Chemical Oxygen Demand (COD) Reduction from Industrial Wastewater at MIDC Waluj Area, Aurangabad, Maharashtra (India).

Potadar Vishnu [1], Jogdand Onkar K [2], Gawade Mahesh [3] Kadam Vaishali[4]

Department of Environmental Science, Deogiri College, Aurangabad
Department of Environmental Science, Deogiri College, Aurangabad
Department of Environmental Science, Deogiri College, Aurangabad
Department of Environmental Science, Deogiri College, Aurangabad

---***---

Abstract - Chemical Oxygen Demand (COD) is a measure of the total organic matter in the wastewater. It includes both the biodegradable and non-biodegradable matter. Industrial effluents with high concentrations of toxic heavy metals are of great concern because of their persistence and non-degradability. The present research work represents the analysis of water released from industries in the form of effluent from MIDC, Waluj area of Aurangabad. The initial results of pH were ranged in between 6.7 to 7.9. Average pH was 7.29. After the treatment pH of the samples were ranged in between 6.5 to 7.8. Average pH was 7.17. The initial results of TSS of the samples were ranged in between 2545 to 3312. Average TSS was 2996.2. After the treatment TSS ranged in between 77 to 92. Average TSS was 84.6. The initial results of TDS of the samples ranged in between 2525 to 3588. Average TDS was 2985.9. After the treatment TDS ranged in between 1698 to 2057. Average TDS was 1886. The initial results of COD of the samples were ranged in between 1358 to 2567. Average COD was 1822.7. From the analysis of waste water revealed that the high concentration of pollution load is observed in the initial assessment. It was significantly reduced after the treatment. After the treatment COD of the samples was ranged in between 148 to 214. Average COD was 184.9. Significant reduction observed in the COD values. Average COD reduction after the treatment was found in between 85.44 to 93.14%. The average COD reduction was 89.37%. Assessment and treatment of physicochemical indicators of effluent's quality for its management for drinking purpose is proposed to safeguard the public health and ecological systems.

Key Words**:** analysis, wastewater, COD, reduction, pollution

1. INTRODUCTION

Over the last few years, there have been increased concerns on the potential negative effects of industrial wastewater. Good-quality water is needed for most industrial processes, many of these activities generate large amount of effluents of contaminated wastewater, whose eco-friendly disposal into receiving water bodies is of potential environmental and health concern at global level [1].For instance, rising demands on limited water resources coupled with lack of awareness of the issues related to water contamination, has led to significant public debate about the ecological effects of industrial effluents released into the aquatic environments in the many countries [2, 3]. Industrial water demand and wastewater production differs and are sector-specific. Thus, the concentration and composition of the wastewater flows may vary significantly based on the industrial process [1]. Artificial activities such as industrialization and urbanization have resulted in negative impact on the ecological system in terms of degradation and scarcity of fresh water [4], posing a major threat to global food security and natural components [5]. More than half of world's population may face shortage of water by the year 2025 [6]. Higher water demands of increasing population are generally considered as the main driving forces for the reuse of wastewater for city and rural water demands irrigation in many countries [7], in order to fulfil food and water requirements. Wastewater originates from amalgamation of commercial, industrial, domestic or agricultural activities and storm water [8]. Recently countries like North America and Europe were used to dispose off the wastewater directly in to the open land to avoid pollution of fresh water bodies [9]. On the other hand, many of the countries in Asian and African regions like, India, Morocco, Egypt and China are still using untreated wastewater as a main source of essential nutrients [10], for producing food crops [11], as well as to fulfil the demand of gardens development. The direct discharge of industrial and municipal untreated wastewater into drains, canals or various rivers magnifies the water pollution levels. Higher concentration of various pollutants can increase total suspended solids, electrical conductivity, pH, total dissolved solids, biological oxygen demand and chemical oxygen demand. Metals such as Pb, Ni, Cr, and Cd and fecal coliform, results into increase in suitability index of drinking and agricultural purposes [8]. Currently, there are numerous methods that have been adopted to treat organic and inorganic pollutants in the industrial wastewater such as chemical coagulation, reverse osmosis, membrane filtration methods, photochemical oxidation, ozonation and electrochemical oxidation. These methods have some positive as well as negative effects but the major part is the production of large amounts of waste water in the surrounding.

2. MATERIALS AND METHODS

Over the last two decades, there have been increased concerns on the potential negative effects of industrial wastewater. Waluj MIDC area located near Aurangabad city 12-15 kms away from Central Bus Stand as well as Railway Station of Aurangabad city. Study area is one of the highly grown industrial areas of Maharashtra

Industrial Development Corporation (MIDC). In this area many large, medium and small scale industries and export oriented units are located. As a part of National Environmental Policy and to abate industrial pollution, it is proposed to set up common effluent treatment plant (CETP) by Maharashtra Industrial Development Corporation and Maharashtra Pollution Control Board (MPCB).

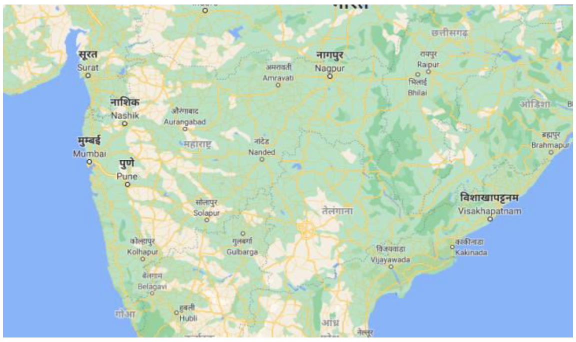

Fig. 1: Study area selected for the analysis

Common Effluent Treatment Plant concept is for treating effluents by means of a collective effort mainly for a collect of small scale industrial units. This concept is similar to the concept of Municipal Corporation Sewage Treatment Plants. Collection tank is the tank where the incoming effluent or waste water from different types of industries received For the successful plant operation it is very essential to have uniform or even or homogenized quality effluent available to feed for treatment facility. With the help of Dosing pump set optimum level dose & maintain pH Level 8.5 – 9.5 as well as solid separation. The effluent coming from equalization tank is treated by dosing them. This platform consists of four chambers & automated pH meter installation. Primary Clarifier is the conical shape at bottom to settle down the sludge & even lauder is provided for supernent overflow of effluent. After the removal of sludge, the effluent, water is brought in aeration tank. CETP is the plant where physico-chemical and biological parameters of waste water are treated. It results into the significant decrease in the pollution load.

3. RESULTS AND DISCUSSION

The present study was undertaken to analyze the physicochemical parameters of the waste water released from the industrial processes of MIDC Waluj area and tabulated in the table no. 1 and 2. The initial results of analysis of physico-chemical parameters of the waste water have been tabulated in table no. 1 and graphically represented in the fig. 2 respectively.

Table 1: Values of physico-chemical parameters at Equalization Tank

Parameter	pH	TSS	TDS	Acidity	Alkalinity	COD
Sample 1	6.9	2647	2525	250	1289	2567
Sample 2	7.1	3120	3025	258	1305	2256
Sample 3	7.6	2545	3364	373	1289	1895
Sample 4	7.7	3312	2945	265	1305	1589
Sample 5	6.7	2925	2836	356	1278	1360
Sample 6	7.5	3245	2973	323	989	1658
Sample 7	7.8	2839	2656	378	1168	2408
Sample 8	6.8	3247	3588	339	987	1358
Sample 9	7.9	3019	3030	377	1105	1458
Sample10	6.9	3063	2917	252	1028	1678
Average	7.29	2996.2	2985.9	317.1	1174.3	1822.7
Max.	7.9	3312	3588	378	1305	2567
Min.	6.7	2545	2525	250	987	1358

(Note: Except pH all the values are expressed in mg/litre)

The observed values show the significant variation in the values. The pH of the samples ranged in between 6.7 to 7.9. Average pH was 7.29. The TSS of the samples ranged in between 2545 to 3312. Average TSS was 2996.2. The TDS of the samples ranged in between 2525 to 3588. Average TSS was 2985.9. The Acidity of the samples ranged in between 250 to 378. Average Acidity was 317.1. The Alkalinity of the samples ranged in between 987 to 1305. Average Alkalinity was 1174.3. Significant variation observed in the COD values. The COD of the samples ranged in between 1358 to 2567. Average COD was 1822.7. The BOD and COD data analysis and ratios can be used for the functional characterization of industrial wastewaters. Generally, municipal wastewaters have BOD and COD ratios in between 0.2:1 and 0.5:1, with the ratio being comparatively steady for domestic waste [12]. However, generation of industrial effluents of variable composition and loading may largely fluctuate the ratio [1].

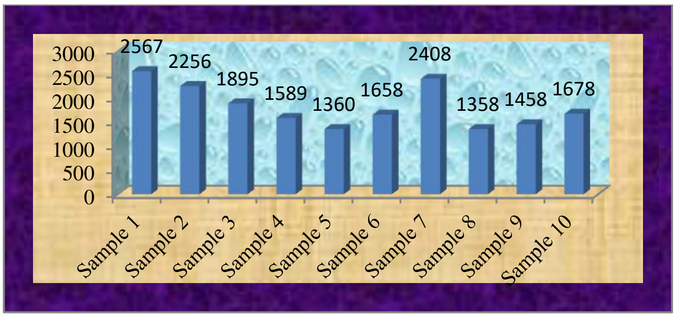

Fig 2: Initial values of COD analysis before the treatment

The obtained results of analysis after the treatment of physico-chemical parameters of the waste water have been tabulated in table no. 2 and graphically presented in Fig. 3.

Table 2: Values of physico-chemical parameters at Aeration Tank and after treatment

Unit	Aeration Tank		Treated Effluent				**Overall COD Reduction in (%)**
Sample nos.	ML SS	DO	pH	TDS	TS S	COD	
Sample 1	3578	3.5	6.9	1698	87	178	93.06
Sample 2	3056	3.2	6.5	1897	92	198	91.22
Sample 3	2589	3.4	7.5	1786	78	214	88.70
Sample 4	2895	2.9	6.8	2057	88	207	86.97
Sample 5	3204	2.7	7.9	1987	90	198	85.44
Sample 6	3058	3.01	7.04	1782	83	167	89.92
Sample 7	2687	3.48	7.05	1721	81	165	93.14
Sample 8	2985	4.5	7.9	1906	84	148	89.10
Sample 9	3178	3.57	6.7	2051	86	169	88.40
Sample 10	3306	2.8	7.5	1975	77	205	87.78
Average	3053.6	3.306	7.179	1886	84.6	184.9	89.373
Max.	3578	4.5	7.9	2057	92	214	93.14
Min.	2589	2.7	6.5	1698	77	148	85.44

(Note: Except pH all the values are expressed in mg/litre)

The observed values show the significant variation in the values of initial treatment and after the treatment. The initial results of pH ranged in between 6.7 to 7.9. Average pH was 7.29. After the treatment pH of the samples was ranged in between 6.5 to 7.8. Average pH was 7.17. The initial results of TSS of the samples ranged in between 2545 to 3312. Average TSS was 2996.2. After the treatment TSS ranged in between 77 to 92. Average TSS was 84.6. The initial results of TDS of the samples ranged in between 2525 to 3588. Average TDS was 2985.9. After the treatment TDS ranged in between 1698 to 2057. Average TDS was 1886.

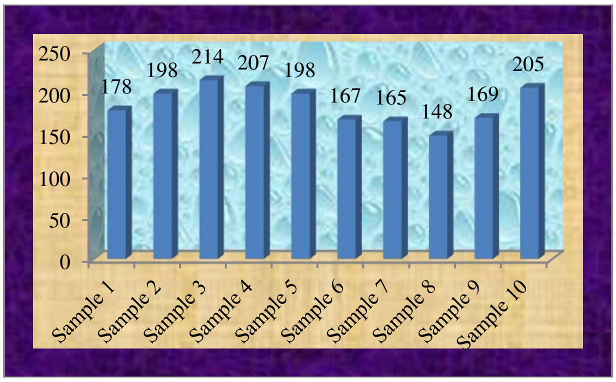

Fig 3: Values of COD analysis after the treatment

The initial results of COD of the samples ranged in between 1358 to 2567. Average COD was 1822.7. After the treatment COD of the samples ranged in between 148 to 214. Average COD was 184.9. Significant variation observed in the COD values. The organic load of wastewater and the treated effluent contributes significantly to oxygen demand level of the receiving water in terms of DO, COD and BOD. High organic load in untreated wastewater is associated with high BOD and COD leading to increased depletion of dissolved oxygen (DO) [1].

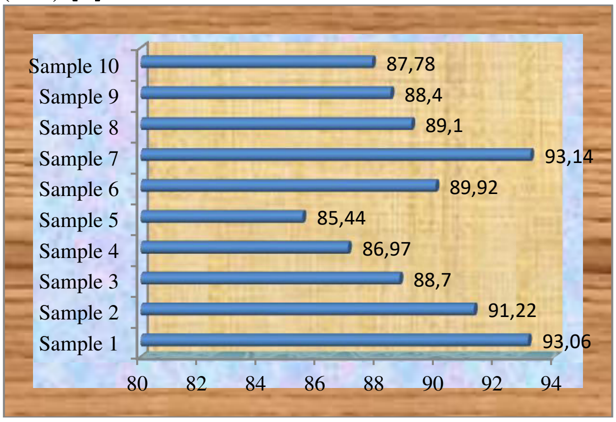

Fig 4: Average reduction (percentage) of BOD after the treatment

Average COD (%) reduction after the treatment was found in between 85.44 to 93.14 %. The average COD reduction was 89.37%. Numerous studies revealed that, DO level below 5 mg/L would negatively impact on aquatic bodies in the receiving surface water bodies and therefore, the reported DO, COD and BOD levels of the final effluents may have an ecological concern. Other physicochemical variables such as pH, BOD, DO, COD, TDS and EC expressed in both temporal and spatial variation [1]. Disposal of insufficiently treated effluents from an array of numerous industries leads to the degradation in the quality, making the water sufficiently unsuitable for the various purposes [13, 14, 15, 16].

4. CONCLUSION:

In the present investigation of waste water treatment and analysis of the physico-chemical parameters were assessed. A rigorous work was performed for the analysis of diverse industrial effluents in the study area. The initial results of Chemical Oxygen Demand (COD) of the samples were ranged in between 1358 to 2567 mg/lit. Initial average COD was 1822.7 mg/lit. From the analysis of waste water, it is revealed that the high concentration of pollution load is observed in the initial analysis. Chemical Oxygen demand of the samples was significantly reduced. After the treatment COD of the samples ranged in between 148 to 214 mg/lit. Average COD was 184.9 mg/lit. Significant variation observed in the COD values. Average COD reduction after the treatment was found in between 85.44 to 93.14 %. The average COD reduction was 89.37%. Therefore it is recommended that, continuous monitoring and maintenance of the wastewater treatment in the study area is needed so as get the precise may be obtained. Further studies involving an analysis of the various parameters from various dimensions would help to understand the status of waste water and its associated impacts in the study area.

REFERENCES

1. Iloms Eunice, Olusola O. Ololade, Henry J. O. Ogola and Ramganesh Selvarajan, Investigating Industrial Effluent Impact on Municipal Wastewater Treatment Plant in Vaal, South(2020). Africa *Int. J. Environ. Res. Public Health*, 17, 1096.
2. Chetty, S.; Pillay, L. Assessing the influence of human activities on river health: A case for two South African rivers with differing pollutant sources (2019). Environ. Monit. Assess. 191, 168.
3. Ololade, O.O. Understanding the nexus between energy and water: A basis for human survival in South Africa. Dev. S. Afr. (2018), 35, 194–209.
4. Molden D: Water for Food Water for Life: A Comprehensive Assessment of Water Management in Agriculture, International Water Management Institute/ Earthscan, (2007). London, UK.
5. Hanjra M. A. and M. E. Qureshi. Global water crisis and future food security in an era of climate change, (2010). *Food Policy*, vol. 35, no. 5, pp. 365–377.
6. Rijsberman F. R.: Water scarcity: fact or fiction?" *Agricultural Water Management* (2006) vol. 80, no. 1–3, pp. 5–22.
7. Scheierling S. M., C. R. Bartone, D. D. Mara, and P. Drechsel: Towards an agenda for improving wastewater use in agriculture, (2008), *Water International*, vol. 36, no. 4, pp. 420–440.
8. Tariq Muhammad, Alia Anayat, Muhammad Waseem, Muhammad Hidayat Rasool, Muhammad Asif Zahoor, Shafaqat Ali, Muhammad Rizwan, Mohamed M. Abdel-Daim, and Saad Alkahtani: Physicochemical and Bacteriological Characterization of Industrial Wastewater Being Discharged to Surface Water Bodies, Significant Threat to Environmental Pollution and Human Health (2020). *Hindawi Journal of Chemistry* Volume, Article ID
9. Asano T., F. L. Burton, H. Leverenz, R. Tsuchihashi, and G. Tchobanoglous: *Water Reuse: Issues, Technologies, and Applications*, McGraw-Hill Professional, (2007) New York, NY, USA.
10. Jimenez B. and T. Asano: Water Reuse: An International Survey of Current Practice, Issues and Needs, IWA (2008), London, UK.
11. Keraita B. N. and P. Drechsel: Agricultural use of untreated urban wastewater in Ghana," in Wastewater Use in Irrigated Agriculture: Confronting the Livelihood and Environmental Realities, C. A Scott, (2004). N. I. Faruqui, and L. Raschid-ally, Eds., pp. 101–112, CABI Publishing, Wallingford, UK.
12. Yildiz, B.S. Water and wastewater treatment: Biological processes. In Metropolitan Sustainability; Elsevier: Amsterdam, *The Netherlands*, (2012); pp. 406–428.
13. Kamika, I.and Momba, M.N.B. Assessing the resistance and bioremediation ability of selected bacterial and protozoan species to heavy metals in metal-rich industrial wastewater. BMC *Microbiol*. (2013), 13, 28.
14. Wepener, V. Van Dyk, C. Bervoets, L. O Brien, G. Covaci, A.and Cloete, Y. An assessment of the influence of multiple stressors on the Vaal River, South Africa. *Phys. Chem. Earth Parts* A/B/C (2011), 36, 949–962.
15. Rensburg van, S.J. Barnard, S. Booyens, S. Comparison of phytoplankton assemblages in two differentially polluted streams in the Middle Vaal Catchment, South Africa. S. *Afr. J. Bot*. (2019), 125, 234–243.
16. Plessl, C. Gilbert, B.M. Sigmund, M.F. Theiner, S. Avenant-Oldewage, A. Keppler, B.K. Jirsa, F. Mercury, silver, selenium and other trace elements in three cyprinid fish species from the Vaal Dam, South Africa, including implications for fish consumers. Sci. *Total Environ*. (2019), 659, 1158–1167.