

IMPACT OF PAPER MILL EFFLUENT ON SOME WATER PARAMETERS OF HINDON RIVER, AT SAHARANPUR.

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An investigation was conducted on the water quality of Hindon river, Saharanpur (U.P.) and the impact of nearby paper mill's effluent on it. The important characteristics of combined effluent of integrated pulp and paper mill with chemical recovery system are dark brown colour, characteristic odour, high content of suspended & dissolved solids, high COD, and resistance to biological oxidation. Therefore, in the present study various physico-chemical & biological parameters of Hindon river were studied to assess the pollution load in the river.

In India today approx. 379 paper mill's are present producing about 37.78 lakh ton of paper¹. Out of 379, 251 mills are of small & medium type. Water pollution may be of several types, such as physico-chemical effect, biological effect, toxic effect (caused by pollutions such as cyanides, biocides, metals & other organic and inorganic compounds). The main polluting constituents in pulp & paper mill's effluent are suspended solids, colour, foam, inorganics such as mercaptans and inorganic sulfides. The process of pulp washing give rise to dark brown coloured waste, known as brown stock wash which is high in pH and COD, conveniently called as brown liquor. The effluent have high BOD and COD and when discharged untreated will damage the receiving water course due to presence of high oxygen demanding organic and inorganic constituents present in effluent.

MATERIALS & METHODS

For the present study, a typical large scale paper mill was selected in North-Western U.P. (Sharanpur) for studying the physico-chemical and microbiological parameters of final effluent and its impact on river Hindon. Samples were collected, four sampling sites were chosen for the assessment of water quality parameters. The physico-chemical and biological parameters were analyzed by using standard methods²⁻³.

Table 1. Physical Parameters of Hindon river Saharanpur (U.P.) at different Sites

Parameters	Site I	Site II	Site III	Site IV
Temperature(°C)	17.50 ± 2.06	36.0 ± 1.22	26.25 ± 1.08	24.50 ± 1.11
Total Solids (mg/l)	617.75 ± 35.25	4590.00 ± 164.16	2657.50 ± 267.84	1265.00 ± 66.89
TDS (mg/l)	617.50 ± 450.63	2422.50 ± 180.74	1260.00 ± 64.03	794.33 ± 44.91
TSS (mg/l)	247.50 ± 44.21	2167.50 ± 93.64	119.50 ± 250.93	499.25 ± 17.93
Velocity (m/sec)	0.17 ± 0.01	0.28 ± 0.03	0.14 ± 8.29	0.12 ± 6.57
Turbidity (J.T.U.)	42.75 ± 11.77	181.50 ± 51.10	196.75 ± 57.45	132.00 ± 28.89
Conductivity (mMho)	199.37 ± 18.23	267.57 ± 26.84	246.95 ± 8.71	109.72 ± 34.20

Table 2. Chemical Parameters of Hindon river, Saharanpur (U.P.) at different Sites

Parameters	Site I	Site II	Site III	Site IV
pH	6.60 ± 0.18	9.12 ± 0.64	9.25 ± 0.11	8.62 ± 0.17
Free CO ₂ (mg/l)	16.96 ± 1.01	19.43 ± 2.08	55.50 ± 2.05	15.60 ± 1.36
Alkalinity (mg/l)	271.25 ± 9.54	382.50 ± 15.43	338.50 ± 15.58	331.25 ± 15.95
Hardness (mg/l)	217.96 ± 27.91	454.52 ± 70.74	527.85 ± 54.22	601.67 ± 53.60
Chloride (mg/l)	23.78 ± 5.62	319.14 ± 83.30	308.14 ± 78.30	215.12 ± 46.53
Calcium (mg/l)	46.28 ± 12.18	319.14 ± 83.30	131.66 ± 33.68	117.03 ± 41.88
Magnesium (mg/l)	161.55 ± 69.94	359.29 ± 53.58	447.64 ± 54.70	530.37 ± 73.24
DO (mg/l)	5.14 ± 1.18	1.28 ± 0.89	2.96 ± 1.35	3.20 ± 1.07
BOD (mg/l)	42.16 ± 1.18	278.99 ± 14.77	132.32 ± 11.32	116.93 ± 58.69
COD (mg/l)	62.40 ± 8.23	392.00 ± 28.84	190.00 ± 15.36	222.00 ± 20.09
Sulphate (mg/l)	11.10 ± 2.56	34.35 ± 8.46	37.38 ± 3.79	34.57 ± 8.50
Inorganic Phosphorus (mg/l)	0.13 ± 0.03	0.56 ± 0.05	0.55 ± 0.22	0.46 ± 0.02

RESULTS AND DISCUSSION

The effluent of paper mill has direct effect on water quality of Hindon river which is getting rapidly degraded. The analysis of various physico-chemical and microbiological parameters are tabulated in table 1-3.

In the study difference in the fluctuation of temperature was recorded, maximum (36.00±1.22°C) at site II, the temperature increased due to effluent of paper mill. Ghosh et al⁴ observed similar trend in the Hoogly estuary. The range of pH was found between

(6.60±0.18) to (9.25±0.11). The maximum value (196.75 J.T.U.±57.45) of turbidity was found at site II. The value of total solids was found maximum (4590.00 mg/l ± 164.16) at site II. Total dissolved solids were found maximum (2422.50 mg/l ± 180.74) at site II. Hardness was found maximum (601.67mg/l ± 53.60) at site IV. The maximum value (382.50 ± 15.43) of alkalinity have been found at site II. The water of Hindon river was found alkaline at all sites, which was due to paper mill's effluent, as also reported by Senthilnathan and Azeez⁵. The values of chlorides in Hindon river ranges from 23.78 mg/l ± 5.62 to 319.14 mg/l ± 83.30. Sahu & Panda⁶ reported the higher concentration of chlorides at Hirakund. Values of calcium were found in between 46.28 mg/l to 319.14 mg/l, these values are under standard of W.H.O⁷ Values of magnesium crossed the W.H.O. limit at all the sites. The maximum value 320.00 mg/l ± 1.07 of dissolved oxygen was found at site IV.. BOD was observed maximum 278.99 mg/± 14.77 at site II, this high value of BOD is due to high temperature. Rajput & Sharma⁸, Abelivovich et al⁹ also recorded high BOD value when the temperature are relatively higher. The maximum value 392.00 mg/l ± 28.84 of COD and phosphorus 0.56mg/l ± 3.79 was found at site II. The maximum value 37.30 mg/l ± 3.79 of sulfate have been found at site III. Maximum Value 1.59¹³*10¹³ SPC/ml ± 1¹¹ of standard plate count was found at site IV.

Table 3. Standard plate count at different sites of Hindon river, Saharanpur (U.P.)

Sites	Standard plate count (SPC/ml)
I	1.57 ¹³ ± 1.5 ¹¹
II	1.4 ¹³ ± 1.5 ¹¹
III	1.52 ¹³ ± 5 ¹¹
IV	1.59 ¹³ ± 1 ¹¹

CONCLUSION

The study shows that the water of Hindon river is highly polluted by paper mill's effluent. Most of the parameters on all the sampling sites were found higher than the limit. So the water is not suitable for the drinking and bathing purposes.

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