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RESEARCH ARTICLE

Studies on seasonal variations in physico-chemical parameters of the river Gomti (U.P.) India

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Abstract

Present work focused on the seasonal variations in the physico-chemical parameters of the river Gomti,district Lucknow. A total 8 parameters were analysed and their seasonal variation is discussed to assess the impact of effluents on water quality. Results of present study are indicative of deteriorating life sustaining quality of river water as well as its non suitability for domestic consumption. Possible effects of water quality on aquatic life as well as possible remedial measures have also been discussed.

Introduction

Water is an indispensable natural resource on earth. All life including human being depends on water. Due to its unique properties water is of multiple uses for living organism. In India 77% of water is used in agricultural sector (Ade and Vankhede, 2001).Water bodies are constantly used as receptacles for untreated waste water accured from domestic and industrial activities. This may render the water bodies unsuitable for both primary and secondary usage (Ahmed et.al.,2010, Singh and Mathur,2005). The presence of safe and reliable drinking water is also an essential pre-requisite for a stable community. Many of the Indian rivers, which are used as drinking water contaminated by various sources (Chaturvedi et.al.,2003, Sujata et.al.,2011).

The physical and chemical properties of fresh water bodies are characterized by the geochemical, climatic, geomorphological and pollution condition (Chaurasia and Pandey,2007). In order to utilize fresh water bodies successfully for aquatic life and fish production and human consumption, it is very important to study the physico-chemical factors, which influence the biological productivity of the water body. Kaushik et.al. (2009) reported that in India, most of the development activities are dependent upon rivers for cleaning as well as disposal purposes. Therefore, comprehensive river water quality monitoring program is becoming a necessity in order to safeguard public health and to protect the valuable and vulnerable fresh water resources (Kannel et. al.,2007).

Materials and Methods

River Gomti is a tributary of river Ganga, arising from foot hills of district Pilibhit and joins Ganga near Jaunpur covering 940 Km stretch area. Sampling sites were selected near Lucknow (U.P.), India (N 26^0 52' 30'') (E 81^0 52'30'') in about 10 Km stretch. Five sampling sites viz-A (Gaughat), B (Pakkapul), C (Daliganj bridge) , D(Nishat ganj bridge) and E (Pipraghat). Each sampling sites was further marked with 1-Northern bank, 2-Midstream and 3-Southern bank respectively. The water samples were collected throughout the study period during summer, monsoon and winter season with the help of fisherman with water sampler capable of taking samples at any depth and with sterile BOD glass bottles between 7.00 AM to 10.00 AM. Physico-chemical parameter were analyzed in the laboratory expect temperature which was monitored at the sampling sites with the help of the thermometer. The chemical used for analysis were all of analytical AR grade. The physicochemical parameters were estimated according to the methods in APHA (2005) and Trivedi and Goel (1986) and compared with standard values of BIS (1991) and Khanna and Bhutiani (2008)

Results and Discussion

The results of the various physico-chemical parameters of three seasons (Summer, monsoon and winter) from March-2012 to Febuary-2013 are summarized in table-1. Wide variations were observed in measured parameters at all stations. The water temperature varied with variation of season as lowest in winter and highest in summer, this result is supported by the finding of (Singh and Gupta, 2004) in Yamuna river. Water temperature directly or indirectly influences many abiotic and biotic componants of aquatic ecosystem. It also reflects to the dynamics of the living organism such as metabolic and physiological behaviour of aquatic ecosystem. In the present study temperature was found ranging 16.3-30.8^{0}C of which maximum value (30.8^{0}C) was noticed in summer season and the minimum value (16.3^{0}C) in winter season . Many workers observed similar trends while working on different water bodies (Sen et.al.,2011 , Srivastava and Srivastava,2011).

pH is considered an important chemical parameter that determines the suitability of water for various purposes. pH of water important for the biotic communities because most of the aquatic organism are adapted to an average pH. The pH values during the summer, monsoon and winter seasons were 7.79, 7.59, 7.51 respectively. Higher value of pH in summer season may be due to low level of water. This result supported by the finding of Chaurasia and Pandey (2007). The lowest pH value was found during winter due to heavy rainfall and dilution effect by Shiddamallaya and Pratima (2008). In the present investigation pH recorded ranges between 7.51-7.79 shoes slightly alkaline conditions. Mary Bai (1989) reported that pH of polluted water fluctuates in the range of 8.0 -9.0.

Dissolved oxygen is one of the most important parameter in assessing the quality of water, directly affecting survival and distributing flora and fauna in an ecosystem. In the present study dissolved oxygen was recorded minimum in winter 8.25 mg / L and maximum in monsoon 10.7 mg/L, may be due to the low solubility at high temperature and high degradation of organic substances by Rajagopal et. al. (2010), this result supported by the finding of Tidane and Shinde (2012). The quantity of D.O. in water is directly or indirectly dependent on water temperature,partial pressure of air etc.Similar result were observed by Kamal et.al.,2007 in mouri river,Kulna Bangladesh and Sen et.al. (2011) recorded low level of D.O. in pond and river water due to pollution.

Carbon di oxide is the chief parameter required for photosynthesis process in plants. In water bodies CO_2 react with water and forms carbonic acid,which soon dissociates into carbonates and bi carbonates, which alters pH of water. Interestingly CO_2 showed varied behaviour in different season in all the five sampling sites.Free CO_2 in the present study varied from 39.3-61.7 mg/L in summer, monsoon and winter season at different sites. The lowest values (39.3 mg/L) of free CO_2 was recorded in winter season, whereas the highest values (61.7 mg/L) in summer season. Similar results were observed by Sahni and Yadav (2012). The increase in CO_2 level during summer may be due to decay and decomposition of organic matter. This is strengthened by the observation of Joshi et.al. (1995),who have observed the addition of anthropogenic and industrial waste was the main causal factor for increase in CO_2 in water bodies.

Acidity values varied from 37.9-91.2 mg/L in summer, monsoon and winter season respectively. Maximum value of acidity was observed in summer season (91.2 mg/ L) and minimum in winter season (37.9 mg/L) during study period. Similar trend was found was Khanna and Bhutiani (2003 and 2010) in river Ganga in district Bulandshahar (U.P.) and foot hills of Garhwal Himalayas and Meenakshi et.al. in Yamuna river.

Alkalinity of water is the capacity to neutralize strong acids that gives primarily a function of carbonate,bicarbonate and hydroxide content and formed due to the dissolution of CO_2 in water. In the present investigation alkalinity values varied from 155-259 mg/L in summer, monsoon and winter season respectively, of which maximum value (259 mg/L) was observed in summer season and minimum value (155 mg/L) in winter season, this result supported by the finding of Sahni and Yadav (2012). Similar trend was also noticed by Sen et al. (2011) in river water in Assam and Khanna et.al. (2011) in river Ganga. Larger quanties of bicarbonates during summer may be due to liberation of free CO_2 in the process of decomposition of bottom sediments which probably resulted in conversion of insoluble carbonates to soluble bi carbonates. Tabrez Ahmed et.al. (2010) also observed similar results in river Gomti.

Total hardness value ranged from 174-250 mg/L in different season of which higher value (250 mg/L) in summer and lowest (174 mg/L) in monsoon season. This may be due to the presense of high content of calsium and magnesium in addition to sulphate and nitrates (Angadi et.al.,2005). Kaur and Sharma (2001) was reported maximum hardness in summer. The increase in hardness can be attributed to the decrease in water volume and increase in the rate of evaporation at high temperature, high loading organic substances, detergent, chloride and other polluted by Rajgopal et.al. (2010).

Chlorides values in the present study were found ranging between 15.1 to 24.7 mg/L of which, maximum value (24.7 mg/L) was noticed in summer season and the minimum value (15.1 mg/L) in winter season. The low concentration of chloride was observed in winter by Sahni and Yadav (2012) in Bharawas pond in Haryana and Shiddamallaya and Pratima (2008) in fresh water body. The higher concentration of chloride is considered to be an

indicator of higher pollution due to higher organic waste of animal origin. Venkatesharaju et.al. (2010) observed that the higher concentration of chloride in the summer period may be due to increased temperature, low level of water and sewage mixing.

Table-1 : Seasonal variation in physico-chemical characteristic of water of river Gomti during 2012-2013.

Parameters	Season	Site-A	Site-B	Site-C	Site-D	Site-E	Average
Temp^{o}C	Summer	32±1.39	31±0.56	30.6±0.89	29.7±0.76	30.7±0.98	30.8
	Monsoon	27.9±0.71	27.7±.39	27.1±0.59	26.9±.24	27.7±.29	27.4
	Winter	18.9±0.09	16.6±.24	16±0.18	15.1±0.3	15.7±.20	16.3
pH	Summer	7.85±0.02	7.96± .19	7.86± .04	8.12 0.09	7.18± .03	7.79
	Monsoon	7.26± .07	7.86± .17	7.37± .32	8.14 0.04	7.32± .14	7.59
	Winter	7.36± .03	7.49± .04	7.77± .05	7.55 0.02	7.38± .02	7.51
D.O.	Summer	9.79± .11	8.55± .08	11.2± .07	11.7 0.05	8.61± .13	9.97
	Monsoon	12± 0.16	10 ±0.10	10.2± .26	11.5 0.21	10.2± .25	10.7
	Winter	8.91 0.08	8.28± .10	8.16 ±.05	7.59 0.04	8.33±0.03	8.25
Free CO_2	Summer	68.7± 0.8	57.4±.36	59.4±0.43	52.8 0.56	70.3±0.48	61.7
	Monsoon	42.9± .89	44.3± .19	45.4± .35	47.9 0.73	45.1±.17	45.1
	Winter	38.8±0.58	38.5± .55	41.3± .72	46.3 0.7	71.7 ±.53	39.3
Acidity	Summer	94.1± 3.2	82.9± 1.1	91.8± .72	104 1.29	83.3±0.41	91.2
	Monsoon	75.2 ±1.4	80.4± .85	70.9± 1.0	72.1 1.05	87.6 ±1.2	77.2
	Winter	57.5 ±2.3	40.7± .40	38.8± 1.6	30 1.67	22.9±0.32	37.9
Alkalinity	Summer	242 ±1.36	271± 1.6	264 ±1.20	273 0.86	248± 1.10	259
	Monsoon	273± 1.10	276 ±1.1	235± 0.61	238 0.65	226± 0.90	249
	Winter	206± 3.64	175± .91	134 ±1.92	127 1.89	134± 1.20	155
Hardness	Summer	208 ±1.29	216± 1.1	192± 1.32	283 0.78	271± 0.78	250
	Monsoon	188±0.83	176± .73	186± 0.7	167 0.98	153± 0.50	174
	Winter	200± 1.73	180± 1.10	187± 2.49	210 1.81	191± 1.77	189
Chloride	Summer	25.4± .36	20.5± .40	20.1± .16	29.2 0.38	28.7±0.61	24.7
	Monsoon	17± 0.16	16.1± .29	15.6± .26	20.2 0.63	15.6 ±.61	16.9
	Winter	12.8 0.30	17.8± .42	22.8±.75	13.7 0.18	8.22±0.12	15.1

Conclusion

From the above investigation, it may be concluded that change in the normal range of a majority of observations, which have been recorded at the different sites of river Gomti during 2012-2013. The present study revealed, the physico-chemical quality of river Gomti is not reasonable. The parameters showed that the quality of water is not now in safe limit and not good for flora and fauna, but the situation is alarming and degradation is in continuous process, therefore to improve the quality of water ,there should be continuous monitoring of the pollution level is necessary and immediate action is required for its better management.

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