Physio-Chemical Properties of River Hindon & Its Impact on Ground Water of Adjoining Areas

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Abstract— River Hindon is the major source of water to highly populated and predominantly rural population of western Uttar Pradesh, India. The main goal of present study was to assess the impact of urban and industrial activities on the water quality of River Hindon at Ghaziabad. For this purpose, water samples were collected from six different sites all along the route of Hindon's main stream and were analyzed for Ph, Turbidity, Electrical Conductivity (EC), Total Dissolved Solids (TDS), Total Alkalinity (TA), Total Hardness (TH), Chemical Oxygen Demand (COD), Biochemical Oxygen Demand (BOD), Dissolved Oxygen (DO), Nitrates, and Chloride levels. There were variations for Electrical Conductivity, Turbidity, TDS, Cl-, NO3-, TA, TH, BOD and COD levels at the different sites. Water pollution indicating parameters were than compared with those allowed or prescribed by the National Pollution Control Board (NCPB) and found to be alarming. This can be attributed to the presence of a large number of industrial units along the river banks. The condition of the river water and human activities made the study significant and interesting to know and access the pollution in the catchment and river Hindon at Ghaziabad. Overall, the quality of water was very poor and degrading and is posing a threat to the community with respect to its use for domestic purposes.

Key words: Biological Oxygen Demand, Chemical Oxygen Demand, Hardness, Alkalinity, Total Dissolved Solids, Electrical Conductivity, Industrialization, Chloride, Nitrates

I. INTRODUCTION

Water is an important natural gift without which the survival is not possible. Earth contains only 2.5% fresh water out of which 98.8% is in the form of ice. Thus, the water available for drinking purpose is very feeble and is degrading very fast due to the pollution caused. The area of study, that is, River Hindon at Ghaziabad is highly polluted due to the accumulation of pollutants from the nearby localities and the industries along its banks.

Rivers are very much prone to pollution and therefore need a continuous check so that decisive measures are taken to preserve their integrity. It has thus become mandatory to monitor the physical and chemical properties of the river water. The area under study acts as a source of drinking water for the local community and is also utilized for agricultural purposes. Due to its continuous degradation by human activities and the industrial sewage being dumped the water quality of the river has deteriorated.

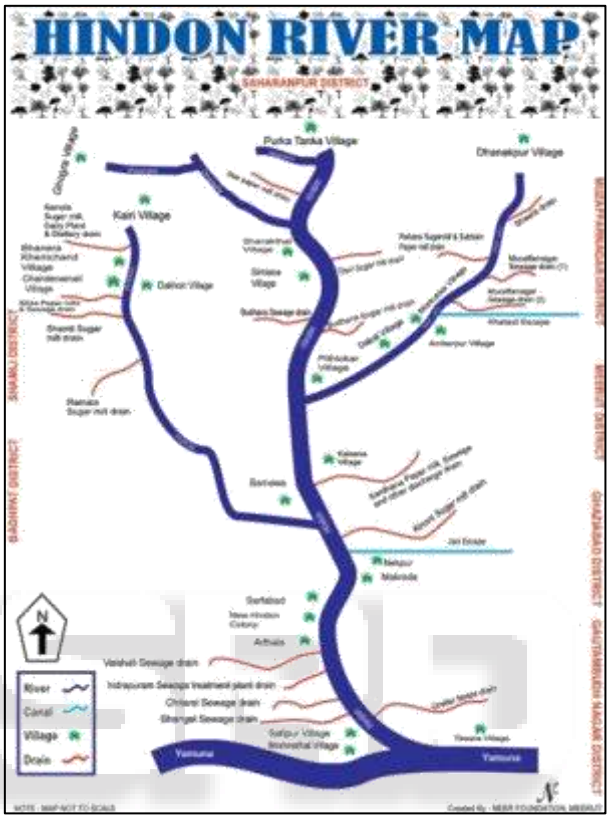

Fig. 1: Hindon-River map
https://ballotboxindia.com/dp/Hindon-River-Origination-%26/5182431549/

River Hindon, a tributary of Yamuna River, is a river in India that originates in the Saharanpur District, from Upper Shivalik in Lower Himalayan Range and flows between Ganges and Yamuna rivers for 400 kilometers through Muzzafar Nagar District, Meerut District, Bhagpat District, Ghaziabad District, Noida, and Greater Noida before merging into Yamuna River just outside Delhi.

II. OBJECTIVES.

The various objectives of the study on River Hindon were as follows:

1) Assessment of physical and chemical parameters of river Hindon.
2) Extent of the pollution caused to the river.
3) Effect of the water quality on flora and fauna.
4) Effect of the water on the adjoining areas.
5) Various water borne diseases caused by the polluted water.
6) Effect of industries on water quality which are situated on the river banks.

III. METHODOLOGY

Six sampling sites were selected from Raj Nagar Extension to Mohan Nagar covering approximately 10 kilometers. A comprehensive study was conducted and the various parameters obtained were compared with the permissible standards.

The results obtained were compared with the standards prescribed by the National Pollution Control Board (NPCB). Sampling was done by using several techniques depending on the accuracy and the approaches towards the research. Generally, grab sample technique is preferred and the same was used in the current research. The test results obtained after testing displayed a heavy load of pollutants in the river water. The water has given rise to various fatal diseases such as cholera, dysentery, jaundice, paratyphoid and fever.

S. No	Parameter	Methods
1	pH	pH meter
2	Electrical Conductivity (µs/cm)	Conductivity Meter
3	Total Hardness (mg/l)	EDTA Titration
4	Alkalinity (mg/l)	Indicator Method
5	BOD (mg/l)	Winkler's Method
6	COD (mg/l)	Open Reflux Method
7	TDS (mg/l)	Filtration Method
8	DO (mg/l)	Winkler's Method
9	Nitrate (mg/l)	Colorimetric Method
10	Chloride (mg/l)	Silver Nitrate Method
11	Turbidity (NTU)	Jackson's Turbidimeter

Table 1: Methods used for estimation of various parameters

Results and Discussion.

The test results obtained are enlisted below

S. No	Parameter	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6
1.	pH	7.1	7.7	7.1	7.2	7.2	7.2
2.	Electrical Conductivity (µs/cm)	390.65	365.62	561	436.3	455.4	465.3
3.	Total Hardness (mg/l)	118	90	121	125	133	130
4.	Alkalinity (mg/l)	126	108	135	130	128	122
5.	BOD (mg/l)	255	245	238	230	230	180
6.	COD (mg/l)	618	585	630	580	630	490
7.	TDS (mg/l)	229	215	340	264	276	282
8.	DO (mg/l)	1.0	1.1	0.50	0.60	0.50	1.2
9.	Nitrate (mg/l)	13	8	18	15	9	16
10.	Chloride (mg/l)	134	122	185	137	128	130
11.	Turbidity (NTU)	32	45	82	48	64	45

Table 2:

pH is the log of reciprocal of H+ ion concentration. It is an indicator of the acidity or alkalinity of water. The pH value varied from 7 to 8.1 which showed a slightly alkaline nature of the river water. High pH value is indicative of bicarbonates and carbonates of calcium and magnesium in the river water.

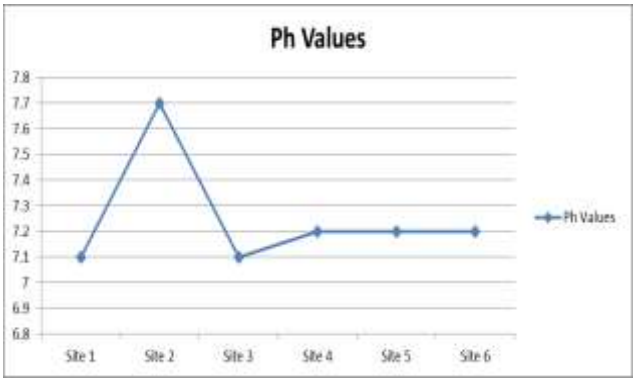

Fig. 2: Ph values

The Electrical Conductivity values in the present study varied from 365 to 565 µs/cm. Higher conductivity values indicate the presence of sewage in water. It is the basic index to check the suitability of water for agricultural purpose.

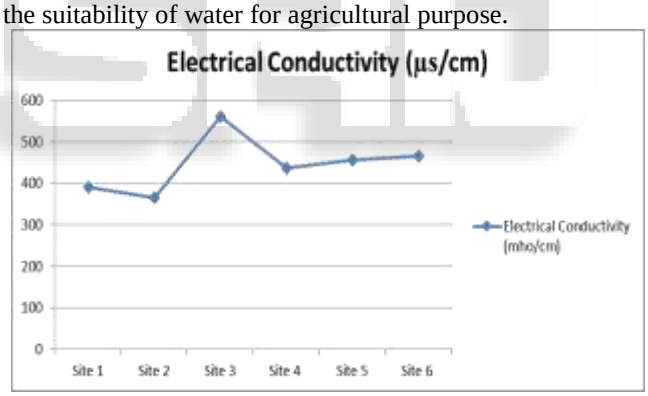

Fig. 3: The Electrical Conductivity µs/cm

Total Hardness value range from 90 – 140 mg/l. Total Hardness is caused due to cations of calcium, magnesium, iron and strontium.

Hardness	Characteristic of water
0 – 60 mg/l	Soft
61 – 120 mg/l	Moderately Hard
120 – 180 mg/l	Hard
>180 mg/l	Extremely Hard

Table 3:

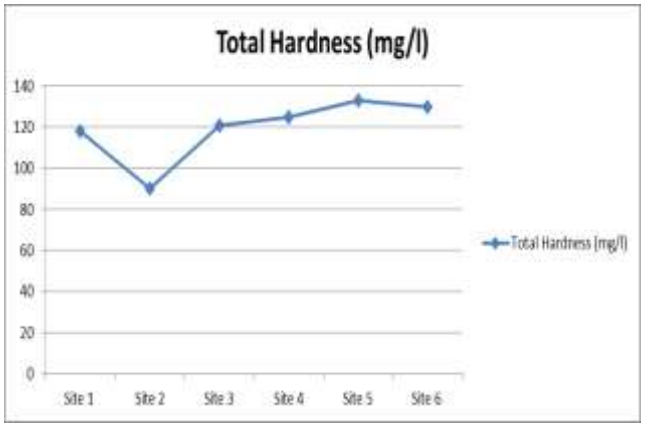

Fig. 4: Total Hardness (mg/l)

Alkalinity values lied between 100 – 150 mg/l. The high value of alkalinity indicates the presence of sewage in river water.

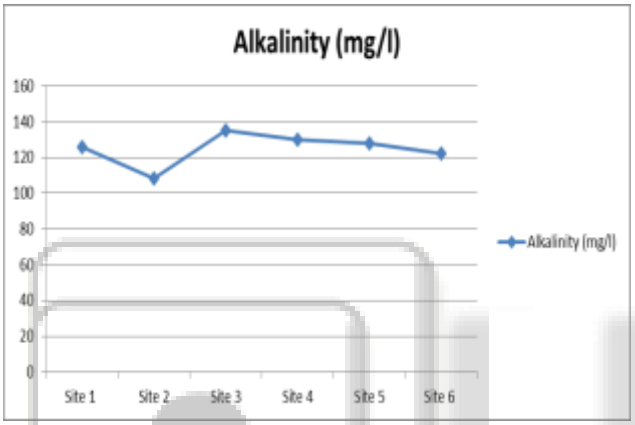

Fig. 5: Alkalinity(mg/l)

BOD is the measure of the amount of oxygen required by micro-organisms to degrade organic matter. It is indicative of organic pollutants in water. BOD values varied from 180 to 245 mg/l. The possible cause may be the mixing of waste water from different sources.

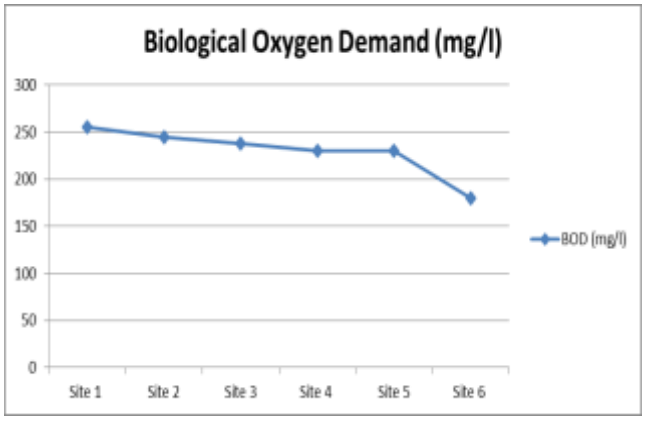

Fig. 6: BOD(mg/l)

COD is the measure of oxygen equivalent to the organic matter content of water susceptible to oxidation by a strong chemical oxidant. The COD values ranged from 490 – 630 mg/l. It is a direct measure of organic pollution in water.

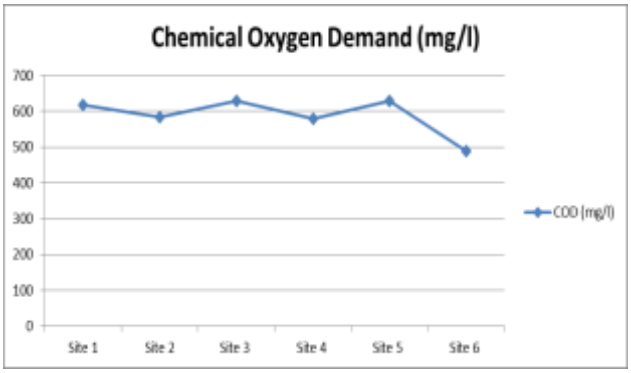

Fig. 7: COD(mg/l)

TDS is the measure of the solids dissolved in water. This includes salts, some organic materials ranging from nutrients to toxic materials. High TDS in water affects dissolved oxygen and increases BOD and COD. TDS values in the present study ranged from 200 – 350 mg/l. High value of TDS indicate the mixing of sewage, cloth washing and garbage dumping. The main sources of TDS are sewage, urban runoff, industrial waste water and chemicals used in water treatment process.

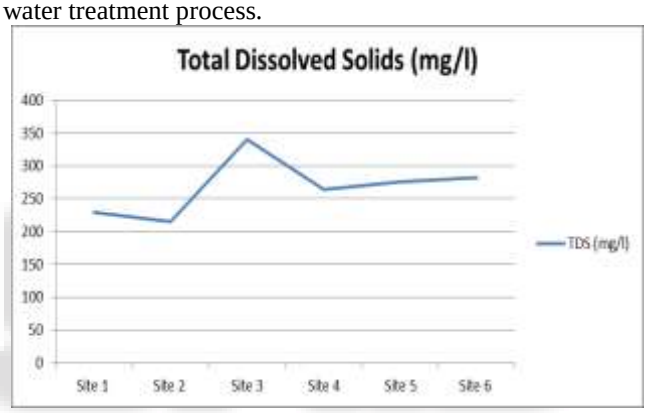

Fig. 8: TDS(mg/l)

Dissolved oxygen value varied from 0.50 mg/l to 1.2 mg/l which is detrimental for aquatic life. This low value will cause aquatic life to perish because of the deficiency of oxygen as it is a direct measure of the extent of water pollution.

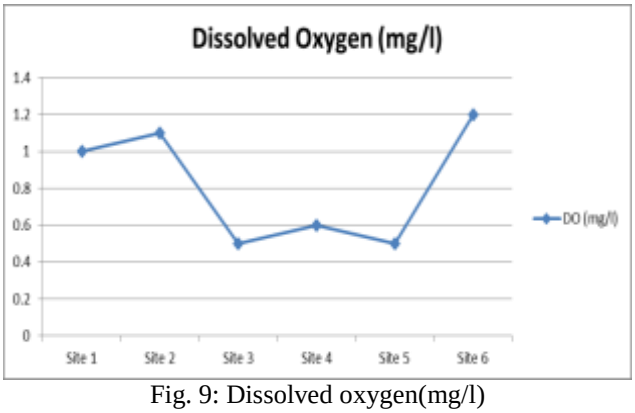

Fig. 9: Dissolved oxygen(mg/l)

Nitrate value ranged from 8 – 18 mg/l. Primary productivity of a stream is promoted by nitrate and higher nitrate in the water is considered as a caution of algae bloom. The possible sources of nitrate contamination include fertilizers, animal wastes, septic tanks, sewage treatment systems and decaying plant debris.

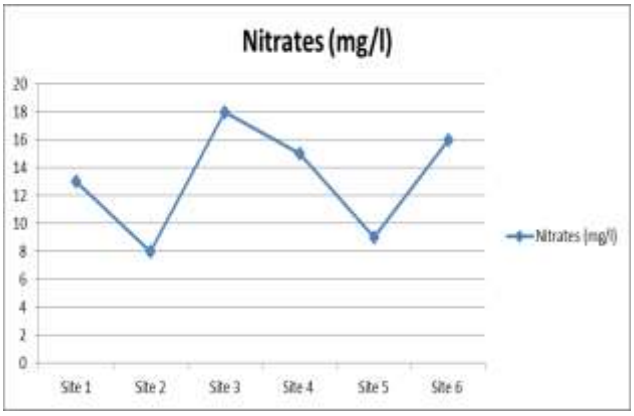

Fig. 10: Nitrate(mg/l)

Chloride concentration varied from 120 – 185 mg/l. People accustomed to higher chloride in water are subjected to laxative effects. Excess chlorine in water may indicate pollution due to sewage and other industrial and human wastes.

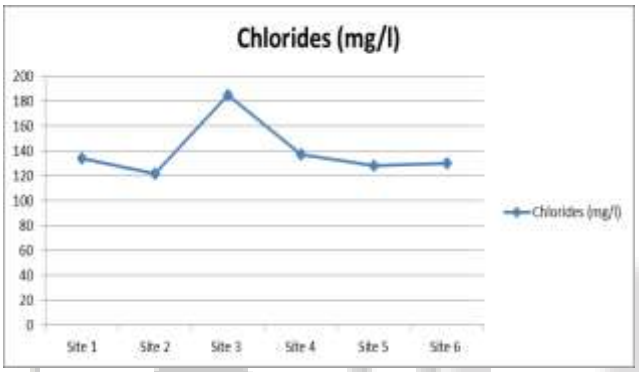

Fig. 11: Chlorides(mg/l)

Turbidity is the amount of suspended matter such as clay, silt or some other finely divided organic material present in water. It depends upon the finesse and concentration of particles present in water. The turbidity value varied from 32 NTU to 82 NTU.

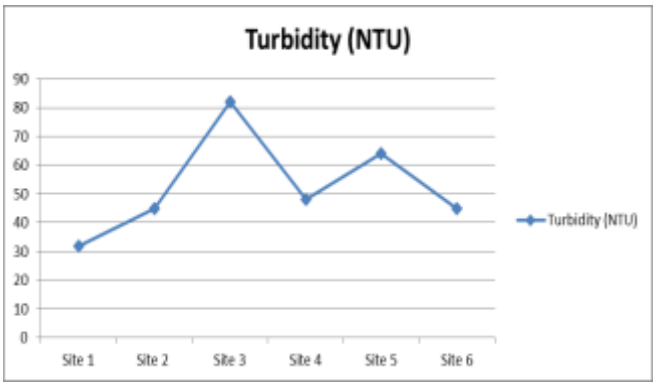

Fig. 12: Turbidity(mg/l)

IV. Conclusion

It can be concluded on the basis of the above parameters that the river water is polluted. The high value of turbidity has made the water unfit for drinking purpose. Due to less amount of dissolved oxygen (DO) there is no presence of aquatic life in the river water. The high value of hardness prevents the formation of lather with soap. The value of pH is within the permissible limit but the water is not fit for human consumption. In addition, it also makes the water unfit for agricultural purpose. Although some parameters were within the specified limit, but the overall condition of water was not satisfactory.

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