Environment Conservation Journal 9(3) 15-19, 2008
(ISSN 0972-3099)

Assessment of pollution level in Hindon river in the stretch of Meerut – Greater Noida due to rapid industrialization

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Abstract

This paper deals with the study of pollution trend in Hindon river between Meerut and Greater Noida stretch along with change in their population density, types of industries and living standards. It was observed that heavy metal pollution increases when we move from Meerut to Mohan Nagar and decreases when we further move towards Greater Noida. Organic pollution and BOD level increased many folds then the permissible limits in Meerut and Greater Noida. Concentration of inorganic ions gradually increases from Meerut to Greater Noida. Where population density is high, organic pollution dominates and where industries are more, heavy metal and inorganic ions load is more. With increase in pollution level, risk of exposure to diseases also increased so, we should emphasize on pollution treatment and control.

Keywords:- *BOD, Heavy metal, Pollution, Meerut, Greater Noida*

Introduction

Water has become the most commercial product of the 21st century. This may sound bizarre, but true. In fact, in the closing decades of the 20th century environmental pollution emerged as a major concern for the survival of mankind through out the world. Modern civilization, armed with rapid advancing technology and fast growing economic system is under threat due to its own activities. Water is the basic component of life and therefore it is of vital importance. Water is to the 21st century, oil was to the 20th century. The stress on the water resources are results of multitude of factors. On one hand, the rapid increasing population and changing lifestyles have increased the need for fresh water and on the other hand, intense competitions among agriculture practitioners, industrial sectors and domestic sectors are pushing the ground water table deeper. This study throws light on the physico-chemical properties of Hindon river in the Meerut-Greater Noida, Uttar Pradesh, stretch. This area is highly populated, have major industries and their number increases as we move towards Greater Noida. A polluted river is severely restricted in its ability to meet any of the above functions. Hindon river is of much importance as it is a major tributary of the Yamuna river. Deteriorated water quality of rivers, reflects lack of respect not only for environmental and health factors, but also for the river's religious significance.

The severe contamination of the Hindon river is not an isolated incidence of river water quality degradation but heavy bacteriological and chemical contamination of rivers are occurring through out India. The following are just a few of these sites, while many other rivers remain just as polluted, as yet uninvestigated. The Hindon river, a tributary of the Yamuna, is heavily used for discharge of chemically contaminated effluents from large number of industries within the vicinity. Groundwater within the region is also subjected to high level of chemical contamination. Groundwater contamination is not only result of hydraulic continuity with the contaminated river, but also as a result of dumping industrial effluents

directly to the groundwater through boreholes. Groundwater contamination in Hindon river has been identified to a depth of 185 meters in Meerut (Janhitfoundation, 2007). Increased industrialization and chemical based agriculture within the western U.P. is identified as a responsible factor for considerable pollution in the river and underlying groundwater aquifer.

Materials and Method

Hindon river originating in Saharanpur and terminating in Yamuna river (Delhi) is located at Lat. 28º40' North and Long. 77º25' East and 268 m above mean sea levels. Water was collected from different locations in this stretch in sterilized bottle. pH and temperature were measured at spot.

Sampling Sites

1. Baleni bridge on road from Meerut to Ghaziabad
2. Hindon Bridge at Mohan Nagar Ghaziabad
3. Greater Noida near Momnath village before confluence with River Yamuna.

Sample collection analysis

Water sample were collected once in a month for one year from above mentioned sampling sites and were tested for various physical and chemical parameters like total solids, turbidity, hardness, heavy metal concentration (Cd, Cr etc.), inorganic ions etc by method mentioned in Khanna and Bhutiani (2005).

Results and Discussion

Study carried on different stretches of Hindon river showed mixed results in its physico-chemical conditions. Table-1 represent results of various physico-chemical parameters at different sampling site in this river. The metal pollution in Hindon river water was assessed for Cd, Cr, Fe and Pb. The metal concentration in water showed wide temporal variation compared with bed sediment because of variability in water discharge and variations in suspended solid loadings. Metal ratios for the bed sediments of the River Hindon were determined and the general trend of relative mobility was observed as Cr > Pb >fe> Cd. The analytical results of various physico-chemical parameters have been compared with the Bureau of Indian Standards (BIS) (1991) – Drinking water desirable / permissible limits are given in the Table-1.

The water quality monitoring results obtained indicate that the organic and heavy metal contamination are continued to be critical in water body and this is mainly due to discharge of domestic waste-water and industrial waste mostly in untreated form. As we go from Meerut to Greater Noida, the form of pollution shifts from organic to heavy metal due to increase in industries in the vicinity the Hindon river. Ghaziabad is a growing industrial city, its population had increased from 5,81,886 (in 1901) to 27,03,933 (in 1991) and still continue to grow mainly on account of its rapid industrialization and its proximity to Delhi. A large number of people reside here but carry on their trades in Delhi or are employed there. The municipal corporations are unable to treat this increasing load of municipal sewage flowing into river water. Secondarily receiving river water also do not have adequate water for dilution. Therefore, the oxygen demand and bacterial population is increasing day by day. This is mainly responsible for water borne diseases. Since, discharge of untreated domestic waste-water is the predominant source of pollution of aquatic resources in India, – the CPCB is regularly monitoring the status of water supply, waste-water generation, collection, treatment and disposal in class I cities (Population> 1,00,000) . The urban areas are responsible for more than 25% of the sewage generation in the region. The small towns and rural areas do

not generate significant amount of sewage obviously due to low per capita water supply. The waste-water generated from such areas, percolate into the soil or evaporate, and thus does not contribute to the pollution of water resources. Hence the focus was laid on large urban and industrialized areas.

Table-1: Comparision between the standards of BIS (1991) and the value of physico-chemical parameter observed within Meerut- Greater Noida stretch.

S. No.	Parameters	Desirable Limits	Meerut	Mohan Nagar	Greater Noida
1.	Color	-	brownish	Muddy	Muddy
2.	pH	6.5 - 8.5	7.44	7.56	7.42
3.	Turbidity (NTU)	5.0	0.83	5.06	5.77
4.	DO (mg/l)	-	6.60	6.80	7.22
5.	COD (mg/l)	250	175.72	177.24	176.22
6.	BOD (mg/l)	-	29	42	48
7.	Total Solid (mg/l)	-	200	235	182
8.	TDS (mg/l)	500	563	570	578
9.	Conductivity (m s)	-	0.34	0.67	1.22
10.	Chloride (mg/l)	250	153.98	152.66	157.66
11.	Nitrate (mg/l)	45	10.45	15.01	15.78
12.	Fluoride (mg/l)	1.00	0.197	0.295	0.285
13.	Hardness (mg/l)	300	210.00	330.00	356
14.	Calcium (mg/l)	75	114.2	118.23	118.75
15.	Magnesium (mg/l)	50	60.71	78.9	78.4
16.	Phosphorus (mg/l)	-	0.878	BDL	BDL
17.	Iron (mg/l)	0.3	0.269	0.233	0.264
18.	Chromium VI (mg/l)	0.05	0.0068	0.065	0.062
19.	Lead (mg/l)	0.01	0.03	0.08	0.1
20.	Cadmium (mg/l)	0.003	0.006	0.017	0.001

Conclusion

The pollution increasing trend indicates that as the population density and number of industries increases from Meerut to Greater Noida heavy metal load in river becomes more alarming. High level of pollution at

Mohan Nagar site is probably due to presence of discharge from industries around it as well as occurence of heavy soil erosion due to less vegetation in this region which contributes lot in raising of organic contaminants in the river. Heavy metal accumulation in human beings are detrimental to his health as, heavy metals causes following defects in human body:

Cadmium: Toxic to humans, it can enter through ingestion, intraperitoneal, subcutaneous, intramuscular and intravenous routes. Highly toxic to freshwater and marine organisms. Increased exposure can increase risk of lung cancer.

Chromium: The metal exists in two forms, i.e. trivalent and hexavalent. Hexavalent chromium in high doses has been implicated as the cause of digestive tract cancers, cutaneous and nasal mucous membrane ulcers.

Lead: Affects human central nervous system, moderate irritation occured when ingested. Lead is a cumulative poison. Increased amount in the body eventually cause disability. Lead can cause irreversible behavioral disturbances, neurological damage and other developmental problems in young children and babies.

The contribution of different point sources to the River Hindon has also been assessed. The highest metal loads were related to the highest flow of the river and thereby increased both by surface runoff and sediment resuspension. Industries producing inorganic chemicals, fertilizers, dyes, paints, pharmaceuticals and battery were identified as hazardous as their waste is non-degradable and tedious to recycle (CPCB 1982-83).

The Biochemical-Oxygen demand (BOD) is one of the most important indicators of pollution level, between Meerut and Greater Noida stretch was within 19-59 mg/l.

Hindon is a major source of water to the highly populated and predominantly rural population of western Uttar Pradesh. It drains a catchment area of about 5,000 km of farmland while also flowing through a number of towns and villages. About 60 functional industrial units are located along the vicinity of River Hindon and its two main tributaries, the Kali and Krishni rivers. These industries abstract large volumes of water from the river for their manufacturing process, and discharge their industrial effluents, often with nominal or without treatment, directly into the river.

Major industries in this area include paper and textiles, dairy units and slaughter houses. “Hindon river no longer serve for domestic purposes as it is too polluted,” says the study. The river is now only used for the watering and washing of livestock. Use of the river for disposal of untreated human sewage is one of the primary cause of poor water quality within the Hindon river. The river receives large volumes of untreated sewage and municipal waste. The river receives a high load of degradable and non-degradable domestic litter. The river water is odorous and become the breading house for disease causing pathogen and vector. The Hindon as well as its tributaries are consistently and massively exceeding the permissible limits provided for surface water and for potable water. Water from the river and tributaries is unable to support a functioning aquatic ecosystem nor is safe for drinking due to the presence of toxic heavy metals, as the entire length of the river apparently has only one water treatment plant, but this does not have adequate capacity. Any person using this water for domestic purposes will exhibit symptoms of heavy metal poisoning. Because of the contaminated river and ground water, villagers along the Hindon river suffer from serious illnesses such as cancer, neurological disorders, stomach and digestive disorders, skin lesions and respiratory disorders.

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