimated by Winkler method[20] by incubating the samples at 20°C for five days in the dark under aerobic conditions.

Chemical Oxygen Demand (COD): COD determines the oxygen required for chemical oxidation of organic matter. COD estimates the amount of organic matter in water more accurately than BOD method. COD method of estimation of organic matter is easier and more sophisticated method than BOD method.

III RESULTS

The results of different parameters for water samples at three different locations are given in Table 1.

Table 1: Results of physic-chemical properties of Musi river water at three different locations

S. No	Property	Location 1 (Vikarabad)	Location 2 (Nagole)	Location 3 (Musi reservoir)
1	Colour	Clear	Black	Grey
2	Odour	Odourless	Very bad	Bad
3	pH	6.0	7.5	6.9
4	Turbidity (NTU)	7.5	18.6	12.2
5	TDS (mg/L)	110	1340	920
6	Electrical Conductance (EC) (µmho/cm)	520	2940	1560
7	Alkalinity (mg/L)	210	640	320
8	Chloride (mg/L)	18	262	175
9	Fluoride (mg/L)	0.1	0.6	0.8
10	Nitrate (mg/L)	10	32	30
11	Sulphate (NTU)	25	40	32
12	Total Hardness (TH (mg/L)	250	530	440
13	Biological Oxygen Demand (BOD)	6.4	38.1	16.5
14	Chemical Oxygen Demand (COD)	10	74.8	42

IV DISCUSSION

Colour and Odour: At location 1 which is origin of the river, water was clear and almost odourless. At location 2, by which most of the city waste is discharged into the river basin, the colour is almost black and the odour is unbearable. At location 3, which is around 120 kilometers from city, there is improvement in colour and odour but still not suitable for any sort of usage, either for domestic or for agriculture.

pH: As mentioned in Table 1, the highest pH is found at location 2 and lowest pH at location 1. This is as expected because as location 2 is the most polluted part of the river due to large domestic sewerage/wastage discharged into Musi river from the city ahead of this location.

Turbidity: Turbidity also highest at location 2 due more sewerage than other locations

Total Dissolved Solids: Total dissolved solids are exceptionally high at location 2 indicating large disposal of soluble wastage from city. It can also be seen that these dissolved solids are still remaining at location 3 as well indicating the long distance flow of river is not much effecting this parameter.

Electrical Conductance: It is highest at location 2 which is in accordance with TDS which is also highest at location 2.

Alkalinity: Alkalinity levels of location 2 and location 3 are very which may be beyond permissible limit. Alkalinity levels at location 1 are minimum.

Chloride and Fluoride: Chloride levels are ranging from 18 to 175 mg/L . Fluoride levels in samples of location 2 and location 3 are very high indicating not suitable for domestic usage. Fluoride level at location 1 is very less.

Nitrate: Due to the industrial and domestic wastage the nitrate content is highest at location and keeping almost the same level at location 3. This indicates that water at location 2 and location 3 is not suitable for either drinking or agriculture.

Sulphate: In general sulphate occurs in natural water and it is one of ions contributing towards water hardness along with Ca^{2+} and Mg^{2+} ions. Location 2 and location 3 have very high sulphate content. At the same time the origin site of the Musi river, location 1, is also showing high sulphate content.

Total Hardness: Total harness is a measure of Ca and Mg content in water. It is highest at location 2 but also high at location 2. This indicates that pollution is not the only factor for total hardness in water.

Biological Oxygen Demand: BOD is highest at location 2 due to much dumping of organic waste from domestic sewage ahead of this location.

Chemical Oxygen Demand: COD also very high location 2 which also indicates lot of organic water entering to river bed ahead of location 2.

V CONCLUSIONS

In conclusion, analysed different physico-chemical parameters of Musi river water, especially at location 2 and location 3, indicate that the river water at these locations is highly polluted. From Musi reservoir, location 3, as the water is used for agriculture and domestic purposes it will drastically impact the human life either directly or indirectly. The aquatic life is effected directly in the Musi river and indirectly in many water bodies in near by villages which receive water either from Musi river or from Musi reservoir. Because of highly polluted water the people living in Hyderabad city and also people living downstream have many health problems. The problems are doubled as ground water also get polluted and not suitable either for agriculture or domestic purpose. So it is critical time for all the concerned authorities to take the problem pollution of Musi river seriously and take up the necessary actions on war putting basis to stop further damage to human life.

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