

## Physico-chemical and biological analysis of Gomati river water affected by urban wastes

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### ABSTRACT

The present work has been taken to assess dynamism in physico-chemical nature of water flowing in river Gomati at Sultanpur due to recurring addition of sewage and waste water for a period of two years (i.e. June 2002 to June 2004). Parameters viz., temp., pH, BOD, COD, DO,  $\text{SO}_4$ ,  $\text{Cl}^-$ ,  $\text{PO}_4^{--}$ ,  $\text{Na}^+$ ,  $\text{Ca}^{++}$ ,  $\text{Mg}^{++}$ , TDS and total coli form were periodically tested. Majority of the values varied from permissible limit which is hazardous for the survival of aquatic life and human beings.

**Key words:** Gomati, physico-chemical, urban wastes, BOD.

### INTRODUCTION

Water is one of the most essential requirements of human beings, animal and plants. Therefore, quality of water plays a vital role for their survival. Indian rivers being polluted day-by day due to inputs of untreated industrial effluents, domestic and sewage water along with agricultural wastes and decaying materials of human, animals and plants<sup>4,12</sup>. A number of water borne diseases are caused due to polluted water which results in large scale death<sup>6</sup>. Keeping in view of the above facts the present work was under taken on monitoring and chemical analysis of Gomati river water in Sultanpur district affected by urban wastes which deteriorate the quality of water.

### EXPERIMENTAL

Gomati water samples of varying grade from four selected sampling points viz., Karaundia Ghat ( $S_1$ ), Gabhria Ghat ( $S_2$ ), Sitakund Ghat ( $S_3$ ) and Hathia Nala ( $S_4$ ) were collected periodically in plastic stoppered bottles at monthly interval during course of investigation (June 2002-2004). Selected sites continuously received daily the domestic,

municipal and industrial wastes from the Sultanpur city. Parameters<sup>5</sup> such as-Temperature was measured by Celsius thermometer, pH by Systronic pH meter 335 digital type, total dissolved solids were determined by evaporating using Barium chloride solution in trace amount of residue. Dissolved oxygen (DO) and Biological oxygen demand (BOD) were measured by modified Winkler method. Chemical oxygen demand (COD) was measured by Dichromate Reflux method. Whereas, chloride by Mohr's method, Phosphate by colorimeter, Sodium by Flame photometric method, Calcium by EDTA titration, Magnesium by calculations. and biological parameters (MPN and coli form index) were studies using standard method. All parameters were analyzed by using standard method of APHA (1992)<sup>3</sup>.

### RESULTS AND DISCUSSION

Results presented in Table 1 clearly indicated that physico-chemical and biological quality of water deteriorated and become harmful to man in his house hold needs and other aquatic life or to a balanced functioning of aquatic ecosystem such as situation is referred to as aquatic

pollution parameters affected by urban wastes as follows.

### Temperature

Results revealed that not much variation was found in temperature of rivers water at different sampling sites. Maximum (25.6°C) temperature was recorded at site S<sub>3</sub> where as, minimum 23.9°C at S<sub>1</sub>. Temperature in one of the most important physical aspect of water pollution which may be harmful as primary pollutant and indirectly through out the D.O. and causing death of aquatic organisms.

### pH

pH of river water was observed in increasing order during tenure of the work. Maximum 8.2 pH value was measured at S<sub>2</sub> and S<sub>3</sub> site where as; minimum 7.8 at S<sub>1</sub>. The above description reveals that the pH of rivers water was usually on the alkaline side and lower the acceptable limit of water quality standard (6.3-9.2) of India and therefore use of water for various purpose is not banned.

### B.O.D.

It was evident from Table 1 that BOD of Gomati river ranged 6.12-6.89 ppm at different sites which was higher than permissible limit (6.00 ppm) indicating more organic wastes and sewer water reaching into river through drain. Maximum 6.89 ppm BOD value was observed at S<sub>3</sub> and minimum 6.08 at S<sub>1</sub> sites. Above description alarming that water river required pretreatment for use.

### C.O.D.

The C.O.D. values of river has been found maximum 131.83 ppm at S<sub>1</sub> and minimum 120.89 at S<sub>3</sub>. All the values were higher than permissible limit 10 ppm which indicates pollution in the river water. Hence pre-treatment of water is essential for using purpose.

### D.O.

Dissolved oxygen is one of the important quality parameters of water. Increase the value of DO exhibited biochemical changes due to abundance population of flora and fauna. The D.O. value of river water ranged 6.92-7.49 ppm at sampling sites. Maximum value was observed at

S<sub>4</sub> where is, minimum at S<sub>1</sub>. D.O. level depends on physical, chemical and biological activities of water<sup>7</sup>. All the values have been found to be higher than permissible limit (4.6 ppm) for natural water<sup>1,2</sup>.

### SO<sub>4</sub><sup>-</sup>

The values of SO<sub>4</sub><sup>-</sup> content was varied and it was found maximum 63.47 at S<sub>3</sub> and minimum 61.11 ppm at S<sub>1</sub> sites. SO<sub>4</sub><sup>-</sup> is an important constituent of hard water in the form of Ca SO<sub>4</sub> and Mg SO<sub>4</sub> which reduces the water quality. Increase its concentration in river water due to industries and domestic wastes. Excess amount of sulphate in water has cathartic effect on human health<sup>10</sup>.

### Cl<sup>-</sup>

During the course of study it was observed that chloride ion (Cl<sup>-</sup>) concentration was higher at all sampling sites. It was maximum (38.81 ppm) at S<sub>1</sub> whereas, minimum (35.03 ppm) concentration was observed at S<sub>4</sub> sites. Increase percentage of chloride was probably due to amount of sewage discharge in the river, similar observation has been made by earlier worker<sup>8</sup>.

### PO<sub>4</sub><sup>-</sup>

Phosphorus is an essential element for all kinds of organisms being a constituent of nucleic acid, nucleoprotein and ATP which acts as universal source of energy. By observing the values Table 1 it reveals that concentration of phosphate ion in the river water was maximum (0.073 ppm) at S<sub>2</sub> sites and minimum (0.062 ppm) at S<sub>4</sub>. The concentration of PO<sub>4</sub><sup>-</sup> at all sampling station was slightly higher than maximum allowed limit. Such higher concentration may be due to continuous addition of detergents through sewage and industrial effluents, use of phosphatic fertilizer and organic phosphate, which reach to water bodies as a surface run off. Addition of this elements in the form of orthophosphate, pyrophosphate, metaphosphate and dihydrogen phosphate causes explosive growth of algae.

### Na<sup>+</sup>

Sodium is an essential element for the growth of animal but required in traces by the plants. Higher concentration of Sodium can be related to cardiovascular disease and in women toxemia

**Table 1: Physico-chemical characters of Gomati river in Sultanpur district influenced by urban wastes.**

S. N.	Parameters	(June 2002- 2004)			
		Sampling sites			
		S <sub>1</sub>	S <sub>2</sub>	S <sub>3</sub>	S <sub>4</sub>
1	Temperature (°C)	23.9	24.9	25.6	24.7
2	pH	7.8	8.2	8.2	8.0
3	BOD (ppm)	6.08	6.12	6.89	6.12
4	COD (ppm)	131.85	126.07	120.89	126.33
5	DO (ppm)	6.92	7.07	7.1	7.49
6	SO <sub>4</sub> (ppm)	61.11	61.54	63.47	62.53
7	Cl <sup>-</sup> (ppm)	36.81	36.76	34.48	35.03
8	PO <sub>4</sub> <sup>-</sup> (ppm)	0.069	0.073	0.070	0.062
9	Na <sup>+</sup> (ppm)	4.9	4.73	4.81	4.53
10	Ca <sup>++</sup> (ppm)	27.52	27.79	28.58	29.45
11	Mg <sup>++</sup> (ppm)	21.52	23.86	22.36	20.67
12	TDS (ppm)	238.27	240.47	226.35	235.95
13	Total coli form (MPN/100)	39.5×10 <sup>3</sup>	40×10 <sup>3</sup>	48×10 <sup>3</sup>	44.25×10 <sup>3</sup>

(Data pooled means of two years)

associated with pregnancy<sup>9</sup>. It was evident from the Table-1 that maximum (4.9 ppm) concentration of Na<sup>+</sup> was recorded at S<sub>1</sub> sites and minimum at S<sub>4</sub>. These values are under tolerance limit (1-500 mg/l). therefore, water may be used for various purpose.

**Ca<sup>++</sup>**

The presence of Ca<sup>++</sup> in water supplies results from passage through or over deposition of lime stone, dolomite, gypsum and gypsiferrous shalex. Minimum (27.52 ppm) concentration was observed at S<sub>1</sub> whereas, maximum 29.45 ppm at S<sub>4</sub>.

**Mg<sup>++</sup>**

Concentration of Mg<sup>++</sup> was found maximum (23.86 ppm) at S<sub>2</sub> site and minimum (20.67 ppm) at S<sub>4</sub>.

Calcium and Magnesium are responsible for hardness of water which is not suitable for drinking.

**Total dissolved solids**

Total dissolved solids was maximum (240.47 ppm) at S<sub>2</sub> and minimum (226.35 ppm) at S<sub>3</sub>. The values are within permissible limit suggested by WHO.

**Total coliform**

Total coliform<sup>11</sup> in the Gomati river was found maximum (48×10<sup>3</sup>MPN/100) at sampling site 3 whereas, S<sub>1</sub> showed minimum (39.5×10<sup>3</sup> MPN/ 100) during the tenure of work. Increase of MPN probably due to input of domestic and other types of wastes of the city into the river through drains.

On the basis of above findings it may be concluded that water of Gomati river highly affected by urban and municipal wastes which results exceeding of permissible limits. Therefore, some precautions is essential for survival of aquatic life and human health.

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