RESEARCH ARTICLE

SAMRIDDHI Volume 12, Issue 1, 2020 Print ISSN: 2229-7111 Online ISSN: 2454–5767

Physiochemical Analysis of Gomti River in Lucknow City, Uttar Pradesh

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Abstract

River water is significant for every living organism. In Indian mythology, rivers are given the status of Goddesses and were worship. Modernization and urbanization have polluted the river water and degraded their status. Assessment of water quality and determination of pollution level has become a big necessity today. In view of the above, the present work envisages findings of various physicochemical characteristics (pH, hardness, chloride, alkalinity, etc.) examined for Gomti river water samples collected from three different locations of Lucknow. This study was meant to determine the recent status of river Gomti along the Lucknow stretch. Results of the study indicated that river water is highly contaminated and not suitable for recreational activities.

Keywords: Gomti River, Physiochemical studies, Water pollution.

SAMRIDDHI: A Journal of Physical Sciences, Engineering and Technology (2020); DOI: 10.18090/samriddhi.v12i01.5

Introduction

River Gomti, one of the major affluent of river Ganga triggers from a reservoir located near Madho-Tanda (Miankot) with an altitude of 200 meters. Its origin starts about 50 km south of the Himalaya foot-hills, and about 3 km east of Pilibhit in Uttar Pradesh. From a public health point of view, an increase in water pollution level due to the dumping of unwanted substances into water bodies has created a big necessity for an assessment of river water quality used for drinking and domestic purposes.[1] Water quality is one of the key concerns for human beings due to its direct link with all living things. Besides, urbanization, dumping of religious materials, *viz.*, flowers, food, sweets, clothes, etc., in the river has increased the pollution level and deterioration of river water quality of the river Gomti which is also a major source for drinking/ potable water supply for the urban population.[2] Unprocessed industrial and household waste, along with sewage, is disposed directly into it through gutters, and has increased the water contamination to a great extent. Festivals are an integral part of the ritual and diverse cultural heritage of India.

Months from September to November are full of Hindu festivals. *Navratri, Dussehra, Ganpati Utsav,* and *Deepawali* are some of the famous Hindu festivals celebrated during this tenure. On these occasions, every year, thousands of small to large idols of Lord *Ganesh*, Goddess *Durga*, and many more are engrossed in the river water. Innumerable biodegradable and non-biodegradable materials, *viz.*, plaster of Paris, papers, clay, colors, jute, clothes, wooden frame, thermocol, etc., are present in them.[1,3,4] Reports on the presence of heavy metals, like lead, chromium, nickel, cadmium, and zinc to a significant extent are also available. A number of persistent colors and toxic chemicals leach from these idols and strew in the river water. These toxic non-biodegradable chemicals enter into human bodies through the food chain. In the present work, various physiochemical studies have been made to find out some possible methods for water quality improvement and its protection.

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How to cite this article: Shamsi, M., Bajpai, S., & Kamboj, M. (2020). Physiochemical analysis of Gomti river in Lucknow City, Uttar Pradesh. *SAMRIDDHI: A Journal of Physical Sciences, Engineering and Technology, 12*(1), 26–28.

Source of support: Nil

Conflict of interest: None

Sampling Sites

Three sampling sites were selected, *namely*, red *Pakka Pul* (I), *Hanuman Setu* (II), and *Indira Dam* (III). Samples were collected and analyzed.

Material and Methods

Three sampling sites were selected which cover the residential Lucknow region, *namely*, red *Pakka Pul* (I), *Hanuman Setu* (II), and *Indira Dam* (III). The samples of water were collected from both the banks and the middle stream of the river on each site. For the collection of the water sample, sampling bottles were soaked overnight in 10% HNO_3 solution, which was then washed twice with double distilled water and rinsed three times with stream water, leaving the last rinse for five minutes to equilibrate. Water samples were collected in acidified PVC bottles. Preservation and transportation of the samples to the laboratory were done following standard methods (APHA, 1998). The iceboxes were used during transportation to avoid unpredictable changes in physiochemical characteristics. The containers were carefully filled just to overflowing, without passing air bubbles through sample or trapping air bubbles in sealed containers. Preparation of the containers included washing with detergent, rinsing with tap water, ultrapure water (Millipore), and air-dried. Each sample was identified clearly and indelibly by allocating a unique identification number. Color, odor, and taste in water are determined physically. pH value in water is determined by using pH meter (Labtronics LT-49). The TDS measurement apparatus determined total dissolved solids in water. Total hardness in water was determined by EDTA complexometric titration using EDTA as a titrant and EBT indicator. The alkalinity was examined by acid-base titration using indicators. Dissolved oxygen and chloride were estimated by iodometric titration and argenometric titration, respectively. The determination of sulfate in water was done by the nephelometry method using the nephelometric turbidity meter. The flame photometer was used for the determination of sodium and potassium.

Results and Discussion

Various parameters required for water analysis of the Gomti river at Lucknow, are listed in Table 1. The data collected by sampling at various locations are analyzed, and the results are discussed.

pH

The pH is a significant parameter for analyzing the quality of water and the extent of the pollution in the river water. A review of pH data with respect to primary water quality criteria prescribed by the Environmental Protection Act, 1986, in terms of pH required in the range 6.5 to 8.5 for class A water. pH is found to be within the range at the three sites, but is at the lower site due to industrial and domestic discharge at this place, which also affects the taste of water at the place. It has been observed that the pH of water gets drastically changed with time due to temperature changes, exposure to air, and biological activity.

Total Dissolved Solids (TDS)

The TDS in water are mostly salts of carbonates, bicarbonates, chlorides, phosphates, and nitrates of calcium, magnesium, sodium, potassium, and manganese, organic matter, salt, and other particles. The maximum acceptable range of TDS in water is 2,000 mg/L. At all three sites, TDS was within range.

Total Dispersed Solids (TSS)

The analysis showed a peaking value of 660 mg/L at the location I (*Hanuman Setu*). It might be due to the presence of high organic matter, salt, and other particles. Higher values of suspended solids were found in post-monsoon, which might be due to runoff from many bathing ghats, drain water discharge, industries, agricultural fields, and garbage dump sites. The study showed lower values during winter and summer seasons.

Dissolved Oxygen (DO)

The DO, not less than 3 to 5 mg/L, is essential for the survival of aquatic life. DO at every location is above the permissible value. So these sites are least polluted from industrial, sewage, and domestic waste. The dissolved level declines during the rainy season, as compared to summer and winter, as in rainy season, runoffs from the content of dissolved oxygen are sufficient enough so that the aquatic animals can survive here.

Hardness

Sulfates, chlorides, carbonates, and bicarbonates of calcium and magnesium are responsible for the total hardness. As the

Table 1: Physiochemical analysis data of river Gomti

Parameters	Units	BIS Desirable limit for drinking water	Sampling Location I: Pakka Pul	Sampling Location II: Hanuman setu	Sampling Location III: Indra Dam
pH	--	6.5-8.5	6.66	6.72	6.84
TDS	**mg/L**	500	**381.5**	**381.5**	**381.5**
TSS	**mg/L**		**660**	**380**	**138**
Hardness	**mg/L**	300	31.2	26.624	25.792
Total Alkalinity	**mg/L**	200	**315**	**365**	**420**
Chloride content	**mg/L**	250	**39.704**	**42.54**	**29.778**
Sulphate	**mg/L**	200	**59.1824**	**65.1284**	**61.532**
Sodium	**mg/L**		8.4	1.44	14.94
Potassium	**mg/L**		0.915	0.405	1.77
Phenol	**ppb**		**986.35**	**1078.205**	**1029.37**
DO	mg/L		6.8	9.3	7.4

presence of organic matter increases, the level of dissolved oxygen decreases, thereby, increasing the concentration of carbon dioxide, which gives more carbonate, which then combines with calcium and magnesium ion gives hardness to the water. The hardness found at three are 31.2, 26.62, and 25.79 mg/L, respectively (Table 1).

Conclusion

The water pollution level of the Gomti river was found to be very high, thereby indicating the poor quality of water, which is unsafe and non-acceptable for any purpose. The level of all the indicators is above the standards, which are the serious concern for the ecology of the river. The deterioration of water was due to 26 drains along its stretch. Various industrial waste, agricultural waste, and domestic wastes are the main cause of increasing urbanization, and the population resulted in an increase in the content of heavy metals that result in pollution of river water. Due to the huge amount of organic and inorganic matter, the river lost its self-purification nature resulting in higher bacterial growth. That is why, it is very necessary to treat the waste coming from industries and other sources before merging into the river so that aquatic species, as well as, human life, may not get affected.

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