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ORIGINAL ARTICLE

Physico-chemical Analysis of Yamuna River Water at Agra, Uttar Pradesh, India

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ABSTRACT

The present study was carried out to determine the physico-chemical properties of Yamuna River water from nine different sampling sites in Agra City. River water samples were collected from nine locations (viz Kailash Mandir, Pohiya Ghat, Balkeshwar, Hathi Ghat and Tajganj) of Agra City, during the months of March and April, 2017 and River water samples were taken to the laboratory and analyzed. The analysis was done for the parameters like Turbidity, pH, Total Dissolved Solids, Electrical Conductivity, Total Hardness, Total Alkalinity, Chloride, Calcium and Magnesium. pH shows that Yamuna River water is alkaline in nature. Turbidity and Total Dissolved Solids were found above the WHO permissible limits.

Key words: *Yamuna, river, physico-chemical and water*

INTRODUCTION

Water is the most essential and prime necessity of life. It is an essential requirement for the life supporting activities. It is considered as plentiful and in expensive natural resources since prehistoric period. Surface water generally available in Rivers, Lakes, Ponds and Dams is used for drinking, irrigation and power supply etc. The usual source of drinking water is from streams, rivers, wells and boreholes which are usually not treated. The quality of various water system depends on the presence of Inorganic and organic ingredients in dissolved and suspended from and their balance is essential to maintain the water quality. Quality of water generally refers to the component of water, which is to be present at the optimum level for suitable growth of plants and animals. All most 75% of the water in India has become polluted due to discharge of domestic sewage municipals waste drains urban agricultural waste large scale of industrial effluents nearby mixs in the river and make the river water as contaminated one (Mishra *et al.*, 2009 and Barde *et al.*, 2015). Aquatic organisms need a healthy environment to live and have adequate nutrients for their growth. The productivity depends on the physicochemical characteristics of the water body. The maximum productivity obtained when the physical and chemical parameters are at optimum level. The Yamuna is the largest tributary river of the Ganges (Ganga) in northern India, originating from the Yamunotri Glacier at a height 6,387 meters on the south western slopes of Banderpooch peaks. The cities of Delhi, Mathura and Agra lie on its banks. Yamuna is one of the most polluted rivers in the world. Agra is situated in western U.P. between 27.11' degree Latitude North and 78.0' degree to 78.2' degree Longitude East. Its Altitude is 169 meters above sea level. The objective of this study is to investigate the physicochemical analysis of Yamuna River in Agra City.

MATERIAL AND METHODS

DESCRIPTION OF THE STUDY SITES:

Water samples were collected at following designated sampling locations identified on the basis of disposal of raw sewage and occurrence of industries which are responsible for point source of contamination for the river. The sampling locations are as follows: (S1) Kailash Mandir, (S2) Pohiya Ghat, (S3) Balkeshwar, (S4) Hathi Ghat and (S5) Tajganj.

COLLECTION AND CHARACTERIZATION OF WATER SAMPLES:

Water samples from the River were collected on weekly basis from 5 selected locations in 2 liter airtight plastic bottles. Thereafter all the samples were transferred to the regional laboratory of Uttar Pradesh Pollution Control Board, Agra and preserved in refrigerator (4°C) prior to processing

and analysis. All the samples were analyzed in the regional laboratory of Uttar Pradesh Pollution Control Board, Agra. All the water quality parameters were analyzed according to the standard methods26. The monitoring was made over a period of 6 months (May- October, 2017), comprising of two sessions i.e. pre-monsoon and post-monsoon. All measurements were done in triplicates. Distilled water was used for experimental purpose. A comparison of analyzed physico-chemical parameters of river Yamuna as observed with drinking water quality standards (Indian) was given in table 1.

Table 1: Physico-Chemical Analysis of Yamuna River at Agra Pre-Monsoon 2017

S.No	Parameters	Kailash Mandir Site-1	Pohiya Ghat Site-2	Balkeshwar Site-3	Hathi Ghat Site-4	Tajganj Site-5
1	PH	8.10	8.8	8.2	7.5	7.0
2	Electric Conductivity (E.C.)	2.965	1.0550	1.0520	1.045	0.95
3	Total Dissolve Solids (TDS)	1950	1820	1650	950	780
4	Alalinity	320	305	290	185	160
5	Total Hardness (TH)	490	130	320	360	240
6	Dissolved Oxygen (DO)	2.8	2.5	4.9	5.2	4.5
7	BOD	24.5	20.7	15.5	11.5	6.8
8	COD	142	120	105	85.5	32.5
9	Calcium	120	109	105	95.5	77
10	Magnicium	75	68.5	70	58.5	46
11	Sulphate	420	385	310	265	125
12	Nitrates	55	45.7	35.5	28	17
13	Chlorides	280	250	270	220	160
Expect PH and EC (ds/m), all unit are in mg/L						

RESULT AND DISCUSSIONS

The various Physico-Chemical parameters of river water are presented in the Table-1

PH values (7.0 to 8.10) of all sites were closed to recommended value (6.8-8.5) of water for drinking purpose. With the exception site-1 (Kailash Mandir) having a little higher PH value (slight alkaline). It was noticed that the PH value of the water appears to be dependent upon the relative quantities of calcium, carbonates and bicarbonates. The water trends to be more alkaline when it possessed carbonates (Solanki *et al.*, 2005). Electrical conductivity values closely correlated with content of total dissolved solids. EC values were as per US guide lines for potable water and irrigation water and were less than 0.7 ds/m. The water sample having 0.7-3.0 ds/m values of EC are considered as moderately contaminated and those with EC higher than 3.0 ds/m are regarded as severally contaminated water it higher values were recorded at site-1 (Kailash Mandir) 2.965. In the present study, the EC value falls in the moderate contaminated category. Similar observation was observed by Krishna Murthy and Bharti (1994) for Kalu River in North Karnataka. Total dissolved solids denote presence of different minerals in water, TDS is mainly on account of carbonates, bicarbonates, chlorides, sulphates, phosphate nitrate, calcium, potassium, Iron (Baanerjee *et al.*, 2014) TDS level tested at all sites were within the permissible limits. A high value was observed at site-1 (Kailash Mandir) and site-2 (Pohiya Ghat). Alknity is a measure of the capacity of water to absorb hydrogen Ion. The higher value of alkalinity indicates presence of bicarbonates, carbonates and hydroxide in water body (Jain et al 2000). Alkalinity levels tested at all sites within the permissible limits (160-320 mg/l) as recommended by BIS (1991). Hardness is caused by the presence of soluble salt of ca. mg. sr. fe. & mn. It is characterized by reduction of lather efficiency of water with soap. In the present investigation the hardness values ranged from 240-490 mg/l the all site were found within the permissible limits by BIS 1991. Dissolved oxygen content is an indicator of organic pollution its value was observed ranged (2.5-5.2 mg/l).

Its valued lover than 4 mg/lare not suitable for aquatic life. Dissolve oxygen at different site fluctuated from 2.5-5.2 mg/l being very low at site-1 (Kailash Mandir) and site-2 (Pohiya Ghat).

This may be due to the microbial decomposition of organic component of sewage and industrial water in the river water. Dissolved oxygen of water used by micro organism in the biological oxidation of organic matter is reflected in terms. The high BOD value indicates more organic wate present in the water source the ranged from BOD observed in 6.8-24.5 mg/l the maximum BOD found at site-1 (Kailash Mandir), Site-2 (Pohiya Ghat) and site-3 (Balkeshwar) the observed result are in close arrangement with study of Jangala and Vaishnav (2012) in Korba District, C.G. India. These value are above the standard limit for drinking water suggested BIS 1991. During the study period, chemical oxygen demonel (COD) value ranged between 32.5-142 mg/l the maximum value are observed at site-1 (Kailash Mandir) which may ascribe to high concentration of organic material source. These ranged of value are higher that the maximum permissible limit as per BIS (1991) suggesting that water sample is more severely affected with organic pollution. Desirable limit of calcium ION in drinking water is 75 mg/l and permissible limit is 200 mg/l (BIS 1991) its concentration ranged from 77-120 mg/land was within the site-1 (Kailash Mandir) recofed slight higher value of calcium. The desirable limit of magnesium for drinking water is 30 mg/l and permissible limit is 100 mg/l (BIS 1991) its higher value observed at site-1 (Kailash Mandir) Mathivanan et al (2005) were of the opinion that higher value of calcium and magnesium may be due to addition of salt from detergents and other man made activities due to lack of effluent facilities and proper disposal system of waste water, water bodies are gatting polluted day by day causing adverse effect on soil flora and fanna. The sulphate concentration ranged from 125-420 mg/l. The maximum value was found in water sample collected from site-1 (Kailash Mandir) which can be attributed to the discharge of domestic sewage and organic wastes in the study area. Excess amount of sulphate may have laxative effect.

The desirable limit for chlorides is of 250 mg/l as prescribed by BIS (1991). Presence of higher level of chlofides is considered as pollution indicator (Joshi *et al.*, 2009). The chloride concentration ranged from 160-280 mg/l. Chloride concentrations were slightly high at site-1 (Kailash Mandir) and site-3 (Balkeshwar). Higher values of these urban sites are due to large amount of sewage discharges and increased rate of decomposition of organic matter because of high temperature during pre-monsoon season (Khanna and Bhutani 2003). The nitrate concentrations ranged from 17-55 mg/. Higher values were observed at site-1 (Kailash Mandir) and site-2 (Pohiya Ghat) because of mixing of various effluents from industries and other waste material similer observations were made by Shridhar *et. al.* (2006) in the palk bay of south east coast of India.

CONCLUSION

The present study revealed deterioration in the water quality of river Yamuna on the high pollution level at the some stations. In view of the findings made in the present study following recommendations are made for better water quality management of the river. The local public has to be informed about proper waste disposal and the importance of clean water. The municipal waste sanitary effluents domestic sewage and industrial effluents should not be discharged into the river. Instead a central sewage system must be provided for first there while the industrial effluents should be treated properly before they are drained out. City garbage should be dumped into low lying areas and proper separation of the biodegradable and non biodegradable materials should be done. Regular monitoring of drinking water sources should be done.

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