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RESEARCH ARTICLE

Influence of Paper Industry Effluent on Water Quality of Chhoeya Drain at District Bijnor, Uttar Pradesh

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ABSTRACT

Industrial/sewage effluent induces water pollution level in running water and water pollution level also depends on seasonal variation. In the present study, waste water was examined in the water drain which was originated mainly through effluent of paper mill at Bijnor district. Water pollution level was more at site 1 which was near to paper mill followed by site 2 and 3. Total Dissolved Solids (TDS), Total Suspended Solids (TSS), Chemical Oxygen Demand (COD), Biological Oxygen Demand (BOD) and turbidity were quite more at sampling site 1 as compared to site 2 and 3. Dissolved oxygen was less at sampling site 1 *i.e.* about 1 mg/L followed by sampling site 2 and 3. Maximum BOD *i.e.* about 266 to 326 mg/L was observed at sampling site 1. This could be happened due to high organic waste from paper mill effluent which reaches at sampling site 1. Interesting observations were observed from February to April, among all three different sites, pH, TDS, TSS, COD, BOD, and turbidity showed more value in water sample of month April. This, could be explained by the alternation of natural temperature from February to April.

1) INTRODUCTION

In modern era, water is a single substance which has multiple uses including drinking, cooking, washing, sanitation, agriculture, and widely used in industrial processes. Various human activities, contribute to the heavy level of pollution in the river / surface water [1, 2] which affects aquatic animals and aquatic vegetation [3, 4, 5]. Water of the ponds, lakes and river is polluted mainly due to discharged waste water from residential areas, sewage outlets, solid wastes, detergents, automobile oil wastes, fishing facilities, agricultural pesticides from farmlands and thus the river water is not suitable for drinking, domestic and irrigation purposes because water is contaminated with several toxic pollutants like Chromium and Bicarbonate [6, 7]. Polluted water is not affecting only the life of present generation but it also affects the life of upcoming generations on earth. Water pollution from agriculture has direct negative impacts on human health [8 9], through various ways including respiratory defects [10], reproductive problems [6, 11], several types of cancers [12], blue-baby syndrome in which the concentration of nitrates increases in water which cause methaemoglobinemia [13, 10, 11]. Water pollution produces numerous hazardous and water borne diseases such as cholera, diarrhoea, dysentery [14] etc. which are transmitted by the drinking of contaminated water. Seasonal variation also affects the surface running water quality Hanas [7] earlier reported that rainy season induced sodium concentration, TDS demand WQI similar repeats reported in Ganga river at Haridwar [15]. Increasing water pollution causes not only the change of water quality but it also affects the human health and the balance of aquatic ecosystems, economic development, and social prosperity [16]. Various human activities along the bank of river, contribute to the heavy level of pollution of the river and pollution level increases which adversely effects on flora and fauna of aquatic ecosystem [3, 17, 5]. In this era agriculture, heavy loads of untreated municipal and industrial wastewater is the main sources of pollution of rivers, ponds and groundwater in different countries including United States of America, China and low-income countries respectively [18, 19]. Lat two decades back years different modern strategies of agriculture used different types of veterinary medicines including antibiotics, vaccines and growth promoters (hormones), which runoff through water to ecosystems and drinking-water sources and affected through different ways [20]. Every year 80 percent of untreated municipal wastewater is discharged into water bodies and industry is responsible for dumping millions of tons of heavy metals, solvents, toxic sludge and other wastes into water bodies each year [20]. The length of Holy River Ganga is about 2525 km originated from Gomukh to Bay of Bengal, it cross almost maximum cities which have high population density and rich industrial belt. Indiscriminate

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disposable of industrial waste / sewage waste/agricultural runoff [21] etc play an important role to pollute Ganga water. Keeping this view, the present objective are based on the effects of paper mill and domestic work in water drain which enter in Ganga River at Bijnor district.

2) MATERIALS AND METHODS

Description of study area and site selection

The present study was carried out in waste water drain and selected sites namely (Chhoeya Bridge, Aagri and Near Chhachhari Mode; shown in table 1) of district Bijnor (Fig. 1), Uttar Pradesh. The aforesaid sites were at water drain, which have several industrial waste water like paper mile, all selected sites were about 15 km apart from each other. The water sample were taken weekly during spring season (February to April) 2018. In this seasons flow rate of water is less (ie more retention time) which enhance biological water pollution. Keeping these views; spring season was selected of the present study.

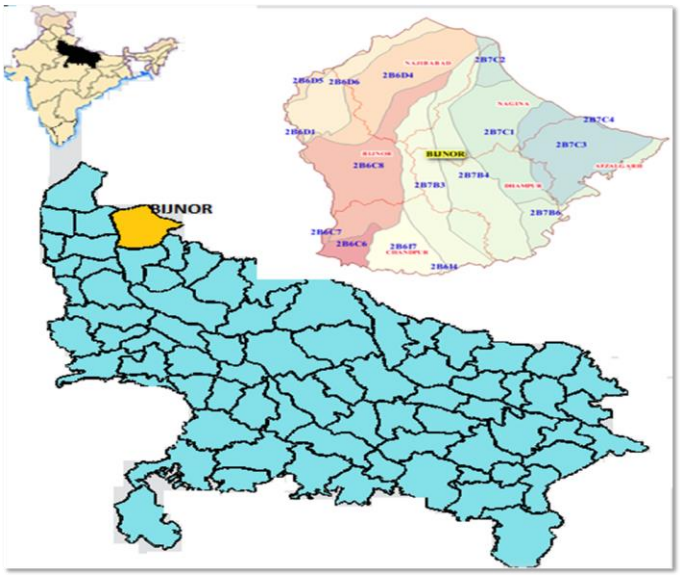


Figure 1: Description about the study area of Bijnor district of Uttar Pradesh.

Table 1: Details of sampling sites at different locations with coordinates of Bijnor district of Uttar Pradesh.

S.N.	Sampling Sites	Latitude	Longitude
1.	Chhoeya Bridge	29º23'45.91"N	78º13'06.53"E
2.	Aagri	29° 20' 7.1484" N	78° 10' 30.0576" E
3.	Near Chhachhari Mode	29° 14' 38.76" N	78° 10' 46.56" E

SITE 1: This sampling site was near to Paper Mill of Bijnor district which manufactures various grades of writing and printing paper based on bagasse /agro waste and effluent of paper mill discharge into Chhoeya drain (**Fig. 2A &D**).

SITE 2: This sampling site was at Aagri village which is situated on the bank of Chhoeya Drain. It is faraway 15.6 km of first sampling site *ie* Chhoeya drain. At this site domestic/agricultural wastes were also discharged in to the drain (**Fig. 2B**).

SITE 3: This sampling site was selected at Chhachhari Mode, which was apart form 30.0 km Paper Mill. At this site density of human population was quite more as compared with site and 2; hence the chances of domestic waste enter in water drain (**Fig. 2C**).


Sampling Site - A


Sampling Site - B


Sampling Site - C


Sampling Site - D

Figure 2: Field photograph of different sampling sites of Bijnor district [29.3721^0 N, 78.3842^{0}E] India. (A) & (D) image at Chhoeya Bridge, (B) image at Aagri and (C) Near Chhachhari Mode of Uttar Pradesh, India.

Waste Water Quality Examination

Waste water qualities were examined (as earlier described methods of APHA, [22] 2012 and Trivedi [23] on the basic of Total Dissolve Solid (T.D.S.), pH, Dissolved Oxygen (D.O.), Biological Oxygen Demand (B.O.D.), Alkalinity, Chemical Oxygen Demand (C.O.D.), Total Suspended Solid (T.S.S.) and Total solid (T.S.).

3) RESULT AND DISCUSSION

Water pollution is one of the important environmental issues across the globe. Many toxic substances which enter in flowing river or water bodies deteriorate water quality and affects ecosystem and surrounding environment. Rapid industrialization, urbanization and population density deteriorated water purity and water qualities [2], enhances organic, inorganic pollution load including heavy metals like Copper, Iron, Zinc, Lead, Arsenic, Mercury, Cadmium and Nickel [7, 24] etc in water bodies, which leads rapid water pollution. In the present study, waste water was examined in the water drain which was originated mainly through effluent of paper mill **(Fig. 2A, B, C & D)**. evaluation of impact of paper mill effluent in water drain we selected self administrative three different sites, site:1 is about 10 km apart from paper mill while distance between site 1 to site 2and site 2 to site 3 were about 15 km, water drain fall on Ganga river at district Bijnor from site 3 and the distance between to bank of ganga was about 30 km **(Fig. 3)**. All water sampling was done weekly from water drain at it surface, the sampling was done

between February to April 2019 *i.e.* spring session. pH of waste water from all sites were slightly basic in nature (pH: 8.9 to 7.6) while site 1 reveled more basic fallowed by site 2 and 3 (Table 1). T.D.S, TSS, COD, BOD, and turbidity were quite more at sampling site 1 as compared to site 2 and 3. Dissolved oxygen was less at sampling site 1 *i.e.* about 1 mg/L fallowed by sampling site 2 and 3 (Table 1). This indicates that dissolved oxygen favored more population growth of microbial community; hence it was justified through the observation of BOD. Maximum BOD *i.e.* about 266 to 326 mg/L was observed at sampling site 1. This could be happened due to high organic waste from paper mill effluent which reaches at sampling site 1. Earlier reports available on assessment on water quality monitoring which entered and based on Ganga river [25, 26, 27, 28], few information is available of running water status which entered at Ganga river at Bijnor district. There for the present study is quite valuable and remarkable about water quality status at Bijnor district. Interesting observation reveled from February to April among all three different sites pH, T.D.S, TSS, COD, BOD, and turbidity reveled more value in water sample of month April. This could be happened due to alternation of natural temperature from February to April.

4) CONCLUSION

The finding present study conclude that surface water quality of water drains at Bijnor district too poor and its quality reduces in month of April as compare to month of February 2019. Physico-chemical parameters reveled that effluent of paper mill induces water pollution load in water drain which further entered in Holy River Ganga from site 3. This situation is an alarming for aquatic living things and its surrounding. Indiscriminate disposal of waste water in water drain should be restricted otherwise surface water quality are gradually decreases and destroy aquatic ecosystem and environment.

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Table.3: Physico-chemical parameters of waste water from water drain at different sites Sampling site 1: Chhoeya Bridge, Sampling site 2: Aagri and Sampling site 3**:** Near Chhachhari Mode.

Parameters	Sampling site 1			Sampling site 2			Sampling site 3		
	Feb.	March	April	Feb.	March	April	Feb.	March	April
pH	8.9±0.2	8.2±0.3	8±0.5	8.1±.02	7.9±.03	8±.02	8±0.3	7.6±.03	8.2±0.2
TDS	980±23	950±36	910±65	995±22	890±19	870±39	750±22	570±26	684±32
TSS	610±26	626±35	626±42	580±26	460±40	440±16	400±26	450±11	386±34
DO	01±.01	1.1±.01	1.1±.03	1.3±0.6	1.7±0.5	1.8±.02	1.2±0.3	1.4±0.5	1.3±0.1
COD	1270±85	1199±36	1130±85	1290±80	1083±46	897±95	1280±66	842±42	580±65
BOD	310±23	266±16	326±42	260±13	200±19	200±25	189±14	160±11	120±25
Turbidity	360±16	340±22	345±15	345±16	340±25	350±16	320±20	296±24	312±16

Data are average of three replicate at one sampling time, four sampling time in one month. TDS=(Total dissolved solid) mg/L, TDS=(Total suspended solid) mg/L, DO=(Dissolved oxygen) mg/L, COD=(Chemical Oxygen demand) mg/L, BOD=(Biological oxygen demand) mg/L.

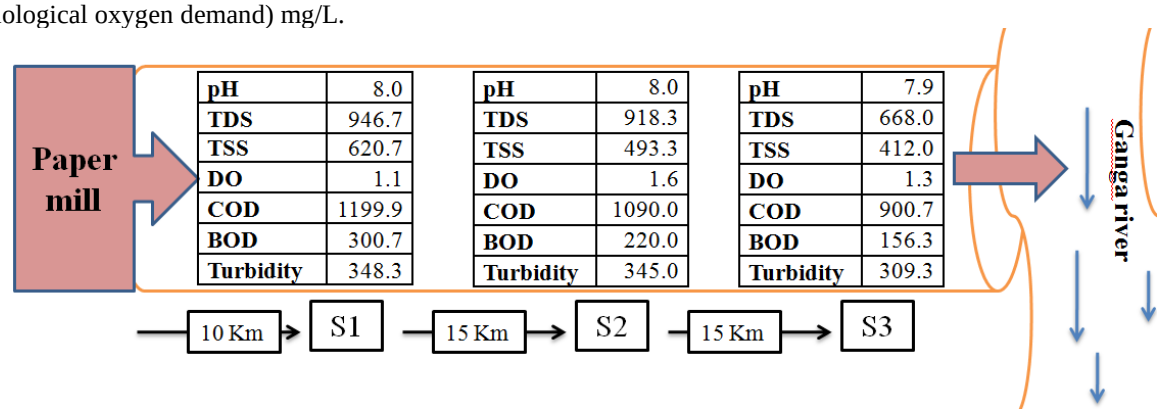


Figure 3: Schematic representation of the present study with average water quality at different sites Sampling site 1: Chhoeya Bridge, Sampling site 2: Aagri and Sampling site 3**:** Near Chhachhari Mode. Data are average of three replicate at one sampling time, four sampling time in one month and three months are taken *ie* total average samples ($\sum_n$=36). TDS=(Total dissolved solid) mg/L, TDS=(Total suspended solid) mg/L, DO=(Dissolved oxygen) mg/L, COD=(Chemical Oxygen demand) mg/L, BOD=(Biological oxygen demand) mg/L.

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