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Water quality status of River Hindon in Ghaziabad with particular reference to presence of pesticides

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Abstract **Physiochemical assessment of surface water samples of river Hindon for presence of contaminants degrading quality of water and for presence of organic pesticides is being reported in this paper. Water pollution parameters like pH, turbidity, Conductivity, COD, DO etc for 10 samples collected from selected points near agricultural fields from Hindon river pre and post monsoon were analysed. The sampling zone was stretched across 10sq.k.m .Pesticides were analysed by GLC and identified by comparing with standard reference compounds .Traces of Various pesticides were found in all samples. All the analysis parameters including Pesticide content was found beyond prescribed limit. Organochlorine pesticides content was found more in post monsoon samples suggesting entry route of pesticides into river water is mainly run off water from nearby fields during monsoon months. An urgent plan need to be formulated to prevent sedimentation of river and for improving the quality of river water.**

Keywords *– Pesticides; surface water; ground water ; COD; DO; pH; Hindon*

I. Introduction

The Hindon river is very important river of Western Uttar Pradesh. The river is purely rain fed. The river basin is the part of indo gangetic plain and covers an area of about 7083 sq km. The Hindon flows through the sugarcane belt of Western Utter Pradesh. The river along with its two main tributaries, the Kali (west) and Krishna rivers, had industrial manufacturing units consisting of pulp and paper, steel, rubber, ceramic, plastic, dairy, laundry, and sugar industries discharging largely untreated effluent directly into water making water unfit for any use [1] The river basin is purely the agricultural field due to which water and sediment of the river got polluted by pesticides and agricultural field discharge [2-3].

Among various organic, inorganic and biological water pollutants, pesticides are considered to be most toxic because of their carcinogenicity and long existence in the environment. Most of the pesticides are toxic, not only to the pests which they are used, but also to non target organisms Long term and rampant use of pesticides results in persis bioaccumulation and long range transport [2] of hazardous chemicals. Contamination of aquatic environ due to excessive use and runoff from agricultural fields marine life and reduces fish production. The toxicants entire ecological balance and result in severe health haza human beings. These changes occur so slowly, the problem becomes visible only after it has taken a serious making it very difficult to reverse the trend.

A. The Impact

Over the last few years, the water quality of Hindon further deteriorated. There has been substantial cha observed in the COD, BOD and DO parameters as wel coliform count. Alteration of water chemistry inclu increase in turbidity, acidity, electrical conducti temperature, free ammonia, dissolved chloride and pestic content due to agricultural and industrial discharge whic toxic to fish and microorganisms. The increase concentration of chemical nutrients subsequently results anoxia, severely affecting water quality. The water qu below the bathing standards and is considered practic unfit for any use.

TABLE I: PARAMETER OF WATER QUALITY FOR BATHIN STANDARD

Parameter	*Prescribed limit*
Dissolved Oxygen (DO)	Not less than 5mg per liter
Biochemical Oxygen Demand	Not more than 3 mg per liter
Total Coliform (TC)	Not more than 500 per 100 ml

Source: Report on Government of NCT Delhi 2005

A. OBJECTIVE OF THE STUDY

There is an urgent need for continuous monitoring of water pollution, so that some corrective measures can be taken before its too late. Recently there has been a growing interest in environmental monitoring [8-9] and regulatory activities [10-11] world over, resulting in signing of protocols and agreements globally but the situation can only be controlled by working at ground level and continuous monitoring. The objective of present study is to carry out physico-chemical analysis of river water to ascertain the load of organic pollutants and to determine the concentration levels of organic pesticides in water, to understand the cause and effect, there by suggest suitable corrective measures.

II. MATERIALS AND METHODS

Surface water samples were drawn from 10 points over a stretch of 10 km from river Hindon near Mohan Nagar and Hindon Airforce Base. The sampling was carried out in two phases. The first phase of sampling was carried out in May 2014 while the second phase of sampling was done in October 2014. River water samples were collected from the agricultural fields near the river bed, total area covered is around 10sq. km . The attempt was made to find out the pesticides used by farmers in their fields. It was found that mostly lindane and different isomers of other organochlorine pesticides were used. In this study post monsoon samples from the Hindon river were collected by grab sampling and analysed for various pollution parameters.

TABLE II PHYSIOCHEMICAL ANALYSIS OF HINDON RIVER WATER

	Parameter	*Average amount in post monsoon Sample*	*Average amount in pre monsoon sample*
1.	pH	5.9 – 7.9	6.4 - 8.4
2.	Turbidity (in NTU)	2-24 NTU	0-1 NTU
3.	Conductiviy	0.600 m MHo/m	0.400 m Mho/n
4.	DO	2 - 6	1.1 - 5
5.	COD	260 - 500 ppm	3.1-15.4ppm

For Chemical analysis, all the solutions are prepared as per APHA standard methods [12]. For COD determination, open reflux method using COD digestor from Spectralab was used. For pH, Conductivity and Turbidity measurements digital desktop meters of Labtronics Instruments were used.

Solid Phase Extraction (SPE)

A water sample of 500ml was taken in a one litre separatory funnel and 10 g NaC1 was added to it. The funnel was shaken to dissolve NaC1 and then 50ml of 15% dichloromethane in n-Hexane was added and the pesticide extracted. The lower aqueous layer was drawn into a fresh one litre separatory funnel and re- extracted twice with fresh portions of 50ml of 15% dichloromethane in n-Hexane. The three extracts were combined and dried by passing through an absorbent column containing a 5cm layer of anhydrous Na_2SO_4 over a small pad of glass wool at the bottom. The extracts were concentrated to remove the traces of dichloro- methane and finally taken in n-Hexane for GLC analysis. Analysis of pesticides was carried out by using a Nucon- Amil 5700 Gas chromatograph, with high bore column. The temperature was maintained at 220 ^{0}C with nitrogen as carrier gas and FID detector connected to a computerised recorder system. The compounds were identified by comparing their chromatographs with those of standard compounds.

III . RESULT AND DISCUSSION

Analysis of surface water sample shows presence of traces of pesticides like HCH, including those already banned like Heptachlor, Aldarin, Endosulphansulphate in all samples under investigation. Concentration and retention time of pesticides found is given in Table 3 and Table 4 respectively. The concentration of β HCH is found more than any other isomer, which may be attributed to stability of this isomer especially to microbial degradation. In all samples the concentration of pesticides is more in post monsoon samples.

Agricultural activities within the vicinity of the river have affected quality of surface water due to run off from these fields. Industrial and domestic use of pesticides also contributes to entry of these hazardous chemicals into water bodies. Absence of DDT and DDE suggests growing awareness among farmers about its ill effects, as it is already under restricted use in our country. Presence of lesser amounts of Aldrin, Endosulphansulphate and Heptachlor as compared to HCH may due to banning of these pesticides since 1996.[9,10]

Excess of pesticide contaminants in post monsoon sample may be due to presence of pesticide residue in soil [10], which ultimately get carried away by run off water and contaminate the receiving river water . [13-15]

TABLE -III AVERAGE CONCENTRATION OF VARIOUS PESTICIDES IN HINDON RIVER WATER

S.No	*Compound*	*Conc. in water µg/l (pre-monsoon)*	*Conc. In water µ g/l (post monsoon)*
1.	α-HCH	0.250	9.2
2.	β –HCH	0.518	10.0
3.	Y- HCH	ND	7.1
4.	Aldrin	0.083	0.298
5.	Heptachlor	0.019	0.201

6.	Endosulphansulphate	0.892	12.0
7.	DDT,DDE	ND	ND
8.	Lindane	ND	0.45
9.	Malathion	ND	ND

TABLE -IV RETENTION (RT) TIME OF VARIOUS PESTICIDES UNDER GIVEN CONDITIONS

S.No	Compound	Retention time(min)
1.	α-HCH	14.8
2.	B-HCH	18.5
3.	Y-HCH	18.9
4.	Aldrin	34.0
5.	Heptachlor	24.0
6.	Endosulphansulphate	55.0
8.	Lindane	12.0

IV. CONCLUSION

The assessment clearly shows that the river water is contaminated with toxic pesticides. The amount of pesticides increases manifold in river post monsoon as the river basin is surrounded by agricultural fields. The amounts exceed WHO and Bureau of Indian standards parameters. There is utmost need to have more awareness as well as stricter monitoring of unauthorized use of synthetic organic pesticides for agriculture activities. Regulations on waste disposal and management should be strictly implemented along-with regular monitoring of hotspots and raising awareness about the health effects will towards cleaning Hindon river. Use of alternative pesticides and adopting cleaner technologies needs to be promoted to avoid further pollution.

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