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WASTEWATER QUALITY STUDIES OF INLET AND OUTLET AT MUNICIPAL WASTEWATER TREATMENT PLANT AT BHOPAL, INDIA

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ABSTRACT

This study was aimed to determine pH, turbidity, DO and BOD reduction from Municipal Wastewater. Municipal wastewater treatment plant is based on screening, sedimentation and waste stabilization technique using anaerobic and facultative ponds. In the present study, samples of influent and effluent wastewater from Badwai Municipal Wastewater treatment plant (MWWTP) situated at Bhopal, Madhya Pradesh were collected during the year 2010. Physicochemical parameters namely pH, turbidity, DO and BOD were analyzed using standard methods. The results with treated water indicate that the wastewater treatment plant is efficient in treating wastewater and all the parameters were found to be in permissible limits. This treated water can be used for secondary purposes like industrial cooling and agricultural uses.

Key words: Municipal wastewater, pH, Turbidity, DO and BOD.

INTRODUCTION

Municipal wastewater contains 99.9% water, soil which barely comprised 0.1 % are partly organic and partly inorganic or partly in suspension and partly in solution. Offensive nature of the municipal wastewater is mainly due to the organic matter, which it contains. In addition, municipal wastewater is charged with numerous living organisms derived from faeces, some of which may be agents to disease. Sewage contains minerals, animals and vegetables matter in suspension, as well as large number of bacteria and (eggs of) intestinal. It may contain food, grease, cigarette, leaves feaces etc. The organic compounds in wastewater may be used as food for bacteria which can bio-chemically digest or oxidize the organic compounds to produce energy for growth. This oxidation of organic material, if

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done under aerobic conditions (i.e. in the presence of oxygen), "consumes" oxygen and produces carbon dioxide. An organic waste can therefore be said to have a biochemical oxygen demand, i.e. the amount of oxygen required by aerobic bacteria to oxidize it.

The term BOD is used to refer to the organic material in a waste and can be used in quantitative expressions relating to organic material. e. g. the expression g BOD or kg BOD describes an amount of organic material. The amount of BOD in a specific volume of wastewater is the concentration or strength of the wastewater and is expressed in terms such as g/m^3 or mg/L or parts per million of BOD (all numerically equivalent). The loading rate of organic waste to a treatment system or a receiving environment (e.g. land) is expressed as a mass of BOD/ volume (or area) of treatment system per unit of time: e.g.- g BOD/m^3/day for loading rate of an anaerobic pond; g BOD/m^2/day to a facultative pond.

Operating conditions and process carried out influence the amount and characteristics of the by products ad waste and formed. The waste water varies both quality and characteristics from the industries and Domestic waste. The composition of wastewater from the same industry also varies widely from day to day[1,2]. Wastewater stabilization pond is considered as the most appropriate system to treat the increasing flows of urban wastewater in tropical and subtropical regions of the world[3].

EXPERIMENTAL

Material and methods

The present municipal wastewater treatment plant (Badwai) is situated at a geographical location of coordinate's $23^o15'44''$ N, $77^o28'23''$ E. Badwai, municipal wastewater treatment plant receives the wastewater generated in CTO, Hemu Colony, Beta Village, Koh-e-fiza etc areas. Badwai municipal wastewater treatment plant is designed to treat 16.67 MLD. The Badwai municipal wastewater treatment plant (MWWTP) is based on screening, sedimentation and waste stabilization technique using anaerobic and facultative ponds. Wastewater samples were collected from inlet and outlet of municipal wastewater treatment plant (MWWTP) from January to December 2010. Samples were analyzed to determine the efficiency of the treatment plant in ruducing those parameters from the inlet to outlet of MWWTP. Samples were collected in glass containers, pre-cleaned by washing with non-ionic detergents, rinsed in tap water, in 1 : 1 hydrochloric acid and finally with demonized water before usage. Before sampling, the bottles were rinsed three times with sample water and pH, turbidity, dissolved oxygen (DO), biochemical oxygen demand (BOD) and were analysis in the analytical laboratory according to the methods prescribed as in the APHA[4].

RESULTS AND DISCUSSION

Monthly samples were collected from inlet and outlet of municipal wastewater treatment plant Badwai, Bhopal. The results obtained for pH, turbidity, dissolved oxygen (DO), biochemical oxygen demand (BOD) are shown in the Table 1.

Table 1: The value of pH and DO at inlet and outlet of municipal wastewater treatment plant during the period 2010

Parameters/ Months		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
pH	**Inlet**	6.62	6.72	6.76	6.89	6.87	6.75	6.74	6.64	6.62	6.69	6.72	6.64
	Outlet	7.62	7.79	8.12	8.38	8.26	7.89	8.02	7.78	7.58	7.85	7.79	7.54
DO	**Inlet**	0	0	0	0	0	0	0	0	0	0	0	0
	Outlet	5.2	4	4.4	4	3.2	3.6	4	4.4	3.4	4.4	4	4.4

pH

During the study period the minimum value of pH was recorded as 6.62 in the month of January, while the maximum value of pH was recorded as 6.89 in the month of April in inlet and in outlet the minimum value of pH was recorded as 7.54 in the month of December, while the maximum value of pH was recorded as 8.38 in the month of April in 2010 (Table 1). pH during this year depicted an increasing trend from January onwards attaining maximum value in the month of April. Thus in study period minimum values of pH were recorded in winter months, while maximum values were recorded in summer months. The pH range suitable for the existence of most biological life is quite narrow and critical, and is typically 6-9 [5]. The normal range for irrigation water is pH 6.5-8.5[6]. High pH above 8.5 is often caused by high bicarbonate (HCO_3^-) and carbonate (CO_3^{2-}) concentrations; high carbonates cause calcium and magnesium ions to form insoluble minerals leaving sodium as the dominant ion in solution[7].

Dissolved oxygen

During the study period the minimum value of dissolved oxygen was recorded as 0.0 mg/L in inlet in all months 2010, while the maximum value of dissolve oxygen was recorded as 5.2 mg/L in outlet in the month of January 2010 (Table 1). In general, the treated final effluent varies between 4.15 and 5.38 mg/L. The DO content in treated final effluent which was observed to deplete faster than DO from the receiving water body could be attributed to

the presence of degradable organic mater which resulted in a tendency to be more oxygen demanding. The DO values obtained from this study are similar to those reported elsewheres[8-10].

Turbidity

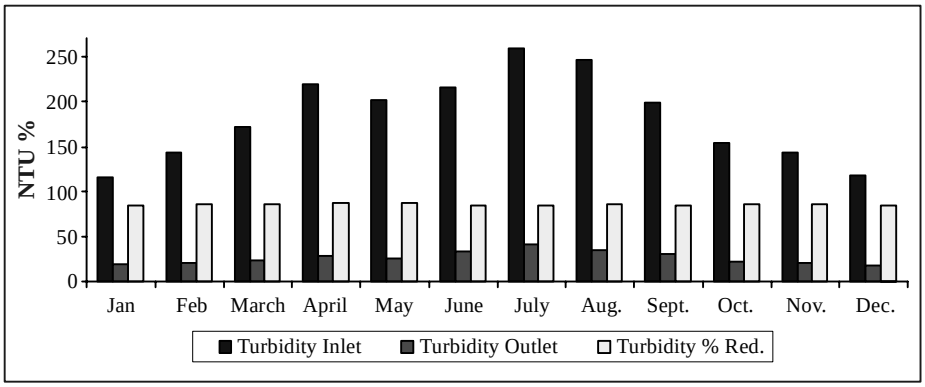

Fig. 1: Percent reduction of turbidity

During the study period the minimum value of turbidity was recorded as 116.5 NTU in the month of January, while the maximum value of turbidity was recorded as 259.6 NTU in the month of July in Inlet 2010 and the minimum value of turbidity was recorded as 17.8 NTU in the month of December, while the maximum value of turbidity was recorded as 41.4 NTU in the month of July in outlet of Municipal wastewater treatment plant in 2010 (Fig. 1). Turbidity during this year depicted the maximum value in the month of July.

Percent reduction in turbidity values at inlet and outlet Badwai treatment plant during the period 2010 is shown in Table 2. Maximum reduction in turbidity values during the period of investigation was observed in the month of April (87.33%), while the efficiency of reduction was slightly less in the month of July (84.05%) in 2010. The turbidity values obtained from the stations in all seasons was higher than WHO standard of 5 NTU[11]. These values are grossly exceeded in the water samples and it disqualifies the receiving water body for direct domestic use. Also, the excessive turbidity in water can cause problem with water purification processes such as flocculation and filtration, which may increase treatment cost. There may be a tendency for an increase in trihalomethane (THM) precursors, where highly turbid waters are chlorinated. High turbid waters are often associated with the possibility of microbiological contamination, as high turbidity makes it difficult to disinfect water properly[11]. The turbidity values obtained in this study were higher than those by earlier workers[12,13].

Percent reduction in biological oxygen demand values at Inlet and outlet of Badwai Municipal waste water treatment plant during the period 2010 is shown in Table 2.

Table 2: The value of turbidity and BOD at inlet and outlet of municipal wastewater treatment plant during the period 2010

Parameters/ Months		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Turbidity	**Inlet**	116.5	142.2	171.3	219.5	202.5	215.5	259.6	246.5	198.5	154.3	142.8	117.4
	Outlet	18.5	20.5	23.3	27.8	26.2	33.4	41.4	35.2	30.4	22.7	20.2	17.8
	% Red	84.12	85.58	86.4	**87.33**	87.06	84.5	**84.05**	85.72	84.69	85.29	85.85	84.84
BOD	**Inlet**	168.6	252.6	318.6	388.6	498.4	448.6	357.8	252.6	278.2	298.8	245.6	185.4
	Outlet	38.2	47.2	58.6	63.2	84.6	88.6	78.6	61.6	65.4	68.6	48.2	40.6
	% Red	77.34	81.31	81.61	**83.74**	83.03	80.25	78.03	**75.61**	76.49	77.04	80.37	78.1

Biological oxygen demand

During the study period the minimum value of biological oxygen demand was recorded as 168.6 mg/L in the month of January, while the maximum value of biological oxygen demand was recorded as 498.4 mg/L in the month of May in inlet 2010 and the minimum value of biological oxygen demand was recorded as 38.2 mg/L in the month of January, while the maximum value of biological oxygen demand was recorded as 88.6 mg/L in the month of June in the outlet of Municipal wastewater treatment plant in 2010 (Fig. 2).

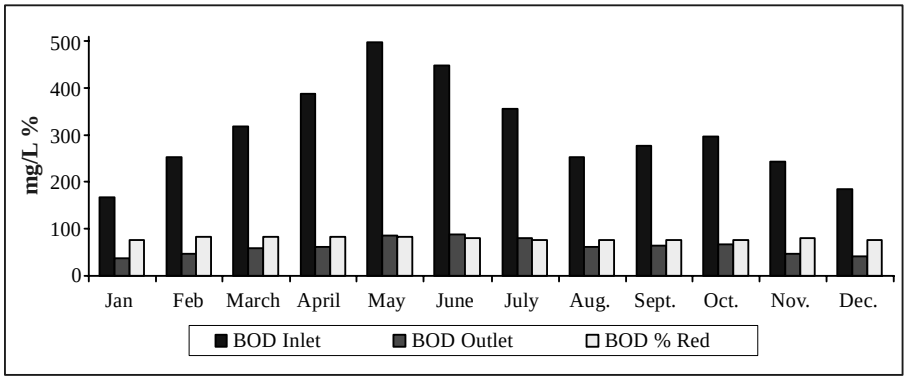

Fig. 2: Percent reduction of biological oxygen demand

Biological oxygen demand during this year depicted the maximum value in the month of April. Biological oxygen demand during this year depicted an increasing trend

from January onwards attaining maximum value in the month of April. A fluctuation in biological oxygen demand values were observed in inlet and outlet during the course of investigations. Thereafter the biological oxygen demand values reduced substantially.

Percent reduction in biological oxygen demand values at inlet and outlet Badwai treatment plant during the period 2010 is shown in Table 2. Maximum reduction in biological oxygen demand values during the period of investigation was observed in the month of April (83.74%), while the efficiency of reduction was slightly less in the month of August (75.61%) in 2010.

BOD indicates the presence of microbial activities and dead organic matter on which microbes can feed. BOD is directly linked with decomposition of dead organic matter present in the wastewater and hence the higher values of BOD can be directly related with pollution status of the wastewater[14]. The higher value of BOD means present of more biodegradable organic material[15]. BOD of samples was not found in limit prescribed by WHO[16] and BIS[17].

CONCLUSION

The present study reveals the assessment of physicochemical parameters like pH, turbidity, DO and BOD high concentration in inlet and low concentration in the final treated (Outlet) wastewater due to various stages of municipal wastewater treatment plant (MWWTP) Bhopal. Performance of MWWTP was evaluated which has shown its capability to reduce turbidity and Biological oxygen demand from inlet to outlet. From the above study, it was observed that high concentration of turbidity and BOD was present in the inlet however better water quality was found after treatment in final treated water. Instead of discharging the treated water onto the nearby bodies of water, it is proposed to let it pass through the municipal wastewater treatment plant which would reduce most of the pollutants. So the municipal wastewater treatment is essential for maintaining the water quality and the final treated wastewater can be used for secondary purposes like irrigations, gardening and industrial cooling.

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