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Physico-Chemical Characteristic of Hindon River, Uttar Pradesh (India)

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Abstract: *Hindon River originates from the upper Shivalik in lower Himalayan range of District Saharanpur Uttar Pradesh (India). The river passes through six districts, including Noida and Ghaziabad, in Uttar Pradesh before it meets the Yamuna ahead of Dankaur (Uttar Pradesh). Two of its tributaries – Kali River and Krishna River - in Ghaziabad are also equally polluted like the main river. Paper mills, sugar manufacturing plants, alcohol distillation units and slaughterhouses located at places like Saharanpur, Muzaffarnagar and Baghpat are blamed for the pollution. The Hindon Air Force Base of the Indian Air Force also lies on its bank in the Ghaziabad district on the outskirts of Delhi.*

"The analytical results of the Hindon River that its water quality does not meet the prescribed standard of primary water quality criteria for bathing water as per the notification under the Environment (Protection) Rules with respect to dissolved oxygen (DO), biochemical oxygen demand (BOD), total coli form, and pH," it added. The aim of this study was to assess the level of different Parameters (pH, Electrical Conductivity, Alkalinity, BOD, COD, TDS, DO, Chloride) in Hindon River at Indrapuram, Ghaziabad (India). A total of 4 stations, covering the upstream and downstream sites of Hindon, were selected for this study.

Keywords: *Tributaries, Effluent, chemical, parameters, discharge, upstream and downstream etc.*

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 square kilometres. The main tributary of Hindon River is Kali River; it originates from the Doon valley and travels 150 kilometres passing through Saharanpur, Muzzafarnagar, Meerut, and Bhagpath districts of Uttar Pradesh. The Kali river is too polluted river, the industrial waste from the Saharanpur adds into it and then it add to Hindon and waste water from the industrial belt from Saharanpur to Noida release into the Hindon further treatment or not. Effluent discharged from sugar and paper mills, slaughter houses, and chemical industries in Uttar Pradesh(India) are degrade the water quality in the Hindon, so much so that the water is not fit for bathing. The Central Pollution Control Board (CPCB) submitted an affidavit in the National Green Tribunal showing that the water in the Hindon River does not meet the prescribed standard of primary water quality criteria for bathing. Government take the appropriate steps for set up the STP(Sewage Treatment plant) on the Hindon river for the treatment of waste water and give the instructions to industries for set up Effluent treatment plant for the treatment of effluent before release into the river. But the reality is that there is not so good working for the waste water treatment on Hindon River, further most of the STP plants are not in good working condition and industries not set up well efficient working ETP plant. Villagers say that the situation was different a decade ago. "We have spent our childhood swimming in the Harnandi, which is its original name. When the industrial effluent discharges directly into the river, we started noticing the change. It became dirty emitting a foul smell and we stopped using its water for bathing or washing clothes," Ghanshyam, a villager, says.

II. Methodology

We have selected a Hindon river tributary from Indrapuram (Ghaziabad) over a length of about 4km adjacent to which a flyover is being constructed it is placed at Latitude 28.641485, Longitude: 77.371385 and many of the industries which are installed near Indrapuram released their effluent in it. Four Sampling sites have been selected to obtain the sample of water over a time period of two months and tests such as pH, Electrical Conductivity, Total Hardness, Alkalinity, BOD, COD, Alkalinity, TDS , DO and Chloride etc. will be carried. Total 4 samples will be taken and tested in laboratory to give the results.

Table1- Methods used for estimation of Physico - Chemical parameters

S. No	Parameter	Methods
1	pH	pH Meter
2	Electrical Conductivity(µs/cm)	Conductivity meter
3	Total Hardness (mg/l as $CaCO_3$)	EDTA Titration
4	Alkalinity (mg/l)	Indicator Method
5	BOD at 27^oC for 3 days (mg/l)	Wrinkler's method

6	COD (mg/l)	Open reflux method
7	TDS (mg/l)	Filtration Method
8	DO (mg/l)	Wrinkler's method
9	Chlorides(mg/l)	Silver Nitrate Method

III. Results

pH- The standard values of pH for drinking water by BIS is between 6.5-8.5 while, WHO is between 7.0 - 8.5. pH value for drinking water is limited from 5.5 to 8.5 and for effluent discharge it is between 5.5 and 9 as per IS: 2490 and CPCB. High value of pH may results due to waste discharge, microbial decomposition of organic matter in the water body (Patil et al., 2012) .High pH particularly in combination with high water temperature can increase the amount of unionized ammonia which is highly toxic to fish. The pH value was in the River sample range of 7-8 which is acceptable but not fit for drinking and this shows the alkaline nature of river making it unfit.

Electrical Conductivity-Electrical Conductivity can be used to monitor the quality of surface water, process water in water supply and treatment plants and waste water. Electrical Conductivity may be used as a measure of the concentration of ionizable solutes present in the sample. It is expressed in Siemens per centimeter. High electrical conductivity affected the germination of crops and it may result in much reduced yield (Srinivas et al., 2000). Higher the ionizable solids, greater will be the EC. The conductivity in the study area was in the range of 380-580 µs/cm.

Table 2: Physico - Chemical characteristics of Hindon River water samples at four different point

S. No	Parameter	Site 1	Site 2	Site 3	Site 4
1	pH	7.2	7.8	7.3	7.7
2	Electrical Conductivity(µs/cm)	387.65	432.25	506.75	570.75
3	Total Hardness (mg/l as $CaCO_3$)	105	111	130	139.4
4	Alkalinity (mg/l)	125	128	235	237
5	BOD at 27^oC for 3 days (mg/l)	252	280	595	615
6	COD (mg/l)	610	630	2090	2135
7	TDS (mg/l)	235	262	309	348
8	DO (mg/l)	1.2	1.1	0.3	0.2
9	Chlorides(mg/l)	130	138	210	245

Total Hardness- Hardness is the property of water which prevents the lather formation with soap and increases the boiling points of water (Patil and Patil, 2010). The simple definition of water hardness is the amount of dissolved calcium and magnesium in the water. In hard water soap reacts with calcium to form soap scum. Hardness is caused by compound of calcium and magnesium, and by variety of other metals. General guidelines for classification of water are 0 to 60 mg/l as $CaCO_3$ is classified as soft; 61 to 120 mg /l as $CaCO_3$, moderately hard; 121 to 180 mg/l as $CaCO_3$ is hard; and more than 180 mg/l as $CaCO_3$ is very hard. The total Hardness is in the range of 100-140 mg/l as $CaCO_3$ which shows the higher concentration of magnesium and calcium compounds making water hard.

Alkalinity- Alkalinity value in water provides an idea of natural salts presents in water. Alkalinity is important for fish and aquatic life because it protects or buffers against rapid changes. Living organism's especially aquatic life function best in pH range of 6.0 to 9.0. Higher alkalinity levels in surface water will buffer acid rain and other acid waste and prevent pH changes that are harmful for aquatic life. Alkalinity values are in the range from 125-237 mg/l, mixing of waste water from different sources such as industrial wastes is the possible cause of high alkalinity values at some points. The alkalinity values are under the reasonable limit 600 mg/l as per WHO (1993).

BOD- Biochemical Oxygen demand is a measure of quantity of oxygen required by microorganisms in the oxidation of organic matter. Natural source of organic matter include plant decay and leaf fall. Oxygen consume in the decomposition process robs other aquatic organisms of the oxygen they need to live. Organisms that are more tolerant of dissolved oxygen levels may replace a diversity of natural water system contain bacteria. The test of BOD Conduct by Winkler's method in the laboratory. BOD values are in the range from 250-610 mg/l, mixing of waste water from different sources such as industrial wastes is the possible cause of high BOD values at some points, which is higher than the permissible limit 30 mg/l according to Environment (protection) rules 1986.

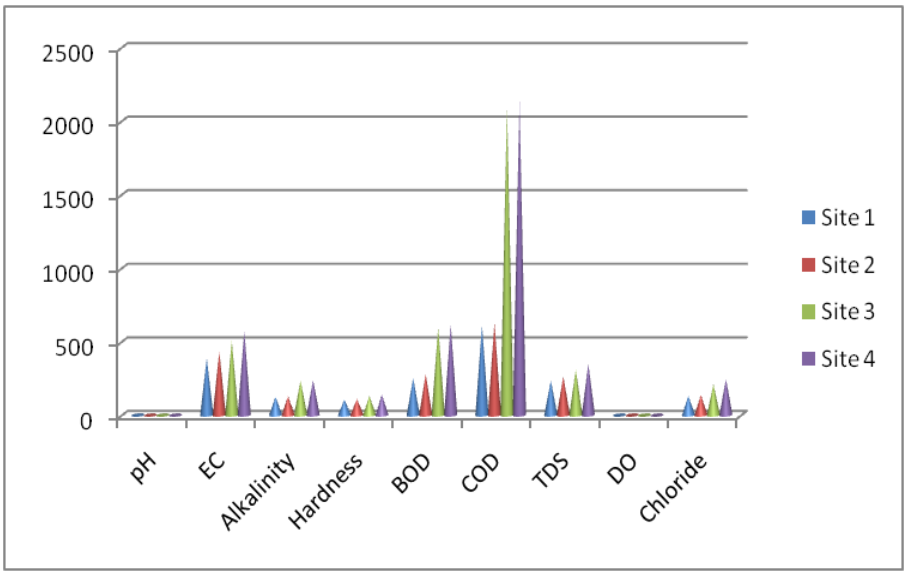
COD- Chemical Oxygen Demand is a measure of capacity of water to consume oxygen during the decomposition of organic matter and oxidation of inorganic chemicals such as ammonia and nitrite.COD

measurement are commonly made on samples of waste water are of natural water contaminated by domestic or industrial wastes. High COD may cause oxygen depletion on account of decomposition by microbes (Siva Kumar et al., 1989) to a level detrimental to aquatic life. COD values are in the range from 610-2135 mg/l, mixing of waste water from different sources such as industrial wastes is the possible cause of high COD values at some points, which is higher than the permissible limit 250mg/l (Environment Protection Rules, 1986)

DO-Dissolved oxygen is the amount of oxygen that is present in water. It is measured in mg/l. In limnology dissolve oxygen is an essential factor second only to water itself. A dissolved oxygen level that is too high or too low can harm aquatic life and affect water quality. Bottom feeders, crabs, oysters and worms need minimal amount of oxygen (1-6 mg/l), while shallow water fish need higher levels (4-15 mg/l).Test of DO can be done in the laboratory by Wrinkler's method. The dissolved oxygen in the river is within the range of 0.2-1.2 mg/l which is much below the standard values and will result in the death of aquatic life due to deficiency of oxygen.

TDS-Total Dissolved Solids refer to any materials, salts, metals, cations or anions dissolve in water. TDS varied in present study range from minimum of 230-350 mg/l as $CaCO_3$.Higher values of TDS indicate the mixing of sewerage, cloth washing and garbage dumping.

Chloride-Chloride occurs naturally in all types of water. Chloride in natural water results from agricultural activities, industries and chloride rich rocks. In the study areas chloride level is within the permissible limit of WHO (250 ppm), which indicates less contamination of chloride. The chloride contents in surface water sample were tested by silver nitrate methods. The chlorides are in the range of 130-245 mg/l which is higher than the normal values and is mainly due to domestic and industrial wastes. . People accustomed to higher chloride in water are subjected to laxative effects (Fried and Combarnous, 1971). The high chloride content may be affected the aquatic life and also the human who consume its water



Graph of Physico-Chemical Prameters of Hindon River at different sites of Indrapuram, Ghaziabad (India)

IV. Conclusion

On the basis of above parameters we can easily say that the river is highly polluted, due to the industrial effluents released into it. The limit of above parameters in the river is so high than the permissible limit. This water is neither able to use in washing, nor be in irrigation. The levels of different parameters which are so common parameters to represent the characteristics of water and waste water like pH, Electrical Conductivity, Total Hardness, Alkalinity, BOD, COD, TDS, DO, Chloride, etc we can see the results of these parameters in the given table-1.Out of the four sites (From where the sample is collected), on the site, where the high amount of industrial effluent released into the river, the level of parameter has high than the other site. So, on the basis of above data we can easily say that the Hindon River is most polluted river of Uttar Pradesh (India), which also degrade the ground water. The ground water of most of the villages, towns and cities, which locate on the bank of this river, become highly polluted with yellow colour appearance. Many of the persons in those villages suffered from cancer after the use of this polluted water from the long time, through the hand pump. So, there are so drastic conditions for the villagers and those who used to live near its bank. It is also harmful for aquatic life. In Hindon River, aquatic life mostly extinct due to the less DO or high BOD conditions.

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