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Physico-chemical Analysis of River Panvdhoi at Saharanpur (U.P)

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Abstract

The seasonal physico-chemical and heavy metals concentration of Panvdhoi river Saharanpur has been analysed . Various parameters Viz. temperature, conductivity, turbidity, total solids, total dissolved solids, total suspended solids,pH, BOD, COD, DO, free CO_2, alkalinity ,hardness chloride were observed. In Heavy metals lead, copper, zinc and mercury were observed. Less concentration of these parameters were obtained at Sampling station A,B and C while greater amount were observed on sampling station D and E.

Introduction

Water is most precious commodity of life. It is not only the basic need for sustaining human life but also vital to all the segments of economic development .

Water is being adversely affected ,qualitatively and quantitatively by all kinds of human activities on land , in air and/or in water . According to Bernar (1951) domestic sewage consists of about 99.9% water coming from washing , rinsing ,flushing and other activities. The major part of pollution takes place by industrialization because in the industrial sewage there are a large number of chemicals and heavy metals.

District Saharanpur is situated in the north of Uttar pradesh. Many rivers flows through the Saharanpur Viz. Yamuna , Hindon, Damola, Maskara, Krishna, Kalinadi, Panvdhoi etc.

River Panvdhoi flows through Saharanpur district, it is a stream fed river and a tributary of Hindon. This river originates near Shanklapuri Shiv Mandir of Panwarka, then it goes to Saharanpur. It is about 16 Km. in length and then in Saharanpur it mixes with river Dhamola. Due to industrialization in district Saharanpur main drain carries away some effluent from the factories and also from the residential colonies. This drain carries domestic sewage, which is poured into river panvdhoi. Therefore , it can be well considered that it carries a variety of pollutants of equally different in physico-chemical nature.These effluents changes the physico-chemical characteristics to such an extent that they sometimes lead to high fish mortality.

The location of Saharanpur on Globe is on latitude 29 ^{o} 58' North and longitude 77^{o} 33' east while the height from sea level is 270.50 meter. Present study was carried out on stretch of 16 Km from Shanklapuri Shiv mandir to near Dhamola which is having a width of 1-6 meter and depth of 0 .5 to 1.5 meter.

River Panvdhoi is a small tributary having a length of 16 Kms, It originates from Panwarka and in Saharanpur conflicts into Dhamola. The place where it originates is called Sarkadi Ki Puliya.In this point the width of the river is 1-4 meter and depth is 1.5 meter.

Due to New developing Urban areas however, so far no study has been made to find out the seasonal variation in the ecology of the river Panvdhoi at Saharanpur.Hence the study was conducted to fill up this Lacuna.

Materials and Methods

Sampling Stations of the Study

(A) Shanklapuri Shiv Mandir
(B) Makhraj Ka Pul
(C) Lal Das Ka Baada
(D) Jogyan Pul
(E) Near Dhamola

For ecological study of river Panvdhoi the water samples were collected fortnightly from different sampling stations for a period of two year.

Various physico-chemical parameters and Heavy metals were analyzed following the standards methods of APHA (1998), Trivedi and Goel (1986), Mathur (1982) and Khanna and Bhutiani (2004).

Results and Discussion

The results (average annual values) of the present study are given in table 1-2 . In the present study a difference in the fluctuation of water temperature was observed 15.6 ^{O} C ±4.5 ^{O}C to 25.6 ^{O} C ± 4.0 ^{O} C . The water temperature showed an upward trend from winter season to summer season followed by a downward trend from monsoon season onwards. A more or less similar trend has been observed in the river Yamuna by Chakrabarty *et al*. (1959) and in the Kallayi by John (1976). Same trend of temperature was observed by Khanna (1993) in river Ganga at Haridwar

The annual average value of dissolved oxygen ranged between 10.47 mg/l ± 2.09 mg/l to 1.20 mg/l ± 1.07 mg/l ,Chopra *et al*. (1990) , Gopal and Shah (1993) , Joshi *et al*. (1993) and Sharma (1999) also got the same results and have opined that low temperature in winter increases the oxygen retaining capacity of water and solubility of oxygen in water.A negative relationship has been observed between BOD and DO content. A similar pattern has been reported by Khanna (1993) in river Ganga. The annual average value of biochemical oxygen demand ranged between 2.26 mg/l to 78.10 mg/l.

The annual average value of COD ranged between 4.81 mg/l ± 1.59mg/l to 1156.66 mg/l ± 188.76 mg/l . Similar trend of COD have shown by Khanna and Singh (2000) in river Suswa at Raiwala.

Annual Average value of free CO_2 varied between 1.55 mg/l ±1.61 mg/l to 4.89mg/l ±1.34mg/l . Pahwa and Mehrotra (1966) and Ray *et al*. (1966) have reported that the Ganga river contains maximum free CO_2 in rainy Season at Allahabad.Annual average value of total disssolved solids varied between 105.24 mg/l ± 13.10 mg/l to 787.93 mg/l ± 326.17 mg/l

The annual average values of pH varied between 7.20 ± 0.18 to 8.65 ± 0.40.High value obtained during rainy season may be due to rainy water, runoff of sewage drains etc. It was recorded that pH remains slightly alkaline in nature throughout the study.Das (1961) reported that pH of water has an important behaviour on plankton and microbial production.

The annual average value of alkalinity varied betrween 50.02 mg/l ± 15.76 mg/l to 781.66 mg/l ± 62.11 mg/l. Similar observations was also obtained by Holden and Green (1960) , Talling and Rzoska (1967) and Abidin (1948a) .

The annual average value of total hardness ranged from 95.66 mg/l ± 11.71 mg/l to 280.31 mg/l ± 17.12 mg/l .Mishra and Joshi (2003) observed hardness in river Ganga at Hardwar and found more or less similar trend in their study. The annual average value of Chloride varied between 5.31 mg/l ± 5.26 mg/l to 60.51 mg/l to 2.09 mg/l.Chlorides are present in sewage , sewage effluents and farm drainage . Significant levels of chloride content were showed by many rivers like Yamuna , Sengar *et al*. (1985) and Tungbhadhara , Reddy and Venkateshwarlu (1987).

In the present study heavy metals, lead, copper, Zinc and mercury were taken for observation. The annual average value of heavy metals are given in table 2.The annual average of Lead ranged between 0.0702mg/l ± 0.02291 to 4.9075 mg/l ± 0.6582. The minimum value was found from sampling station A in 2002-2003 and maximum from sampling station E in 2003-2004. The annual average value of copper varied between 0.053 mg/l ± 0.0324 to 1.5945 mg/l ± 0.3729 in which average value of copper was obtained at sampling station A in 2003-2004 and maximum average value at sampling station E in 2002-2003. The annual average value of Zinc ranged between 3. 1651 mg/l ± 0.0528 to 4.871 mg/l ± 0.1750 in which minimum average value of Zinc was obtained from sampling station A in the year 2002-2003 and maximum was recorded at sampling station E in the year 2002-2003. The annual average value of Mercury varied between 0.0000 mg/l ± 0.0000 to 0.0006 mg/l ± 0.0002. The minimum was found as nil in both the years (2002-2004) at sampling station A,B,C and maximum at sampling station E in 2003-2004 (Table- 2). The concentration of these metals at sampling station C,D and E give a highly misleading picture of the degree of metal pollution. Heavy metals get contaminated into aquatic systems as result of various natural activiries (Weathering of soils and rocks from volcanic eruptions) and from a variety of human activities involving the mining , processing or use of metals or substances. Some metals , such as copper and zinc are essential micronutrients, while others such as mercury and lead are not required even in small amount by any organisms. Virtually all metals , including the essential metal micronutrients, are toxic if exposure levels are sufficient high. Andren (1974) reported that about 67 percent of the mercury in the Mississippi river water is associated with suspended sediments.

References

Abdin,G. 1948a. Physical and Chemical investigation relating to algal growth in the river Nile. ***Cairo Bull. Inst. Egypt***, 29: 20-24.

Andren,A.W. 1974. Ph.D. Thesis, Florida State University Ocenography department , Tallahaseefla.

APHA. 1998. *Standard methods for the examination of water and waste water* . American public health association,1015 fifteen street , NW Washington ,15: 1-1134.

Berner,L.M. 1951. Limnology of the lower Missouri River, ***Ecology***, 32 : 1-12.

Chakarbarty, R.D., Ray, P. and Singh, S.B. 1959. A quantitative survey of plankton and physiological conditions of the river Jamuna at Allahabad in 1954-1955. ***Indian J. Fish***. 6(1) : 186-203.

Chopra, A.K., Madhwal, B.P. and Singh, H.R. 1990. Abiotic variable and Primary productivity of river Yamuna at Naugaon, Uttarkashi, Garhwal. ***Indian J. Ecol.*** 17(1) : 61-64.

Das, S.M. 1961. Hydrogen ion concentration, plankton and fish in fresh water Eutrophic lakes of India, ***Nature***, 191(4787) : 511-512.

Gopal, B. and Shah, M. 1993. Conservation and management of rivers in India: Case study of the Yamuna, ***Environmental Conservation***, 20(2) : 243-253.

Holden, J.M. and Green, J. 1960. Hydrobiology and plankton of the river Sokoto. ***J. Anim. Ecol***. 29(1) : 65-84.

John, V. 1976. Hydrobiological studies on the river Kallayi in Kerala. ***Indian J. Fish***., 23: 72-85.

Joshi,B.D., Pathak, J.K. ,Singh, Y.N., Bisht, R.C.S. and Joshi, P.C. 1993. On the physico-chemical characteristics of river Bhagirathi in uplands of Garhwal Himalaya. ***Him. J. Env. Zool***. 7 : 64-75.

Khanna,D.R. 1993. *Ecology and Pollution of Ganga rive*r. Ashish Publishing House, New Delhi: 1-241.

Khanna,D.R. and Singh, R.K. 2000. Seasonal fluctuations in the plankton of Suswa river at Raiwala Dehradun. ***Env. Cons. J***. (2&3) : 89-92.

Khanna ,D.R. and Bhutiani, R. 2004. *Water analysis at a glance*.ASEA Publication, Rishikesh.

Mathur, R.P. 1982. *Water and wastewater testing*. Neem chand and Bros. Publishers, Roorkee, 1-54.

Mishra,S.and Joshi, B.D. 2003. Assessment of water quality with few selected parameters of River Ganga at Haridwar.***Him. J. Env. Zool***. Vol. 17 (2) : 113-122.

Pahwa,D.V. and Mehrotra, S.N. 1966. Observation on fluctuation in abundance of plankton in relation to certain hydrological conditions of river Ganga . *Proc. Nat. Acad. Sci.* 36B(2) : 157-189.

Ray,P., Singh ,S.B. and Sehgal,K.L. 1966.A study of some aspects of the river Ganga and Jamuna at Allahabad (U.P.) in 1958-59. *Poc. Nat. Acad. Sci. India*, 36B(3): 235-272.

Reddy,P.M. and Venkateshwarlu, V1987. Assessment of water quality and pollution in river Tungbhadra near Kurnool (A.P.) ***J. Environ. Biol.*** 8(2) :109-119.

Senger,R.M.S., Sharma, K.D. and Pathak, P.D 1985. Studies on distribution of algal flora in polluted and nonpolluted regions in Yamuna river at Agra (U.P.) . ***J. Indian Bot. Soc***. 64 : 365-376.

Sharma,A. 1999. *Limnological studies of Ban Ganga and distributional pattern of stream bottom fauna*. Ph.D. thesis, University of Jammu.

Talling, J.F. and Rzoska, J. 1967. The development of plankton in relation to hydrobiological regime in Blue Nile. ***J.Ecol***. 55: 636-662.

Trivedi,R.K. and Goel,P.K. 1984. ***Chemical and biological methods for water pollution studies*** Karad: Environmetal Publications. 1-251.

Table 1: Average annual value of physico-chemical parameters of river Panvdhoi

Psysico-Chemical Parameters	Sampling Station 'A'		Sampling Station 'B'		Sampling Station 'C'		Sampling Station 'D'		Sampling Station 'E'		Average
	2002-2003	2003-2004	2002-2003	2003-2004	2002-2003	2003-2004	2002-2003	2003-2004	2002-2003	2003-2004	2002-2004
Temperature(°C)	15.6 ± 4.50	16.5 ± 6.30	17.6 ± 4.20	19.3 ± 4.30	20.2 ± 5.20	20.4 ± 5.70	23.4 ± 5.50	23.1 ± 4.40	25.0 ± 4.40	25.6 ± 4.00	20.7 ± 3.50
Conductivity	191.44 ± 127.32	206.70 ± 137.55	191.44 ± 127.18	206.84 ± 137.63	165.56 ± 117.35	166.33 ± 116.22	148.96 ± 110.11	137.71 ± 102.53	142.07 ± 104.39	149.20 ± 105.64	170.62 ± 26.56
Turbidity	57.78 ± 54.54	68.81 ± 70.78	49.58 ± 40.44	44.89 ± 27.63	243.33 ± 30.55	242.20 ± 39.75	533.93 ± 126.08	524.18 ± 85.38	908.46 ± 101.05	901.07 ± 198.83	357.42 ± 341.56
Total Solids (mg/L)	179.53 ± 168.53	210.96 ± 25.71	181.92 ± 169.96	213.17 ± 219.34	186.60 ± 23.33	187.44 ± 28.89	1627.40 ± 647.20	1598.38 ± 629.34	1726.94 ± 651.22	1825.66 ± 748.50	793.80 ± 777.64
T.D.S. (mg/L)	121.67 ± 113.62	141.74 ± 149.86	123.03 ± 114.19	142.78 ± 149.85	105.24 ± 13.10	105.58 ± 13.30	720.46 ± 313.85	787.93 ± 326.17	766.66 ± 351.18	500.00 ± 379.86	351.51 ± 304.54
T.S.S. (mg/L)	57.85 ± 54.94	69.22 ± 70.70	58.88 ± 55.79	70.39 ± 69.73	81.53 ± 10.23	81.85 ± 15.62	905.93 ± 347.60	810.45 ± 343.52	960.26 ± 307.78	965.83 ± 378.07	406.31 ± 14.53
pH	7.32 ± 0.25	7.20 ± 0.18	7.34 ± 0.25	7.24 ± 0.16	7.50 ± 0.09	7.51 ± 0.07	8.42 ± 0.42	8.51 ± 0.40	8.65 ± 0.37	8.65 ± 0.40	7.83 ± 0.63
BOD (mg/L)	2.26 ± 0.32	2.29 ± 0.53	2.54 ± 0.85	2.57 ± 0.74	8.42 ± 2.74	8.80 ± 3.12	281.66 ± 66.58	293.33 ± 73.71	468.33 ± 80.98	475.00 ± 78.10	154.52 ± 203.23
COD (mg/L)	5.69 ± 1.45	4.81 ± 1.59	5.62 ± 0.69	4.95 ± 1.69	28.11 ± 6.56	25.90 ± 6.37	768.33 ± 173.22	878.33 ± 174.73	1075.00 ± 220.17	1156.66 ± 188.76	395.34 ± 504.84
DO(mg/L)	9.55 ± 2.16	9.56 ± 1.99	9.61 ± 1.41	10.47 ± 2.09	7.56 ± 0.89	7.57 ± 1.82	4.66 ± 0.58	4.44 ± 0.69	1.68 ± 1.47	1.20 ± 1.07	6.53 ± 3.41
Free CO2 (mg/L)	2.02 ± 1.95	1.55 ± 1.61	2.56 ± 1.52	2.22 ± 1.56	2.69 ± 1.25	2.59 ± 1.17	3.93 ± 1.36	4.29 ± 1.39	4.74 ± 1.56	4.89 ± 1.34	2.17 ± 1.22
Alkalinity (mg/L)	50.02 ± 15.76	51.93 ± 15.74	50.89 ± 15.94	52.70 ± 15.82	261.17 ± 11.99	244.25 ± 39.71	711.08 ± 3.57	701.05 ± 92.54	781.66 ± 62.11	762.24 ± 112.55	366.70 ± 330.46
Total Hardness (mg/L)	95.66 ± 11.71	97.57 ± 14.10	96.44 ± 12.19	100.56 ± 14.01	221.94 ± 6.96	217.58 ± 7.46	275.63 ± 16.75	275.26 ± 51.77	279.74 ± 17.27	280.31 ± 17.12	194.09 ± 86.04
Chloride (mg/L)	5.51 ± 5.29	5.31 ± 5.26	5.85 ± 5.37	5.74 ± 5.42	34.45 ± 4.33	34.96 ± 6.30	57.16 ± 3.59	44.51 ± 6.15	59.67 ± 3.16	60.51 ± 2.09	31.36 ± 23.95

Table 2 : Average annual value of Heavy metals of river Panvdhoi

Parameters	Sampling Station 'A'		Sampling Station 'B'		Sampling Station 'C'		Sampling Station 'D'		Sampling Station 'E'		Average
	2002-2003	2003-2004	2002-2003	2003-2004	2002-2003	2003-2004	2002-2003	2003-2004	2002-2003	2003-2004	2002-2004
Lead (Pb) (mg/L)	0.0702 ± 0.0076	0.0741 ± 0.0090	0.0711 ± 0.0073	0.0719 ± 0.0087	1.6170 ± 0.3797	1.9533 ± 0.3776	3.3034 ± 0.0776	3.3320 ± 0.1271	4.8452 ± 0.6109	4.9075 ± 0.6582	2.0882 ± 1.9130
Cooper (Cu)(mg/L)	0.0550 ± 0.0291	0.0533 ± 0.0324	0.0626 ± 0.0263	0.0602 ± 0.0332	0.0835 ± 0.0170	0.0811 ± 0.0236	0.8308 ± 0.1756	0.8351 ± 0.1757	1.5945 ± 0.3729	1.5595 ± 0.3328	0.5710 ± 0.6171
Zinc (Zn)(mg/L)	3.1651 ± 0.0528	3.2098 ± 0.0331	3.2109 ± 0.0259	3.2281 ± 0.0304	3.6755 ± 0.2067	3.6813 ± 0.3360	4.2443 ± 0.0732	4.2517 ± 0.1139	4.8695 ± 0.1763	4.871 ± 0.1750	3.8417 ± 0.6772
Mercury (Hg) (mg/L)	0.0000 ± 0.0000	0.0000 ± 0.0000	0.0000 ± 0.0000	0.0000 ± 0.0000	0.0000 ± 0.0000	0.0000 ± 0.0000	0.0001 ± 0.0000	0.0003 ± 0.0002	0.0005 ± 0.0006	0.0006 ± 0.0002	0.0001 ± 0.0002