Physico-chemical and bacteriological investigation of the river Gomti at district Sultanpur

Shri Prakash Mishra
Department of Chemistry, HLYGDC, Lucknow (U.P.)

Abstract

In this study the Physico-chemical and Bacteriological parameters of Gomti river water at district Sultanpur is analysed to know the pollution status of the river. The samples were collected in the month of August-2016 from six sampling stations, viz., Kurwar, Golaghat, Dhobighat, Shmashan Ghat, Papar Ghat and Dhopap Ghat. For the Physico-chemical analysis the parameters selected are: Temperature, Colour, Odour, Turbidity, Total Hardness, pH, Electrical Conductance (EC), Total Dissolved Solid, Alkalinity, Free Ammonia, Sulphates, Chlorides, Dissolved Oxygen (DO), Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD) and Free CO_2 while Total Coliform MPN/100 ml and Faecal Coliform MPN/100 ml is counted for Bacteriological observation. The water samples were estimated by following the Standard Methods for the Examination of Water and Waste Water, 21st Edition (APHA-2005). Over the years of time, Gomti river has been subjected to human interference regularly and water quality is being getting deterioreted profoundly. Major anthropogenic activities practiced in and around the stretch are agriculture, abstraction of water for irrigation and drinking, washing clothes and utensils, discharging of sewage waste, sand dredging, boating, fishing, open defecation and religious ritual activities along the stretch are generating serious threats to the flora and fauna of the river by changing the physico-chemical and bacteriological concentration of the river system.

By comparing with the tolerance limits of Bureau of Indian Standards (**BIS: 10500-2012**), it is concluded that the Gomti river at Sultanpur is heavily polluted due to considerable variation of many patameters from their standard values and the water of this river is not suitable for domestic uses. So, continuous monitoring and treatment process is required to keep the river living and suitable for aquatic biota as well as people depending on it.

Key Words: Physico-chemical analysis, Bacteriological observation, Gomti river, Sultanpur, APHA and BIS.

Introduction

Water in its pure form is a boon on the earth but if polluted becomes poison for the living beings. Polluted water is a carrier of pathogenic micro-organism and cause immense harm to public health [11]. Suspended solids cause colour and smell in water which becomes disagreeable and unhygienic [2]. The pollution in water reduces the oxygen content in it. The pH of water due to pollution deviates from the accepted standard value and becomes harmful.

A survey of literature has revealed that the pollution data on Indian rivers are scarce for most Indian rivers especially of river Gomti, and many of the parameters indicating the status of pollution have not been determined. To consider this fact I analyzed the physico-chemical and bacteriological parameters of river Gomti at district Sultanpur. The objective of the study is to assess the water quality and the pollution load of the river due to the dumping of human excreta, domestic sewage and industrial effluent directly into the river [4]. For this purpose I collected the water samples on 21st August, 2016 and analyzed different parameters of water quality in the laboratory. The samples were collected from 45 kms part of the river into six sampling stations. These are Kurwar, Golaghat, Dhobighat, Shmashan Ghat, Papar Ghat and Dhopap Ghat. Kurwar, Golaghat and Papar Ghat sampling stations were selected for the study because maximum city drains shed their polluted discharges in the river at these points. Dhobighat is that common place which is used by most of the dhobies to wash clothes. This sampling station has the load of approximately 50

dhobies per day who dispose the used soap and detergent in the river directly. Shmashan Ghat is the place where cremation of human dead bodies are done and the left over ashes of bones and used wood are dumped into the river which pollutes it. As per the belief of Hindus, Lord Rama got rid to the sin of Bramh-hatya of Ravan by bathing at Dhopap Ghat. So, it is a point of mass bathing on festivals which pollutes the river heavily. The sampling stations and a part of the river are shown in Fig. 1.
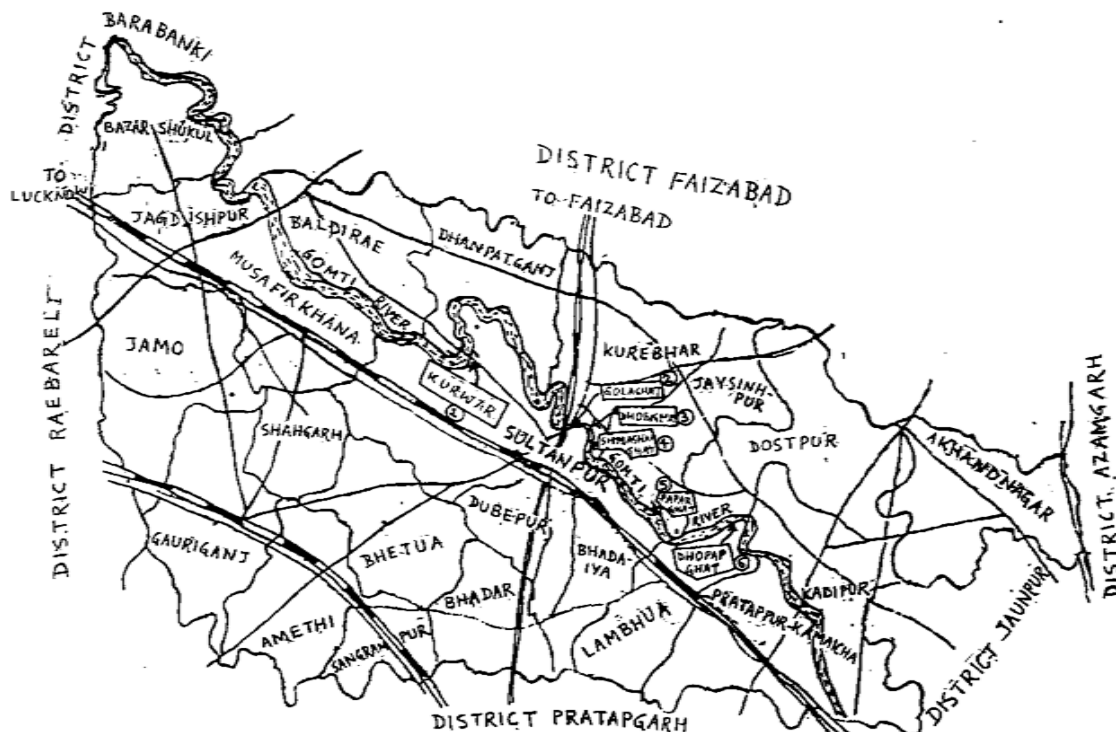

Fig.1:- Sampling stations of river Gomti at Sultanpur.

The following physico-chemical and bacteriological characteristics of water were estimated by using the standard methods (APHA, 2005).

Physico-chemical Parameters:

1. Temperature
2. Colour
3. Odour
4. Turbidity
5. Total Hardness
6. pH
7. Electrical Conductance
8. Total Dissolved Solid
9. Alkalinity
10. Free Ammonia
11. Sulphates
12. Chlorides
13. Dissolved Oxygen (DO)
14. Biochemical Oxygen Demand (BOD)
15. Chemical Oxygen Demand (COD)
16. Free Carbon Dioxide

Bacteriological Parameters:

1. Total Coliform MPN/100 ml
2. Faecal Coliform MPN/100 ml

Materials and Methods

In this study, the pollution status of river Gomti at district Sultanpur was estimated on the basis of their physico-chemical and bacteriological analysis. The samples were collected from different sampling stations at the surface and at depth varying from 1-3 meters.Thegrab water samples of 2-litres were collected in the glass sample containers with the help of vertical point water samplers, depth-integrating samplers (USD-49) and displacement samplers (for the determination of dissolved oxygen).Analytical methods used in water engineering are standard methods given in Standard Methods for the Examination of Water and Waste water; APHA (American Public Health Association) 21st Edition, 2005 [1]. A list of test methods is given in Table-1.

Table-1: Test methods used for analysis of different parameters.

S. No.	Parameter	Unit	Test Method
1.	Temperature	^{0}C	By Thermometer
2.	Colour	mg/l	By Pt-Co Comparator
3.	Odour	TON	Using Threshold Odour Number (TON) Method
4.	Turbidity	JTU	By Jackson Candle Turbidity Meter
5.	Total Hardness (as $CaCO_3$)	mg/l	EDTA Titration
6.	pH	-	By pH Meter (Model 111 E)
7.	Electrical Conductance	μS/cm	EC Meter
8.	Total Dissolved Solids (TDS)	mg/l	Gravimetric Analysis (Filtration and weighing of residue)
9.	Alkalinity	mg/l	Alkalimetry
10.	Free Ammonia (as N)	mg/l	Alkalimetry
11.	Sulphates (as SO_4)	mg/l	By Titration
12.	Chlorides	mg/l	By Argentometric Titration
13.	Dissolved Oxygen (DO)	mg/l	Iodometric Titration (Winkler Method)
14.	Biochemical Oxygen Demand (BOD)	mg/l	5 days incubation at 20 ^{0}C and titration of initial and final DO
15.	Chemical Oxygen Demand (COD)	mg/l	Dichromate oxidation and titration with ferrous ammonium sulphate
16.	Free CO_2	mg/l	Acidimetry
17.	Total Coliform	MPN/100 ml	Placing a small Durham tube upside down inside a larger tube containing lactose broth and incubated at 35 ^{0}C for 48 hours.
18.	Faeal Coliform	MPN/100 ml	Following the same procedure as for Total coliform and incubated at 44.5 ^{0}C for 24 hours.

Results and Discussion

It is found by the analysis that all the physico-chemical and bacteriological characteristics highly varied at all the sampling stations which indicates the heavy pollution stress of the river[3,5,8,10]. The analysis report is given in Table-2 by comparing it with the tolerance limits of various parameters.

Table-2: Comparison of the values of different parameters atvarious sampling stationswith their tolerance limits.

Parameter/ Sampling Station	Kurwar	Golaghat	Dhobighat	Shmashan Ghat	Papar Ghat	Dhopap Ghat	Tolerance Limit(BIS: 10500-2012)
Temperature (^{0}C)	27.0	26.6	26.3	26.8	26.4	26.3	10-15.6
Colour (on Pt-Co Scale), mg/l	95	100	105	75	85	80	300
Odour	200	185	175	155	170	160	300
Turbidity (JTU)	160	155	165	135	155	140	25
Total Hardness, mg/l	450	442	520	575	412	432	600
pH	8.2	8.0	8.4	8.5	8.0	7.9	6.5-8.5
Electrical Conductance (EC), μS/cm	340	342	355	369	330	334	750
TDS, mg/l	1750	1270	1625	1148	1728	1685	1500
Alkalinity, mg/l	176	168	282	285	185	193	200
Free Ammonia, mg/l	6.0	6.5	6.9	7.0	6.2	6.6	5
Sulphates, mg/l	229	232	340	245	220	230	400
Chlorides, mg/l	260	240	336	270	256	234	600
DO, mg/l	3.4	3.6	3.8	4.3	3.7	3.5	4
BOD, mg/l	10.3	9.8	9.2	7.0	9.1	10.5	3
COD, mg/l	28.7	26.7	25.0	18.6	24.6	28.8	1
Free CO_2, mg/l	8.3	7.8	7.5	6.0	7.2	7.8	6
Total Coliform MPN/100 ml	2600	2815	2715	2850	2895	2736	500
Faecal Coliform MPN/100 ml	1550	1623	1570	1627	1680	1676	500

Conclusion

The research study concluded that the Gomti river at Sultanpur is heavily polluted and the water of this river is not suitable for drinking, bathing and other domestic uses due to high coliforms count. As the river is an indicator of the society's standards and a dirty river means a dirty society. So, continuous monitoring and treatment process is required to keep the river living and suitable for aquatic flora and fauna. Some steps and awareness programs must be planned to educate local villagers to safeguard the precious river and its surroundings.

Acknowledgement

References

[1] **APHA (2005):**Standard Methods for the Examination of Water and Waste water, 21[st]Edition, Washington DC, USA.

[2] **Dey Kallol, Mohapatra S.C. and Mishra, Bidyabati (2005):** Assessment of water quality parameters of the river Brahmani at Rourkela. J. Indl. Polln. Contl., 21 (2), 265-270.

[3] **Gopalswami, P.M., Kumar, P.E. and Kulandaivelu, A.R. (2003):** Study on the quality of water in the Bhawani river. Assian J. Chem., 15 (1), 306-310.

[4] Hussain, M.F. and Ahmad, I. (2002): Variability in physico-chemical parameters of Pachin river (Itanagar). Indian J. Environ. Hlth., 44 (4), 329-336.

[5] Kaur, H., Syal, J. and Dhillon, S.S. (2001): Water quality index of the river Satlaz. Poll. Res., 20 (2), 199-204.

[6] Kelkar, P.S. and Nanoti, M.V. (2005): Impact assessment of Ganga Action Plan on river quality at Varanasi. J. Indian Water Work Assoc., 37 (3), 225-234.

[7]Martin, P. and Haniffa, M.A. (2003): Water quality profile in the south Indian river Tamirabarani. Indian J. Environ. Prot., 19 (2), 90-95.

[8] Murhekar Gopalkrushna H. (2011): Determination of Physico-chemical parameters of Surface Water Samples in and around Akot City. Int. J. of Res. in Chem.and Envt., 1 (2), 183-187.

[9] Shaw, J.K.E., Watt, W.E., Marsalck, J., Anderson, B.C. and Crowder, A.A. (1997): Flow pattern characterization in an urban storm water detention pond and implications for water quality. Water quality Res. J. Canada, 32 (1), 53-71.

[10] Sunil Kumar, K., Ravikumar, P., Somashekar, R.K. and Prakash K.L. (2010): Physico-chemical and Bacteriological investigation on the river Cauvery of Kollegal stretch in Karnataka. Kathmandu Univ. Journ. of Sci., Engg. and Tech., Vol. 6, No. 1., pp 50-59.

[11] Venkatesharaju, E.T., Manjappa, S., Prakash Naik, S. and Kumar Vijay (2006): Water quality assessment of river Tunga, Karnataka. Env. Eco., 24 (5) (1), 23-26.

* * *