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STUDY ON WATER QUALITY INDEX FROM GOMTI RIVER STRETCH AT LUCKNOW, UTTAR PRADESH, INDIA

* Sharad Chandra Srivastava[1]*, Pankaj Verma[1], Ambrish K.Verma[2], Madhu Tripathi[1]
1. Aquatic Toxicology Laboratory, Department of Zoology, University of Lucknow (U.P.) India.
2. Uttar Pradesh Pollution Control Board, Lucknow (U.P.) India

Abstract- Surface waters are the most vulnerable to deterioration due to their easy accessibility for disposal of waste waters. The experiments was focused on the study to identify and quantify the pollution in help of water quality index(WQI), The Gomti River, a major tributary of the Ganga River in state of Uttar Pradesh, India. Six sites are selected on the River Gomti for water sampling. Water quality index values were recorded at all sites during pre-monsoon and post-monsoon. Based on the Water Quality Index at site-1 was classified as clean even as other sites of the river were slightly polluted and come under category of fair and marginal. Further deterioration in water quality may aggravate the present scenario at sites of Gomti River system and water will not only be unable to support aquatic organisms**,** but also threaten the existence of aquatic life.

KEYWORDS: WQI, Gomti River, Aquatic life, Pollution, water parameter.

I. INTRODUCTION-

Rivers are the principal source of fresh water to supply life necessities and man's economic activities. Overtime, water requirement have emerged for drinking and personal hygiene, fisheries, agriculture (irrigation and livestock supply), industrial uses, hydropower generation and recreation activities, during the recent decades natural variations in river runoff, quantitative and qualitative characteristics of renewable water resources have been much affected by many factors, among them are, an intensive development of industries and irrigated land use, population growth, organization and relative drastic water consumption and earth's surface transformation. This has been resulted in the contamination as well as depletion of water resources in many regions of country.

The Gomti River receives pollution load both from the point and nonpoint sources (Srivastava et al 2014). It receives agricultural runoff from its vast catchment area spread over 10 districts directly or through out is course, receives untreated row waste water and industrial effluents through its five major tributaries and more than 40 drains in Lucknow (UPPCB, 2013). Other pollution sources are washing of clothes and animals in the river water. The river also receives industrial pollution load from various industries in the catchment stretch in Lucknow area the local drains. Disposal of domestic and industrial wastes in the river Gomti has become a very serious problem. The quantity of domestic sewage and industrial waste produced in Lucknow is about 325 million liters per day (MLD) according UPPCB, 2013. At present there is only one treatment plant located at Gaughat to receive the sewage from Sarkata, Pata, and Nagaria as well as from Gaughat itself. This treatment plant of 42 MLD capacities has been constructed by National River Conservation Directorate under Gomti action plan for treatment of sewage. Therefore, a major of the sewage is discharged untreated at various places through sewage pumping stations in the river Gomti.

The water quality can be affected both by the biological and chemical contaminants. The injudicious disposal of waste effluents may contaminate the water as a translocation of toxic chemicals and many lead to adverse affects on living organisms. The water pollution has direct relationship with physico-chemical parameters if they are found beyond permissible limits (Kumar and Shukla, 2002). Some of these parameters such as nitrate, fluoride, hardness, alkalinity, chloride, temperature, pH, heavy metals etc. are toxic and impose much deleterious effect on public health and environment (WHO, 2006, USEPA, 2012). Fine

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suspended particles or colloidal substances make water turbid. Water temperature directly acts on gametogenesis and responsiveness of hormonal stimulation. Oxygen is one of the most important constituent of water act in respiration of biota, decomposition of organic matter, inflow of oxygen deficient water. Presence of ions and rise in temperature remove oxygen from the natural water. CO_2 directly affect the pH of water (Blum, 1953). Total alkalinity is the, measure of the capacity of water to neutralize the strong acid. Total alkalinity is the main action of productivity. Chloride may occur in fresh water as a result of salt decomposition in the soil. The basic experiments were focused on the study to identify and quantify the pollution, a quantitative assessment of physico-chemical criteria of the water.

II. MATERIAL AND METHODS–

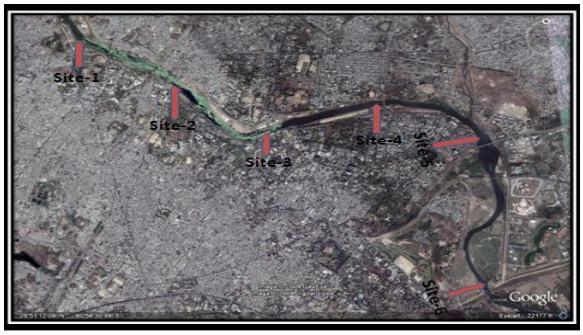

Fig.1. Map showing the sites

The Gomti River flowing through the Lucknow city, the state capital of Uttar Pradesh with population of about 3.5million. Sampling network was designed to cover key sites, which reasonably represent the pollution station of the river system exerting impact on river hydrochemistry. Six sites are selected on the river Gomti for water sampling. A brief description of these sampling sites is given below:

Site-1.
This location is up stream of Lucknow. It is situated 276 feet, N 26°51.513" latitude E 80°55.695" longitude, it is intake point from the river for water supply to the city.

Site-2.
It is situated 280 feet, N26° 52.023', latitude E80° 55.50', longitude; it is one of the oldest, densely polluted site, major sewage effluents from the old Lucknow.

Site-3.
This loction is in situated mid of Lucknow at 271 feet, N 26° 51.741' latitude E 80° 55.385' longitude. It is a locality dominated by business activities in the heart of the city. Fishermen locality with washer man washes the clothes on the bank of the river.

Site-4.
It is situated at 272 feet, N 26° 52.453' latitude E 80°54.701' longitude. It is 6 km away from Gaughat. It is also polluted, showing black color because decomposition of organic waste discharged by the industries.

Site -5.
It is situated at 282 feet, N 26° 51.690' latitude E 80° 57.356' longitude. The site is badly polluted. This site adjacent to crematorium ground at the river bank receiving a lot of ashes of dead bodies.

Site-6 .
It is situated at 276 feet, N 26° 50.382' latitude E 80° 57.904' longitude .The river flow at this location is reduced/controlled due to the barrage, a major out fall (GH canal) discharge into the river between the barrage and this location .

The sampling program was planned taking in to account the objectives of the study, and the parameters to be analyzed. Efforts were made to centralize the aim of sampling to achieve the representativeness and validity of the sample the study was conducted for pre-monsoon and post- monsoon on one year and the frequency of sampling was set keeping in mind objectives of the study and nature of the sample (Betley and Gardiner 1977). The Grab water sample (2 litter) collected in the high quality jerry canes from depth of 30cm below the surface from three point (1/4, 1/2, 3/4) a cross the river width at all the selected sites (site 1 to 6). For DO and BOD sample were collected separately in BOD (300ml) bottles avoiding any kind of bubbling and trapping of the air bubbles in the bottle. Sample for DO were fixed immediately using $MnSO_4$and alkaline Nail solution. All the chemical and solvents used were of analytical grade (AR) procured from E-Merck and Hi media. All the reagents and standards were prepared in double distilled water (DDW) to maintain the consistency of the results. The analytical data quality was ensured through careful standardization, procedural blank measurements, spiked and duplicate sample. The ionic charge balance of each sample was within ±5 %. All the observations were recorded in duplicate. All the parameters were analyzed using standard methods for the analysis of water (APHA, 2005). The EC, TDS, pH was measured with the help of digital kit (Elco Kit model No. PE 136) and turbidity measured

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with the help of Neflometer (model No 131). Nitrate and Fluoride was also measured with the help of expandable ion analyzer orian 149.

For the estimation of level of heavy metals, firstly, 200 ml water in conical flask was taken and evaporated to 20 ml on hot plate at controlled temp of 80 ºC. 3 ml concentrated HCl (35%) and 1 ml concentrated HNO_3 (65%) were added and allowed continue boiling till the volume reduced to 5 ml. In case of any sedimentation now concentrate HCl was added and boiled for one minute. Samples were removed from hot plate and the volume was made to 25 ml using deionized water in measuring flask after filtration (Whitman filter no paper 40). These digested samples were stored in a plastic reagent bottle for further analysis. The digested samples are used for estimation of metal levels by using a UNICAM-flame atomic absorption spectrophotometer (AAS, Agilent). Analysis of sample was done according to standard, reagent blank and sample replicate randomly inserted in the analysis process to assess contamination and precision.

Heavy metals (mg/L) = $\frac{Reading-Blank\ x\ Dil\ 1*Dil2**}{Volume\ of\ Sample}$

*Mack of volume (final)

** if sample required dilution

Water Quality Index-

Calculating the water quality index (WQI), the methods followed by Tiwari and Mishra,(1985) and Singh(1992). The quality rating scale has been assigned to the parameters, which is also weighed according to its relative importance in the overall water quality.

Calculation of WQI-

The unit weight of each parameter is calculated by the formula

$$W_i = \frac{(Wt)i}{\sum(Wt)i} as \sum wi = 1$$

The quality rating scale (q_i) for physico-chemical parameters, the values for the parameter have been divided into four stage viz., permissible, slight, moderate and sever for which quality rating (q_i) ranges from 0 to 100. It calculate on help of software (BIOPATRA) water quality calculator (www.textbookx.com).

$$WQI = \frac{\sum(SI)i}{\sum Wi}$$

Therefore, WQI = Σ qiWi as W=1

Table NO. 1. WQI value has been determined water quality is ranked by relating it to one of the fallowing categories

WQI value	Interpretation	Category
95-100	Water quality is protected with a virtual absence of threat or impairme Conditions very close to natural or pristine level.	Excellent
80-94	Water quality is protected with only minor degree of threat or impairmen Conditions rarely depart from natura of desirable levels.	Good
65-79	Water quality is usually protected bu occasionally threatened or impaired. Conditions sometimes deport from natural or desirable levels.	Fair
45-64	Water quality is frequently threatene or impaired; Conditions of then depa from natural or desirable levels.	Marginal
0-44	Water quality is almost always threatened or impaived; Conditions usually depart from natural or desira levels.	Poor

III. RESULT AND DISCUSSION:

Water quality index is an important parameter to asses the quality of an aquatic system. Seasonal quality of WQI each location was presented in table 2. During the pre-monsoon study the value of water quality index were 65.651, 53.19, 52.853, 48.418, 48.499 and 44.244 respectively from site1 to site 6 and the post-monsoon observation were 81.139, 74.037, 73.821, 68.574, 67.953 and 59.058 respectively. Overall the index showed that the quality of all locations was in good agreement to fair category in the permissible rating of water pollution.

High concentration of the metallic components poses a threat to the survival of a vast majority of aquatic biota. It is therefore, suggested that the industrial effluents should be properly treated before it enter the natural water resources. In present study, the values of quality index in water of River Gomti in Lucknow were higher during post monsoon at all site this may be attributed due to evaporation of water and lower values recorded in pre monsoon may be attributed to the dilution of river water caused by heavy influx.

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Site-1 was classified as clean in post monsoon whilst other sites of the river were slightly polluted and come under category of fair and marginal but the pre monsoon WQI observation value belonging to Category of fair and marginal (table 1) . Sai River found in the range of excellent and good at district Unnao, Lucknow and Hardoi respectively (Kumari and Chaurasia, 2015). The result indicates that all sites are suitable as a habitat for the survival of aquatic organisms. Community of fish and other aquatic biota in the assessed river has apparent effect of physico-chemical changes of water on their life. Fish has migrated to other neighboring site to avoid adversities caused by water quality (US EPA 2001), Physico-chemical characteristics of Gomti River system which is a like a flowing pond in the middle sections of river has the ability to detain pollutants for long periods of time with decreased WQI. Dilutions and dispersal process of pollutant was inhibited by slow current flow rate and limited vertical turbulent .In such situation toxic situation chemicals discharged in the river system affected the distribution and abundance fish community in the river. Further deterioration in water quality may aggravate the present scenario at sites of Gomti River system and water will not only be unable to support aquatic organisms, but also threaten the existence of aquatic life.

Environmental degradation, during the past several years, has increased considerably due to anthropogenic interference on delicate environmental aspects. Pollution of river ecosystem by chemicals from industries and agriculture is increasing day by day (Sharma and Kansal, 2011). Industrial and agricultural effluent entering the water bodies also affects the hydrochemistry. Fishes are economically important non target organism; they are quite sensitive to a wide variety of toxicant and are used as pollution indicator in the water quality management (EIFACS, 1980).

Environment protection has attracted the attention of the wide section of people all over the world and now it has become a global issue among scientists and researchers working in this area because the Water quality index shows that is a quality useful tool for the quick assessment of water resource. Unfortunately, several toxic pollutants are being regularly discharged in large quantities into the environment especially into the aquatic environment even same of than are unknown and unidentified but must be affecting the biota.

Table NO. 2. Water quality index (WQI) of Gomti River at study sites (1-6) during pre– and post-monsoon.

Parameter (Unit)	Pre-monsoon						Post-monsoon					
	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6
Temperature(°C)	1.16	1.17	5.71	3.3	4.28	5.9	4.87	3.93	5.55	2.0	5.1	6.4
pH	1.56	0.1	0.7	0.55	0.5	0.427	0.85	0.35	0.30	0.35	0.45	0.42
Turbidity (NTU)	0.26	0.2	1.92	2.38	1.992	0.21	0.18	0.192	1.41	0.731	0.34	0.19
Conductivity(µs/cm)	19.1	1.80	3.82	2.36	2.267	2.1	29.9	27.2	24.1	20.5	24.4	20.0
TDS (mg/L)	10.93	7.71	3.23	6.256	8.9	9.8	15.4	16.8	16.1	12.2	10.01	8.1
Hardness (mg/L)	12.1	12.6	10.07	6.623	5.6	7.4	7.91	6.7	5.7	5.63	6.44	6.3
Chloride (mg/L)	3.9	0.6	3.5	5.148	5.9	4.341	6.4	5.0	4.5	5.7	5.34	5.1
Alkalinity (mg/L)	2.27	9.7	0.95	2.556	3.1	2.80	3.206	2.6	3.1	3.0	3.56	5.88
Free CO_2 (mg/L)	1.84	2.8	2.28	3.479	2.50	1.95	0.57	0.59	0.71	0.7	0.66	0.71
Fluoride (mg/L)	0.84	0.63	0.92	0.74	0.586	0.507	0.503	0.507	0.46	0.5	0.51	0.47
Nitrate (mg/L)	0.49	0.2	0.85	0.688	0.543	0.489	0.473	0.536	0.44	0.55	0.45	0.4
DO (mg/L)	0.19	0.2	0.29	0.26	0.251	0.122	0.271	0.295	0.31	0.295	0.2	0.22
BOD (mg/L)	3.21	1.51	0.21	0.26	0.24	0.017	0.21	0.19	0.02	0.03	0.02	0.020
COD (mg/L)	0.8	0.3	0.26	2.3	0.26	0.013	0.25	0.262	0.2	0.028	0.27	0.02
Al (mg/L)	0.24	3.81	0.52	3.65	3.65	0.64	5.42	5.625	6.73	5.22	1.30	0.42
Cd (mg/L)	0.026	0.1	0.2	0.12	0.109	0.29	0.23	NaN	0.251	0.20	0.34	0.176
Co (mg/L)	0.235	0.3	0.1	0.22	0.2	0.133	NaN	NaN	0.7	0.1	0.033	NaN

Cr (mg/L)	0.038	0.15	0.01	1.41	0.141	0.184	NaN	NaN	0.4	0.94	0.12	NaN
Cu (mg/L)	0.069	0.3	0.01	0.14	0.14	0.20	0.22	0.20	0.34	0.30	0.2	0.17
Fe (mg/L)	0.198	3.21	0.5	0.228	0.22	0.32	1.25	0.30	0.23	0.36	0.2	0.232
Mn (mg/L)	0.075	0.19	0.9	0.21	2.1	1.27	1.1	0.22	1.96	1.88	1.61	2.3
Mo (mg/L)	0.2	0.83	0.74	0.57	0.057	NaN	NaN	NaN	0.1	0.6	0.65	0.9
Ni (mg/L)	0.2	0.23	0.033	0.033	0.033	NaN	NaN	NaN	0.21	0.20	0.15	0.2
Pb (mg/L)	0.72	0.5	9.75	0.6	0.6	0.45	NaN	0.05	NaN	0.06	0.50	0.03
Zn (mg/L)	5.0	4.05	5.38	4.337	4.33	4.681	1.926	2.49	NaN	6.5	5.1	0.40
TOTAL (WQI)	65.651	53.19	52.853	48.418	48.499	44.244	81.139	74.037	73.821	68.574	67.953	59.058

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REFERENCE-

1. APHA; (2005). Standard methods for the examination of water and waste water. American Public Health Association Washington D.C.
2. Batley G. T., and Gardiner D. (1977). Sampling and storage of natural water for trace metal analysis. Water Research (11) pp. 745-756.
3. Blum J.L. (1953). Ecology of river algae .*Bot.Rev*.22 (5): pp . 291-341.
4. Sharma D., and Kansal A. (2011) Water quality analysis of River Yamuna using water quality index in the national capital territory, India (2000–2009) Applied Water Science (1), pp. 147-157
5. EPRA CS-1513. (1980). Adsorption/ coprecipitation of Trace Elements from water, Cauvery River.
6. Kumar A. and Shukla M. (2002). Physico-chemical characteristic of Sai River at Raibarely in relation to its population. Journal of Eco-physiological Occupation Health (2). pp.33-38.
7. Singh D.F. (1992). Studies on the water quality index of some major rivers of Pune.Maharashtra. Proceeding Academy of Environmental Biologey.1.:pp. 61-66.
8. Srivastava.S.C.,Verma P. and Tripathi M. (2014) comparative Analysis of the microbial load in cat fish (*Mystus aor*)And Carp fish (*Labio bata*) from Gomti River, Lucknow India, Flora and Fauna (20) pp.77-82
9. Tiwari T.N. and Mishra M.A.(1985).A preliminary assisnment of water quality index of major Indian rivers. Indian journal Environmental Proceeding. (5)pp.276-279.
10. UPPCB,(2013):http://www.indiawaterportal.org /news/report-Uttar-Pradesh pollution-control-board-uppcb-reveals-deteriorating-condition Gomti-river
11. US EPA;(2001).Fish as indicators http/www.epa.gob/calsuvebi/cellshome/atlas/bioindicators /fishesindicatav.html.
12. US EPA (2012) http/www.epa.gob
13. Kumari V. and, Chaurasia G.L. (2015) Study of Water Quality Status of Sai River in Uttar-Pradesh With Reference to Water Quality Index Assessment. International Journal of Innovative Research in Science, Engineering and Technology. http://www.ijirset.com/upload/2015/january/38_Study.pdf
14. WHO.(2004).www.who.int/water_sanitation_health/publications/facts.