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Physico-Chemical and Biological Analysis of Sewage Water along Hindon River Ghaziabad City (U.P) India

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***Abstract*— The study was carried out to assess the pollution profile along Hindon River .The quality was assessed in terms of physico-chemical and biological parameters .There was 5 sampling sites were selected for the collection of sample and samples were collected in monthly intervals from the study area during six months period from March 2013 to August 2013 .The physico-chemical and biological parameters were water temperature(20.4-29.7 ^{0}C) colour (Colorless-pale yellow), p^H(7.3-8.9), turbidity(70.4-116.8 NTU), alkalinity (189-487 ppm), acidity(12.0-34.9 ppm), Total Solids (TS) (3900-7340ppm), Total Suspended Solids(TSS)(680-1910ppm) , Total Dissolved Solids(TDS)(3019-6120ppm) Biological Oxygen Demand (BOD)(200-400ppm) Chemical Oxygen Demand (COD)(200-700ppm) etc. Plankton composition varied and was made of 6 main families-chlorophyceae, phaeophyceae, Dinophyceae, Cyanophyceae, Euglenophycae , diatoms etc . The water quality 2013 deteriorated from upstream to downstream.**

Keywords*— *Physico-Chemical and Biological Parameters, Water Quality, Turbidity, Planktons, Electronic Conductivity, Upstream to Downstream, Hindon River India

I. INTRODUCTION

Hindon River, a tributary of Yamuna river, is a river in India that originates in the Saharanpur District, from Upper Shivalik in Lower Himalayan Range. The river is entirely rainfed and has a catchment area of 7, 083 km^2. It is located at 28.4^{0}53' N and 77^{0}04' E.It flows between Ganges and Yamuna rivers, for 400 km through Muzaffarnagar District, Meerut District, Baghpat District, Ghaziabad, Noida,Greater Noida before it joins Yamuna river just outside Delhi. The Hindon Air Force Base of the Indian Air Force also lies on its bank in theGhaziabad district on the outskirts Delhi.

The industries of western Uttar Pradesh discharge their effluents, often with no treatment, directly into the Hindon River. This heavy loading of industrial effluent discharge directly into the Hindon River places an intolerable burden on the river's natural ability to assimilate pollutants. Use of the river for disposal of untreated human sewage is a primary cause of poor water quality within the river. The Hindon receives a high loading of degradable and non-degradable domestically generated litter. The Hindon River water has been evaluated for physical and chemical characteristics the presence of toxic contaminants and for biological diversity of river ecology. Water is the most vital resource for all kinds of life on this planet. It is adversely affected both qualitatively and quantitatively on land . The right to safe water is a basic human right, legally defined by the UN Committee on Economic, Social and Cultural Rights as follows;

'The human right to water entitles everyone to sufficient, safe, acceptable, physically accessible and affordable water for personal and domestic uses'.

Hence ,availability of clean water is going to become the greatest contain for the human health. In India the measure source of water are river, pond ,wells and tube wells. In majority of town and city the drinking water often gets contaminated with domestic sewage ,refuse dump ,organic and inorganic substances which make unsafe. The disposal of urban solid wastes on ground place plays an important role in ground water pollution. Most of the landfills thought the area are used refuse dumps. Leach ate from landfill pollute the ground water if water moves through fill material(JeevanRao and Shantaram 1995).

The deterioration of this river has been swift. 60 year old Punna from Malira village located within the Hindon River catchment states 'Arey bees baras pehle to isme ka paani peekare hai'– '20 years ago the water in this river was drinkable'.

The rich aquatic ecology that is expected to be abundant within this rural state, is now absent.This study was therefore implemented as a result of an increasing awareness of the toxic contamination of the Hindon River, and the compromised human health identified within the population of the river catchment.

A wide range of highly acutely toxic organochlorine and organophosphorus pesticides and heavy metals have been identified within rivers and groundwater throughout the catchment, at levels that exceed national and international standards for safe bathing and drinking water by several orders of magnitude. A detailed health survey of the rural catchment population has identified alarming levels of serious debilitating illness and death which are directly attributable to the presence of dangerously high toxic pesticide and heavy

metal contamination within the drinking water of these villagers. Medical expenses incurred by villagers as a result of consuming contaminated drinking water are also shown to exert a heavy economic burden on a population already economically and socially marginalized.

Organochlorine and organophosphorus pesticides are shown to be entering water resources to toxic levels as a result of over-application of agricultural chemicals. Heavy metals are shown to be present as a direct result of discharge of large volumes of untreated industrial effluents.

Material and Methods

Physical, chemical and biochemical parameters where chosen for analysis for each sample taken, including Dissolved Oxygen and Biochemical Oxygen Demand (BOD). These parameters where chosen for assessment as they give a good overview of general water quality. Measurements for Dissolved Oxygen were undertaken in the field. All other parameters were assessed in the laboratory according to the standard methodologies prescribed in the Handbook of American Public Health Association (APHA), American Water Works Association (AWWA) and Water Environment Federation (WEF), 22th Edition 2012.

Water samples were collected in 2 liters sterilized plastic bottles from the sampling sites in monthly intervals and taken to the laboratory at L.R (P.G.) College Sahibabad. The six sampling sites S1,S2,S3,S4,S5,S6 were selected along Hindon river .Temperature and p^H were measured on the spot at sampling sites using mercury thermometer and digital pH meter and other parameters were analyzed immediate at laboratory and result were compared with the Indian Standards ,APHA and AWWA.

Result and Explanation

Physico-Chemical and Biological parameters Method Applied for laboratory analysis

p^H	p^H METER
Temperature	Mercury thermometer
Color (Apparent)	Visible
Odour	Sensation method
Electrical Conductivity	Potentiometry
Total Dissolved Solid (TDS)	Gravimetric, Oven drying at 1000C
Chemical Oxygen Demand (COD	Potassium dichromate ,) closed reflux method
Biological Oxygen Demand (BOD)	5 days incubation at 20 oC

The water quality analysis of sewage water samples along Hindon River have been carried out temperature,pH, Electrical conductivity, alkalinity, TSS,TS and TDS ,BOD and COD.

Temperature: The temperature of sewage water samples varies between 15.6-34 ^oC . The maximum temperature was recorded at fifth sampling site S5.

p^H p^H value was recorded highest 9.30 at S 5 sample during July and minimum 7.5 at S 3 during august. These values indicated slightly alkaline waste from different sources.

Turbidity: The turbidity of water is actually the expression of optical property i.e. tyndal effect in which light is scattered by the particles present in the water. The turbidity estimated ranges 60-105.8 NTU more than Indian Standard.

Alkalinity: Alkalinity was found to be varied between 203-498 ppm .The alkalinity was highest in S5 due to discharge of carbonate and bicarbonate an hydroxyl base at S5.

Acidity:The acidity was recorded range from 12.0-45.0 ppm .

Total Suspended Solids:(TSS) There are several ways by which the transparency of water is reduced. Total suspended solids also to some extent contribute in reducing transparency which is a very important physical factor in water quality monitoring. The total solids were found to be 4000mg/l. These variations in TS value to indicated it increases from upstream to downstream due to added wastewater or sewage every collecting site. The total suspended solids (TSS) are noticed to be highest 2500mg/l at S 5.

Biochemical Oxygen Demand (BOD): The BOD of the sewage is the amount of oxygen required for the biochemical decomposition of biodegradable organic matter under aerobic conditions. The oxygen consumed in the process is related to the amount of decomposable organic matter. The general range of BOD observed for raw sewage is 100 to 400 mg/L.

Chemical Oxygen Demand (COD): The COD gives the measure of the oxygen required for chemical oxidation. It does not differentiate between biological oxidisable and nonoxidisable material. However, the ratio of the COD to BOD does not change significantly for particular waste and hence this test could be used conveniently for interpreting performance efficiencies of the treatment units. In general, the COD of raw sewage at various places is reported to be in the range 200 to 700 mg/L.

Table-1 Showing the temperature Variation During March- August 2013

Sample	Temperature ^{0}C					
	March	April	May	June	July	August
Safipur Village, GBNGR(S1)	21.8	22.0	24.1	27.9	28.3	27.3
Arthala Village,GZB(S2)	20.4	23.5	24.6	26.0	27.3	29.0
Momnathal Village,GBNGR(S3)	22.2	23.4	24.5	26.6	27.9	28.0
RAJ Nagar Extension GZB(S4)	24.0	25.0	27.2	28.0	29.1	29.7
Barnawa Village, Baghpat(S5)	21.6	23.3	25.1	26.2	27.9	28.1

Table -2 Showing the Electical Conductivity Variation during March-August 2013

Sample	Electrical Conductivity(µS/CM)					
	March	April	May	June	July	August
Safipur Village, Gbngr (S1)	178.4	180.3	182.4	184.2	193.3	198.3
Arthala Village,GZB(S2)	186.2	189.1	190.2	192.2	198.1	200.1
Momnathal village Gbngr(S3)	202.1	203.1	204.1	232.1	244.1	256.1
RAJ Nagar Extension Gzb(S4)	267	278.1	281.1	288.2	291.3	297.3
Barnawa Village, Baghpat(S5)	216	237	251.4	266.5	279.8	289.9

Table -3 Showing the p^H and Turbidity Variation during March-August 2013

Sample	pH						Turbidity(NTU)					
	March	April	May	June	July	August	March	April	May	June	July	August
Safipur Village, Gbngr	7.8	7.4	7.3	7.6	7.8	7.9	70.1	75.6	78.7	79.5	82.2	89.5
Arthala Village,GZB	7.3	7.57	7.34	7.7	7.8	7.56	75.7	93.1	89.5	90.6	95.3	97.5
Momnathal Village, Gbng	7.8	8.9	8.2	8.5	8.6	8.9	80.8	94.2	98.2	99.7	109.3	110.7
RAJ Nagar Extension Gzb	8.2	8.4	8.6	8.5	8.7	8.9	81.8	97.4	98.4	99.9	100.3	112.5
Barnawa Village, Baghpat	7.5	7.8	8.7	8.5	8.7	8.8	86.8	98.2	99.6	101.1	115.3	116.8

Table -4 Showing the Alkalinity(ppm) andAcidity(ppm) Variation during March-August 2013

Sample	Alkalinity(ppm)						Acidity(ppm)					
	March	April	May	June	July	August	March	April	May	June	July	August
Safipur Village, Gbngr	203	232	239	240	245	248	12.0	12.6	14.8	13.7	14.1	15.1
Arthala Village,GZB	210	216	231	256	259	274	13.2	14.4	15.1	16.9	26.1	27.5
Momnathal Village, Gbng	189	196	198	219	230	245	16.7	16.9	24.6	24.9	29.7	30.7
RAJ Nagar Extension Gzb	314	316	343	367	397	406	19.7	20.2	23.8	28.8	34.9	30.8
Barnawa Village, Baghpat	402	406	412	498	476	487	20.2	25.8	28.9	26.8	32.1	46.9

Table -5Showing the Total Solids(ppm) Variation during March-August 2013

sample	Total solids(ppm)					
	March	April	May	June	July	August
Safipur Village, Gbngr	3900	4050	4100	4250	5067	5260
Arthala Village,GZB	5002	4507	4700	5150	5378	5489
Momnathal Village, Gbng	5876	5490	4098	5678	5890	6010
RAJ Nagar Extension Gzb	6120	6020	6348	6570	6767	6500
Barnawa Village, Baghpat	6540	6590	6980	7080	7120	7340

Table -6 Showing the Total Suspended Solids(ppm) Variation during March-August 2013

sample	Total Suspended solids(ppm)					
	March	April	May	June	July	August
Safipur Village, Gbngr	680	760	740	810	840	890
Arthala Village,GZB	690	708	760	870	890	1050
Momnathal Village, Gbng	1005	1080	1150	1200	1360	1450
RAJ Nagar Extension Gzb	790	850	890	951	950	1020
Barnawa Village, Baghpat	1700	1750	1800	1820	1860	1910

Table -7 Showing the Total Dissolved Solids(ppm) Variation during March-August 2013

sample	Total Dissolved Solids(ppm)					
	March	April	May	June	July	August
Safipur Village, Gbngr	3019	3050	3260	3380	3460	3600
Arthala Village,GZB	3280	3370	3450	3500	3690	3700
Momnathal Village, Gbngr	3400	3360	3690	3680	4050	4100
RAJ Nagar Extension Gzb	4300	4480	4500	4560	4780	4870
Barnawa Village, Baghpat	5400	5470	5560	5780	5790	6120

Table -8 Showing the Biological Oxygen Demand(ppm) Variation during March-August 2013

sample	Biological Oxygen Demand(ppm)					
	March	April	May	June	July	August
Safipur Village, Gbngr	110	305	326	338	346	360
Arthala Village,GZB	234	336	345	350	369	370
Momnathal Village, Gbngr	340	398	369	368	398	400
RAJ Nagar Extension Gzb	320	234	321	345	296	289
Barnawa Village, Baghpat	128	234	234	247	289	369

Table -9 Showing the Chemical Oxygen Demand(ppm) Variation during March-August 2013

sample	Chemical Oxygen Demand(ppm)					
	March	April	May	June	July	August
Safipur Village, Gbngr	320	305	326	338	346	360
Arthala Village,GZB	234	336	345	350	369	370
Momnathal Village, Gbngr	340	398	369	700	498	400
RAJ Nagar Extension Gzb	320	234	321	345	596	289
Barnawa Village, Baghpat	128	234	700	689	289	369

II. CONCLUSION

The water quality of Hindon River found to be steadily deteriorated .In the study indicated the some parameters values as TDS, TSS, Alkalinity, Acidity were recorded high from the standard limit (ISI 1992)

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