EPH - International Journal of Science And Engineering
ISSN (Online): 2454 2016
Volume 02 Issue 04 December 2016

DOI: https://doi.org/10.53555/eijse.v2i4.19

SEWAGE WATER CHRACTERISTICS OF BURLA TOWN & ITS IMPACT ON THE POWER CHANNEL

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Abstract:-
This study investigated the waste water characteristics of Burla town which is situated at one end of Hirakud dam and its effect on the power channel. The quality of sewage becoming stronger day by day and affecting both the ecosystem and human health. The sewage water of four major drains i.e. drain of Gaon Burla, drain of Gaud pali, drain of power channel bridge and drain of Bishnu Mandir pada drained into power channel was with high BOD, so not meeting the standard to discharge into inland surface water. The water quality of power channel at different sampling point compared with surface water quality standard (IS: 2296), it was observed that the hardness of SP 3 & 4 were beyond permissible limit and BOD value were high in each sampling point.

Keywords: - Sewage *water, BOD, pH, DO*

1. INTRODUCTION

Sewage is a major point source of water pollution which is the concern of the urban world due to increase in human population and urbanization. Lakes, rivers and streams are the sources of drinking water ,irrigation, fishery and energy production, Iscen et al.,(2008).Water bodies in the present world are facing a variety of pressure affecting both the ecosystem and human health through sewage waste water discharge. Mixing of untreated municipal and industrial effluent with the sea and groundwater not only adversely affects the marine life but also the freshwater assets, human health and agricultural productivity, Beg et al.,(1984). The adverse public health, environmental, socio-economic, food quality, security and aesthetic impacts from sewage contamination are the most discussed topic of environmentalist now-a-days. One of the key tasks of sustainable and long-term land and natural resources management is to optimize water resource utilization referring to the spatial distribution of people and their activities. The pressing water quality and quantity challenges posed by the depletion and degradation of water resources in urban India are confounded by climate change and variability (Jha et al. 2006). .

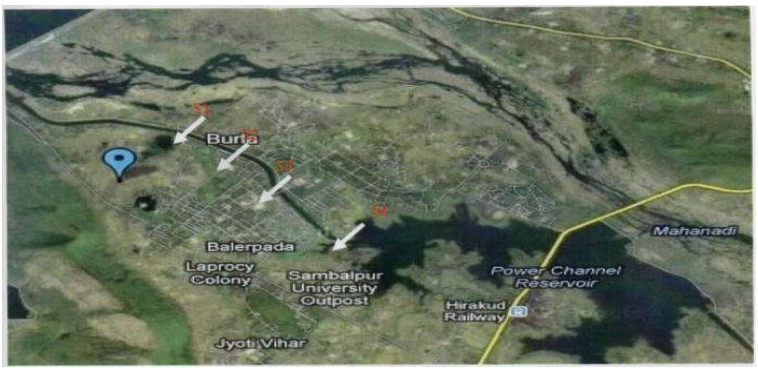
Knowledge of the pollution sources and impacts on ecosystems is important not only for a better understanding on the ecosystem responses to pollutants but also to formulate prevention measures. Substances contained in pollution are frequently toxic to aquatic organisms. Except in case of accidents, their concentrations in surface water are low but the pollutants are present in water environment for long period of time. Under these conditions, the substances can act chronically. Risk of chronic impact of surface water pollution is very often underestimated due to hidden long time action. The impact usually does not manifest markedly by direct death of affected organisms- a failure of important vital functions, which decreases organism vitality, is more common. For this reason, a natural balance of ecosystem may be influenced, and finally it can lead to ecosystem destruction Soldan, (2003). Large scale pollution of rivers has resulted in strict enforcement of waste disposal legislation in most industrialized counters, where waste water is disposed of only following extensive treatment. This is in contrast to most developing countries where most sewage goes untreated. Industrialization is considered the cornerstone of development strategies due to its significant contribution to the economic growth and human welfare, but it carries inevitable costs and problems in terms of pollution of the air and water resources. Specially, water bodies near to industrial area have been extremely affected from disposal of waste which can alter the physical, chemical and biological nature of the receiving water body. So, industrial waste is the most common source of water pollution in the present day as industries are increasing because of industrialization of most developing countries. Industrial and domestic waste contamination of natural water bodies has emerged as a major challenge in country like India. India is endowed with rich water resources, having approximately 45,000km long river systems across the length and breadth of the country. India has 12 river basins, 46 medium river and 14 minor and desert river basins (NRDC, 2009). In India it is estimated that over 70% of all waste water is disposed of untreated and that an investment of US$65 billion would be needed to treat all waste water, Kumar(2003).The physicochemical and microbiological characteristics of Mahanadi river water have been studied in four different seasons and was observed that Mahanadi river water in this region is of category D, i.e. bad, Kar P.K et al.,(2010).

With the above background the present work aims at studying the Physico-chemical characteristics of sewage generated in Burla town and its impact on the power channel.

2. Materials and methodology

2.1. Study sites

Burla is located at 21.5^0N 83.87^0E.the town lies at one end of Hirakud Dam which is located around 2 km west of the town. The presence of Hirakud Dam along with the river Mahanadi and the power channel adds to the rich ecological heritage of the place. Power channel is 25 km long water conductor system to carry water from Burla power house to Chiplima power house. As seen in the map, the power channel runs through the middle of the habitat of Burla town and discharges water to the reservoirs downstream. Map of Burla town with Power Channel:



Sampling points:
Almost all the sewage water of the town is discharged into the power channel without any treatment. Ignoring the smaller ones, the following major point sources of pollution have been taken into consideration i.e. Sampling point 1 (GaonBurla),sampling point 2(Gaud pali),sampling point 3(power channel bridge),sampling point 4(Bishnu Mandirpada).sewage water quality of drains before mixing in sampling point 1,2,3,&4 have also been taken for analysis and these points are referred as DSW-1(GaonBurla), DSW-2(Gaud Pali), DSW 3(power channel Bridge) & DSW-4(BishnuMandirPada)respectively.

2.2. Methodology
DO, BOD, chloride, pH, TS, total hardness, nitrate and phosphate were analyzed by Winkler's method,5 days BOD method, argentrometric method, digital pH meter method, oven dry method, EDTA titrimetric method and spectroscopy method respectively.

3. Result & discussion
Analysis of physico chemical parameter of sewage water.
The DO content of sewage water was found to be 1.96, 1.40, 1.39& 1.15(mg/l) in DSW-1, DSW-2, DSW-3 & DSW-4 respectively. Yayyntas et al., (2007) stated that low level of DO concentration in the fresh water is an indicator of high level of pollution. The BOD content of DSW 1, 2, 3, & 4 were 92,104,130 & 1639(mg/l) respectively. The total solid of DSW 1, 2, 3 & 4 were 600,672,717& 735 (mg/l) respectively. The pH values were well within the range as compared to permissible limit of pH in drinking water which is within 6.5 to 8.5 as per IS:2296.The pH value of DSW 1, 2, 3& 4 were 6.63, 6.40, 6.45 & 7.11(mg/l) respectively. The pH range suitable for the existence of most biological life is quite narrow and critical, Metcalf and Eddy, (2003). Maximum hardness was found in DSW 4 i.e 264 as compared to DSW 1, 2, 3 i.e 96,108,244(mg/l) respectively. The chloride content of DSW 1, 2, 3, & 4 were 170, 149,213 & 532 (mg/l) respectively. Nitrate content of DSW 1, 2, 3& 4 were 6.68, 6.80, 12.85 & 3.42 (mg/l) respectively. Phosphate content of DSW 1, 2, 3 & 4 were 0.01, BDL, 0.01 & 0.03(mg/l) respectively. DO content of DSW 1 was more than other three sampling point but BOD, TS, pH, hardness, chloride and phosphate were high in DSW 4 than other sampling points. Nitrate was high in DSW 3(Table 1). When comparison of physicochemical parameters of DSW 1, 2, 3 & 4 was made with respective value of sewage water discharge standard, it was revealed that the BOD and Total solid is beyond permissible limit in each sampling point.

Table 1: Physico-chemical characteristics of sewage water

parameter	*Sewage water*				*Standards*
	DSW 1	DSW 2	DSW 3	DSW 4	Discharge into inland surface water
DO(mg/l)	1.96	1.40	1.39	1.15	-
BOD(mg/l)	92	104	130	163	20
Total solid(mg/l)	600	672	717	735	100
pH	6.63	6.40	6.45	7.11	5.5
Hardness(mg/l)	96	108	244	264	-
Chloride(mg/l)	170	149	213	532	1000
Nitrate(mg/l)	6.68	6.80	12.85	3.42	10
phosphate (mg/l)	0.01	BDL	0.01	0.03	5

Analysis of physico-chemical parameter of power channel water.
The DO of power channel water at sampling point 1, 2, 3 & 4 were 7.4, 7.2, 6.9 & 6.6(mg/l) respectively. The BOD of power channel water of SP 1, 2, 3 & 4 were 10.2, 26.4, 55.7 & 70.5 (mg/l) respectively. Total solid of SP 1, 2, 3 & 4 were 200, 245, 304 & 336(mg/l) respectively. The hardness of SP 1, 2, 3 & 4 were 95.7, 95.9, 301.2 & 308.4(mg/l) respectively. The chloride content of SP 1, 2, 3 & 4 were 80, 62, 104 & 223(mg/l) respectively. Nitrate content of SP 1, 2, 3 & 4 were 0.44, 0.32, 1.52 &0.58 mg/l respectively. Phosphate content of SP 1, 2, 3 & 4 were BDL, BDL, 0.02 & 0.02(mg/l) respectively. PH content of SP 1, 2, 3 & 4 were 6.20, 6.23, 6.18 & 6.98 respectively (mg/l). (Table 2).

When these data were compared with the surface water quality standard (IS: 2296) it was found that DO and BOD was beyond permissible limit in each sampling point but in SP 4 hardness was beyond permissible limit. When it was compared with power channel water before contamination it was found that DO of SP1 and SP2 were slightly more after contamination and SP3 and SP4 were slightly lowboy of SP3 and SP4 become high after contamination. After contamination the total solid of SP4 was high. pH of each point were slightly decreased after contamination. Chloride level of each point increased but hardness of SP4 increased after contamination.

Table 2: Physico-chemical characteristics of water of power channel

parameter	*Sampling point(SP)*				*surface water quality standards (IS:2296)*	*Power channel water quality before contamination*
	SP 1	SP 2	SP 3	SP 4		
DO (mg/l)	7.4	7.2	6.9	6.6	5	7.19
BOD (mg/l)	10.2	26.4	55.7	70.5	3	32.3
TS (mg/l)	200	245	304	336	500	306.5
pH (mg/l)	6.20	6.23	6.18	6.98	6.5-8.5	7.48
Hardness (mg/l)	95.7	95.9	301.2	308.4	300*(*represents essential characteristics of drinking water)	127.7
Chloride (mg/l)	80	62	104	223	250	59
Nitrate (mg/l)	0.44	0.32	1.52	0.58	45	_
phosphate(mg/l)	BDL	BDL	0.2	0.2	5	_

Statistical analysis:

Negative correlation found between Total solid and DO (-.956) at 0.05 significant level where as positive correlation positive correlation found between pH and phosphate (.956) at 0.05 significant level in Sewage water. (Table 3). TS with BOD (.998) and hardness with phosphate (1.00) shows positive correlation at 0.01 significant level and hardness with BOD (.950) and pH with chloride (.958) shows positive correlation at 0.05 significant level where as DO and BOD are negatively correlated (-.991) at 0.01 significant level in power channel water. (Table 4).

Table 3: correlation-coefficient matrix showing relationship between different physico-chemical parameter of sewage

		DO	BOD	TS	pH	Hardness	Chloride	Nitrate	Phosphate
DO	Pearson Correlation	1	-.840	-.956*	-.370	-.749	-.648	.130	-.444
	Sig. (2-tailed)		.160	.044	.630	.251	.352	.870	.556
	N	4	4	4	4	4	4	4	4
BOD	Pearson Correlation	-.840	1	.897	.732	.933	.914	-.235	.840
	Sig. (2-tailed)	.160		.103	.268	.067	.086	.765	.160
	N	4	4	4	4	4	4	4	4
TS	Pearson Correlation	-.956*	.897	1	.368	.897	.658	.063	.515
	Sig. (2-tailed)	.044	.103		.632	.103	.342	.937	.485
	N	4	4	4	4	4	4	4	4
pH	Pearson Correlation	-.370	.732	.368	1	.531	.942	-.721	.959*
	Sig. (2-tailed)	.630	.268	.632		.469	.058	.279	.041
	N	4	4	4	4	4	4	4	4
Hardness	Pearson Correlation	-.749	.933	.897	.531	1	.746	.114	.726
	Sig. (2-tailed)	.251	.067	.103	.469		.254	.886	.274
	N	4	4	4	4	4	4	4	4
Chloride	Pearson Correlation	-.648	.914	.658	.942	.746	1	-.571	.959*
	Sig. (2-tailed)	.352	.086	.342	.058	.254		.429	.041
	N	4	4	4	4	4	4	4	4
Nitrate	Pearson Correlation	.130	-.235	.063	-.721	.114	-.571	1	-.498
	Sig. (2-tailed)	.870	.765	.937	.279	.886	.429		.502
	N	4	4	4	4	4	4	4	4
Phosphate	Pearson Correlation	-.444	.840	.515	.959*	.726	.959*	-.498	1
	Sig. (2-tailed)	.556	.160	.485	.041	.274	.041	.502	
	N	4	4	4	4	4	4	4	4

Correlation is significant at the 0.05 level (2-tailed).

Table 4: correlation-coefficient matrix showing relationship between different physico-chemical parameter of power channel water

		DO	BOD	TS	pH	Hardness	Chloride	Nitrate	Phosphate
DO	Pearson Correlation	1	-.991**	-.988*	-.793	-.916	-.878	-.375	-.907
	Sig. (2-tailed)		.009	.012	.207	.084	.122	.625	.093
	N	4	4	4	4	4	4	4	4
BOD	Pearson Correlation	-.991**	1	.998**	.705	.950*	.819	.492	.945
	Sig. (2-tailed)	.009		.002	.295	.050	.181	.508	.055
	N	4	4	4	4	4	4	4	4
TS	Pearson Correlation	-.988*	.998**	1	.694	.934	.797	.478	.928
	Sig. (2-tailed)	.012	.002		.306	.066	.203	.522	.072
	N	4	4	4	4	4	4	4	4
pH	Pearson Correlation	-.793	.705	.694	1	.562	.958*	-.209	.542
	Sig. (2-tailed)	.207	.295	.306		.438	.042	.791	.458
	N	4	4	4	4	4	4	4	4
Hardness	Pearson Correlation	-.916	.950*	.934	.562	1	.752	.690	1.000**
	Sig. (2-tailed)	.084	.050	.066	.438		.248	.310	.000
	N	4	4	4	4	4	4	4	4
Chloride	Pearson Correlation	-.878	.819	.797	.958*	.752	1	.060	.736
	Sig. (2-tailed)	.122	.181	.203	.042	.248		.940	.264
	N	4	4	4	4	4	4	4	4
Nitrate	Pearson Correlation	-.375	.492	.478	-.209	.690	.060	1	.707
	Sig. (2-tailed)	.625	.508	.522	.791	.310	.940		.293
	N	4	4	4	4	4	4	4	4
Phosphate	Pearson Correlation	-.907	.945	.928	.542	1.000**	.736	.707	1
	Sig. (2-tailed)	.093	.055	.072	.458	.000	.264	.293	
	N	4	4	4	4	4	4	4	4

*. Correlation is significant at the 0.05 level (2-tailed)
**. Correlation is significant at the 0.01 level (2-tailed)

4. Acknowledgement
The authors thank the P.G. Department of Environmental Sciences for making it possible to gather the data for this research work.

5. Conclusion
The present study indicates that the sewage water of four major drains namely, DSW-1(drain of Gaonburla), DSW 2(drain of Gaud pali), DSW 3(drain of power channel bridge), DSW 4(drain of bishnu Mandir pada) drained into power channel was with high BOD and so not meeting the standard to discharge into inland surface water.

The water quality of power channel at sampling point 1,2, 3 & 4 compared with respective value of surface water quality standard(IS:2296), it was revealed that the hardness of SP 3 & 4 were beyond permissible limit and BOD value were high in each sampling point. When comparison was made among water quality of power channel the value of all parameters except DO, nitrate and phosphate following sequence: SP4 > SP 3 > SP 2 > SP 1. But the nitrate content of power Channel Bridge is higher than others.Phosphate content of Gaud Pali power channel water is BDL. The value of DO following sequence SP 4< SP 3 < SP 2 < SP 1.

Therefore the water quality of power channel from the Gaon Burla to bishnu Mandir Pada is not potable in its present form. Proper treatment and disinfection of power channel water is urgently required for health and hygienic point of view for inhabitants of Burla town.

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Photo of sampling points:

Sampling point 1 (Gaon Burla)

Sampling point 2 (Gaudpali)

Sampling point 3(Power Channel Bridge)

Sampling point 4 (Bishnu MandirPada)