Available online at **www.joac.info**

ISSN: 2278-1862

Journal of Applicable Chemistry

2016, 5 (6): 1307-1314

(International Peer Reviewed Journal)

Study of Physico- Chemical Parameters of Waste Water Effluents from Waluj Industrial Area, Aurangabad

Snehal D.Kale[1*] and N.N.Bandela[2]

*Department of Environmental Science, Dr.Babasaheb Ambedkar Marathwada University Aurangabad, Maharashtra, **INDIA**

Email: patilsnehalk@gmail.com

Accepted on 18th November 2016, Published online on 27th November 2016

ABSTRACT

The present study was undertaken for physico-chemical analysis of industrial waste water collected from common effluent treatment plant Waluj Aurangabad in order to evaluate its effect on the surrounding environment. The industrial profile of the area includes Pharmaceutical industries, Food industries, Chemical industries, Automobile industries. Samples were collected at inlet and monitor for 4 months. The parameters studied includes- pH, Temperature, Color, Alkalinity, Conductivity, Chlorides, Hardness, COD, BOD, TDS,TSS etc. The analysis showed that there was vast difference amongst samples with respect to time and locality. It was observed that pH of the effluent slightly acidic (5.5 to 6.9) and TDS was 7048mg L^{-1}. Total solids content was 1528 mg L^{-1} and chlorides were observed up to 4185 mg L^{-1} which is higher than permissible limit. Hardness was observed up to 267 mg L^{-1} and BOD, COD was 46 to 369 mg L^{-1} and 352 mg L^{-1} to 927mg L^{-1} respectively. Most of these values are above the permissible limits ISI 2012 and this has resulted in polluting the environment of the surrounding area of the industry. So there is urgent need to develop technology to reduce the pollution and make the area safe for the components ecosystem including the people living nearby.

Keywords: Physicochemical parameter, Industrial effluent, COD, TSS, TDS, Chlorides, Hardness, Conductivity.

INTRODUCTION

Industrialization is one of the important factors for development of country but pollution caused by industries is major problem throughout the world. Pollution impacts on water bodies and marine life. Industries release an array of chemical contaminants to Ecosystem [4]. The Waste water from industries contain wide range of contaminants such as petroleum hydrocarbons, chlorinated hydrocarbons, heavy metals, various acids, alkalis, dyes and chemicals, detergent. These pollutants cause changes physico-chemical properties of water [6]. From the studies it was found that one – third of water pollution of India comes from Industries that is Industrial effluent, solid waste and other hazardous waste [5]. Chemical Industries, Food Industries, Pharma industries, Fertilizer industries releases chemical in their processing. Industries mainly dispose this waste in surface water. This untreated effluent increase surface water pollution. It is found that all rivers are polluted due to disposal of industrial waste water into surface water.

Some of the previous studies show that oil spill in sea affect the marine life. Fish and sea animals died due to this [5]. Though Indian Industries function under strict guidelines of the Central Pollution Control Board (CPCB) [11] but still situation is not satisfactory. Pollution Control Board makes some norms and guidelines for the industries according to their pollution potentials. Many industries have treatment plants but it's not up to the mark and creates pollution. Small scale industries can't afford this treatment plants and ultimately this all leads to the water pollution. This paper analyzed the physicochemical parameters of Industrial waste water effluent from Common Effluent Treatment Plant waluj industrial area Aurangabad. It is the largest industrial zone of Aurangabad. There are so many industries like Pharmaceutical industries, Chemical Industries, Automobile industries, Food industries. Similar study carried out for Sludge at CETP Hyderabad [26] and Tannery Industry effluents [24].

MATERIALS AND METHODS

Area of Study: The study was carried at the Waluj industrial area which is most rapidly developing and heavily polluted industrial area of Aurangabad [20]. The total notification area is 1298 hectares (12.98km^2) consist of large and medium scale industries like Automobile industries, Pharmaceutical industries, chemical industries, Food industries, Paint industries. Maharashtra Industrial Development Corporation supplies water to the Waluj from Jayakwadi Dam located near to the area. The Industrial area utilized fresh water and untreated and treated water discharge in water body. It creates health hazard and environmental pollution affects aquatic life.

Climatic Conditions: The weather of study area semiarid climate under the Koppel climate classification. Annual Temperature of study area ranges from 17 ^{0}C to 44 ^{0}C. Most of rain fall occurs in the monsoon seasons (June to September) [20]. Average rainfall is 710mm.

Material Requirements: All glassware, pipettes were first cleaned with tap water thoroughly and finally with distilled water. The burette and pipettes were rinsed with solution before use. Analytical grade chemicals were used for the experiment. Standard protocol used for analysis of parameter [1, 3] All analysis were conducted in laboratory.

Industrial Effluent sampling and Preservation: Industrial effluent samples were collected in twice after every fifteen days from Common Effluent Treatment Plant Aurangabad during December 2015 to February 2016. Sampling cans (5 liter capacity) was rinsed with tap water followed by distilled water and used for sampling. It was sealed with paraffin wax after sampling [3]. Total 7 samples were drawn in triplicate over the period of 4 months and were designated as S1, S2, S3, S4, S5, S6, S7 etc. Data was analyzed statistically.

Physico–Chemical Study: The Physico-chemical parameter of effluent were studied includes pH, Temperature, Conductivity, Biological oxygen demand Chemical oxygen demand, TDS, TSS, Hardness, Alkalinity, total chlorides etc. The pH was determined by using pH meter. Other parameter determined according to Manual of Environmental Pollution [3].

RESULTS AND DISCUSSION

The industrial waste water sample analyzed by different physico-chemical parameters and the results are presented in table 1.

Table 1: Physico – Chemical parameters of collected samples

Sample →	1	2	3	4	5	6	7	Average
pH	5.5 ±0.1	6 ±0.15	6.9 ±0.1	6.4 ±0.1	6.8 ±0.15	6.9 ±0.15	6.9 ± 0.15	6.4
Temp.	28 ±0.28	29 ±0.35	28 ±0.30	28 ± 0.35	29 ±0.37	30 ±0.11	30 ±0.20	28
Conductivity	1050 ±4.04	1032 ± 2.64	1076 ±2.08	1200 ±5.03	1432 ±38.15	1900 ±27.97	1000 ±26.05	1241
TDS	8600 ±21.50	1500 ±16.64	2250 ±1.52	850 ±18.90	12,200 ±82.65	11,500 ±35.23	12,439 ±46.49	7048
TSS	226 ±7.09	350 ±20.66	750 ±8.02	423 ±21.79	6000 ±139.31	1500 ±38.97	1452 ±14.01	1528
COD	352 ±4.16	856 ±4.16	872 ±3.5	424 ±19.21	776 ±14.74	924 ±6.50	927 ±12.50	733
BOD	46 ±4.16	321 ±9.5	315 ±11.01	160 ±8.02	296 ±4.16	364 ±5.03	369 ±8.32	267
Chlorides	4238 ±36.09	745 ±23.15	1125 ±37.26	4248 ±33.70	6903 ±7.76	5523 ±42.00	6513 ±12.22	4185
Alkalinity	212 ±9.16	122 ±3.51	258 ±3.05	86 ±3.05	47 ±3.21	165 ±2.51	318 ±13.74	172
Total Hardness	310 ±8.08	345 ±3.06	250 ±4.58	308 ±5.29	342 ±25.10	200 ±4.04	118 ±9.01	267
Calcium hardness	134 ± 3.5	300 ±7.6	126 ±2.08	35 ±2.51	120 ±17.05	50 ±2.51	80 ±7.54	120
Magnesium hardness	176 ±11.53	45 ±4.6	124 ±2.51	273 ±5.68	222 ±7.76	150 ±1.73	38 ±2.08	146

Temperature: Temperature is an important abiotic component which affects the aquatic life of the water bodies. Waste water with higher temperature if discharged to the river may harm the growth of aquatic organisms. It was observed that the industries are major source of thermal pollution of water bodies [5]. So it is necessary to monitor the temperature of the effluent. It was observed that the temperature of waste water was 28^0C to 30^0C [table 1]. This temperature was at par with the corresponding atmospheric temperature.

Color: Color is qualitative characteristic. It assesses overall conditions of waste water. This industrial waste water color ranges from greyish black to black and yellowish black.

pH: pH is most important biotic factor. pH plays important role in chemical reaction in environment [6]. Many reactions are controlled by change in pH. High pH or low pH was harmful for Aquatic life [5]. Some Chemical reaction and organisms are very sensitive for pH change so that its require to monitor and control the pH.. The range of desirable pH of water prescribed for drinking purpose by ISI [11] and WHO [12] is 6.5 to 8.5. The industrial effluent samples pH varies from 5.5 to 6.9. All industrial effluent samples pH was acidic. Effluents contain chemicals, dyes, metals which make pH acidic. It was observed that when the pH value increase, TDS and Alkalinity also increase [16]. Samples 3,5,6,7 have high pH and TDS, Alkalinity (Table 1).

Electrical Conductivity: Conductivity is a measure of materials ability to conduct an electric current. Conductivity measurements are used routinely in many industries and environmental application and reliable way for measuring ionic content in solution [4]. Conductivity value varies from 1000 – 1900 µmhos cm^{-1} in waste water (table 1). Conductivity is an important parameter because health problem occurs when EC exceeds 370µscm [25].

Total Dissolve Solid (TDS): Total dissolve solid is a measure of the combined contain of all inorganic and organic contained in liquid in suspended form.[9] Effluent sample TDS valves found to be 850 to 12.439

mg L^{-1}(figure 1). Permissible limit of TDS was 2000mg L^{-1} [17]. Someswara Rao et al observed high hardness in there ground water samples [27]. The main source of TDS was pharmaceutical manufacturing industries , food industries ,steel industry. These industries were major source of organic and inorganic and other dissolved materials. High value of TDS observed at sample 5, 6, 7. Similarly high value of TDS 996 ppm observed in soap industry waste water by Tekade et al [21]

Total Suspended Solid (TSS): It is water quality parameter use to assess the quality of waste water after treatment in waste water treatment Plant .Effluent samples TSS vales observed 226 to 6000 mg L^{-1} (figure 1).According to Indian standards permissible limit of Total suspended solids was 100mg L^{-1} [17]. Highest TSS observed in sample 5, 6000mg L^{-1}. It shows effluent was highly polluted.

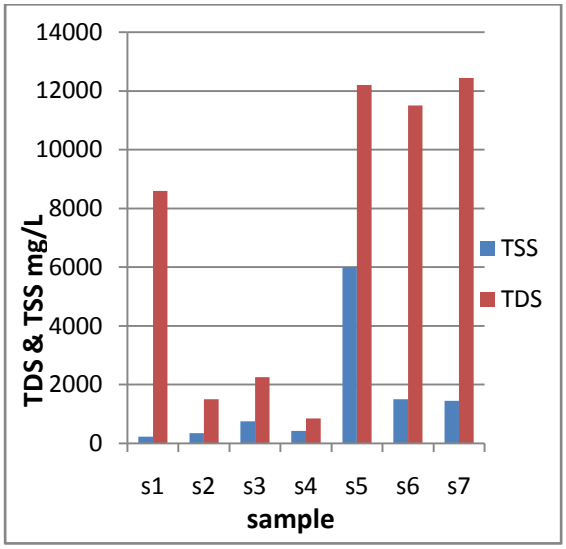

Fig 1

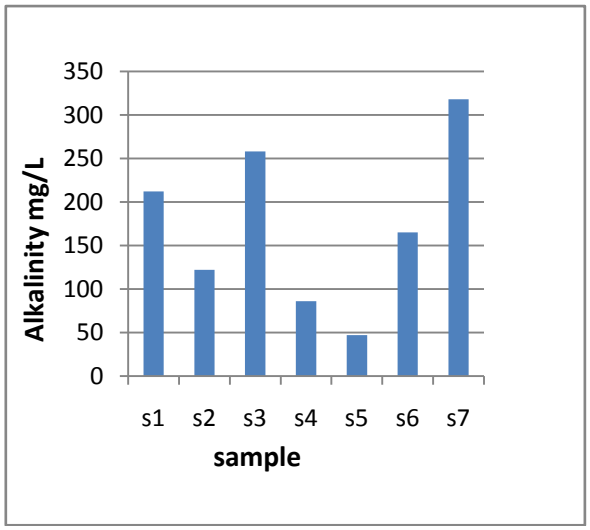

Fig 2

Alkalinity: Alkalinity refers to the capability of water to neutralize acid. During present study total alkalinity observed from 47 – 258 mg $CaCO_3$ L^{-1} (figure 2) 600mg L^{-1} was permissible limit of Alkalinity [17] Effluent Alkalinity was within permissible limits. Phenolphthalein Alkalinity was absent in waste water throughout the study period hence methyl orange alkalinity was analyzed. Alkalinity and pH are related to each other at pH 4.3 or below. As the sample pH was from 5.5 to 6.9, carbonate and hydroxide alkalinity was absent in the sample.[10] In Present Effluent sample dissolved inorganic and organic compound and bicarbonate were main source of alkalinity. Highest alkalinity was observed in sample7, 318mg L^{-1} (table1).

Chemical Oxygen Demand (COD): Chemical oxygen demand test estimate the amount of organic compound in water .COD test measures Domestic and Industrial waste water pollution. COD determined the quality of oxygen required to oxidize organic matter in water under specific conditions of oxidizing agent temperature and time [14] 262mg L^{-1} to 1811mg L^{-1} COD in industrial waste water was recorded by P.Dhingra et al.[22]. Effluent samples COD values was found to be 352-927 mg L^{-1}.(figure 3) which clearly indicates the pollution level of the effluent samples. COD level of effluent varied every day. It was observed S1 and S4 samples COD value between 350- 450 mg L^{-1} and S2, S3, S5, S6, S7 samples COD values are between 750-950 which was higher value. Experimental study shows that COD is higher than BOD (table 1) because COD measures all chemical in water and BOD measures amount of oxygen that require for bacteria to degrade the organic compound present in water [13]. It was observed that COD was 2.5 higher than BOD but variation in COD and BOD is totally based on nature of raw material used[13].

Biological Oxygen Demand (BOD): Biological oxygen demand refers to the amount of oxygen that would be consumed by microbes. The chemical kinetic factors like temperature can favorably affect the BOD reaction. Beruch et al., [7]. BOD is important parameter that shows level of water pollution. Effluent samples BOD values was observed 46 – 369 mg L^{-1} (figure 4) BOD permissible limit was 30 mg L^{-1} [17]. It was observed that as temperature increases BOD also increases BOD directly affect the dissolved oxygen of water greater BOD more rapidly oxygen is depleted in the waste water [19]. S1 and S4 shows low BOD value and S2,S3,S5,S6,S7 samples shows high BOD values. Temperature increases by 1^0C to 2^0C the BOD also increases [13] similar range of BOD (268-387mg L^{-1} was observed by Kesalkar et al in industrial waste water[22]**.**

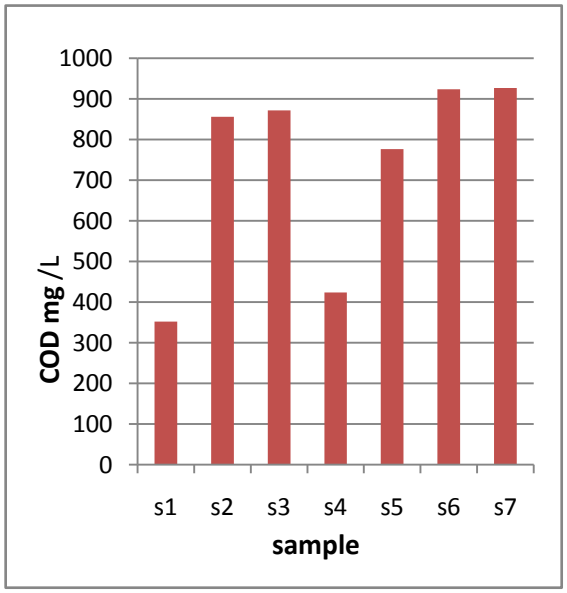

Fig 3

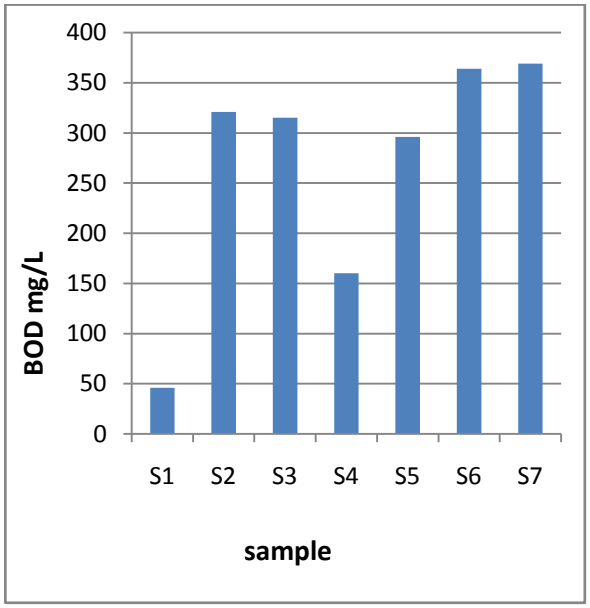

Fig 4

Chlorides: Chlorides are present due to presence of different salts Ca, Na, K in the effluent [25]. Concentration of slats above certain limits harms the aquatic as well as terrestrial life. Chlorides releases in effluent from chemical industries, it release high amount of salts [4]. The chlorides were found to be 745-6903 mg L^{-1} in waste water effluent samples during present study (figure 4) permissible limits of chlorides1000mg L^{-1}[17] .The sample 1,4 5,6,7 shows high amount of chlorides. The experimental data shows chlorides was half of the TDS (table 1).

Total Hardness: Hardness is measure of capacity of water to precipitate soap. Total hardness is sum of calcium hardness and magnesium hardness. The main source of Hardness was presence of minerals. But effluent sample have few sources of minerals. Total hardness was observed to be 118 to 345 mg $CaCO_3$ L^{-1} for industrial waste water whereas the calcium Hardness was 35 – 300mg $CaCO_3$ L^{-1}. Magnesium hardness from 45 to273 mg $CaCO_3$ L^{-1} (figure 6).Hardness of samples was within permissible limit. 600mg L^{-1} is the permissible limit as per WHO [17].

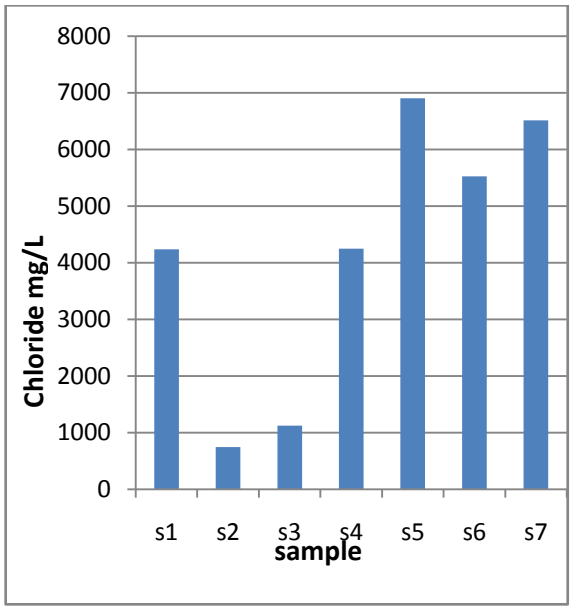

Fig 5

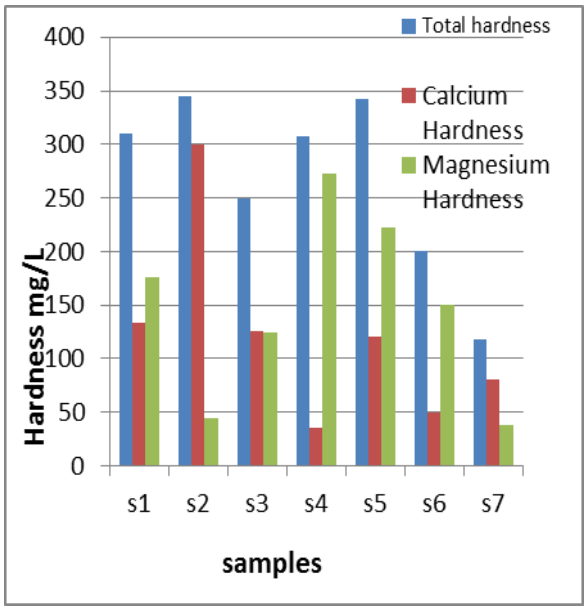

Fig 6

Statistical Study: All Results was analyzed statically. Data was analyzed by using standard deviation. Statistical analysis shows variation in results .All parameters analysis results and statistical data analysis results were given in table 1. Most of the parameters were beyond their permissible limits. COD, BOD of samples was very high, similarly TDS, TSS and chlorides were present in high amounts (table 1). Similar kind of work was done by Lokande et al in 2011 while Studying on physico- chemical parameters of waste water effluents from Taloja industrial area of Mumbai, India. And similar work was also done by Kesalkar et al in 2012 while studying on physico-chemical characteristics of waste water from paper industry.

APPLICATIONS

The results are useful to know pollution load of Common Effluent Treatment Plant (CETP).and its effect on surrounding environment .Similarly its useful for to develop proper waste water treatment method.

CONCLUSIONS

The aquatic environment near industrial area was getting polluted over the period of time due to increasing number of industries spreading around these areas. These industries ultimately dump the effluents in the surrounding environment. The present analysis of such effluent samples clearly indicates alarmingly high level of all pollutants in the Waluj industrial area of Aurangabad. So it is high time to find the solution to treat such samples and have a common policy applicable to all the industries so that the effluents will be free from such harmful chemicals and the aquatic life can breathe happily in such places.

ACKNOWLEDGEMENTS

Author acknowledges to department of environmental science of BAMU Auranagabad and CETP Waluj Aurangabad.

REFERENCES

[1] Andrew D. Eaton, Lenore S Clesceri, Eugene W. Rice, Arnold E. Greenbarg, **2005**: STANDARD METHODS: For the examination of water and wastewater 21st edition; 4-70, 5-14.

[2] Irfan Ali Khan, Atiya Khanum: Biotechnology in the welfare of mankind, Volume 1, ukaaz publication Hyderabad, 145-156.
[3] Dr. N.N.Bandela, Dr. Masorrat sultana, Er. Uday Patil: Manual of Environmental pollution analysis, 1st edition **2005**, Prithavi publication, 15-66.
[4] Ashish Tikariha, Omprakash sahu, **2014**, Study of characteristics and treatment of dairy industry waste water, *Journal of Applicable and Environmental Microbiology*, **2014**, 2 (1), 16-22.
[5] Ram S Lokhade and et al, Study on physico –chemical parameter of waste water Effluent from Taloja Industrial Area of Mumbai, India, *International Journal of Ecosytem*, **2011**, 1 (1), 1-9.
[6] Paulap popa and et al, Study of physic-chemical characteristics of waste water in an Urban Agglomeration in Romania, *The scientific world Journal Volume*, **2012**.
[7] A Devi Ecological Studies of lomon Plankton of three fresh water body Hyderabad, Ph D Thesis Osmnia University Hyderabad, **1980**.
[8] www.veoliwatertech.com/crownsolution/resource/documents/2/2951,waterpp393-394pdf downloaded on 12-10-2016.
[9] bcn.boulder.co.us/basin/data/BACT / INFO/TSS.html downloaded on 10/10/2016
[10] Nittrc.ac.in/Four%20quadrant/ee/Quadrant % 20-% 201/ exp12 pdf downloaded on 12/10/2016.
[11] cpcb.nic.in/uploaded/newitems_116_Guidlinesofwaterqualitymonitoring pdf downloaded on 11/11/2016.
[12] World Health Organization (WHO) Guidelines for drinking water quality health criteria & other supporting Information 1 WHO, Geneva, **1984**.
[13] www.researchgate.net/post/whatisrelationshipbetweentheCODandBODvaluesinwastewater. Downloaded on 11/11/2016.
[14] www.chem.wise.edu/course/116/other doc lab/COD_lab. pdf
[15] S.Mehetre, Bioremediation of organic waste under biophasic conditions using Thermophilic microbial consortia, PhD Thesis, University of Mumbai, August **2008**
[16] dnr.wi.gov/regulations/labcert/documents/training/basics/-genchem.pdfdownloadedon 11/11/2016.
[17] Indian Standered Drinking Water–Specification (second revision) IS 10500:2012.
[18] Indian Council of Medical Research (ICMR) Manual of Standard of Quality for Drinking Water Supplies, (**1975**).
[19] Lokhande et al "Pollution in water of Kasardi River flowing along Taloja Industrial area of Mumbai India" *World Environment*, **2011**, 1 (1), 6- 13.
[20] T. P. Chavan "Effect of effluent on physic chemical characteristics of soil and water in Aurangabad area" Ph.D Thesis Dr. BAMU Aurangabad, 4-12-2001.
[21] P.V.Tekade et al, "Study of physico-chemical properties of effluent from soap industries in wardha", *RASAYAN J. chem.*, **2011,** 4(2), 461-465.
[22] P.Dhingra et.al, "Study of physico-chemical parameter of waste water effluents from industrial area of Jaipur, Rajasthan, India, *International Journal of Innovative science, Engineering and Technology*, **2015,** 2(5), 874 – 876.
[23] V.P Kesalkar et al, "physico–chemical characteristics of waste water from paper industry", *International Journal of Engineering Research & Applications,(IJERA)*, **2012,** 2 (4), 37-143.
[24] Vinay et al, "Impact of Tannery Effluents in stimulated conditions on physic chemical characteristics of river water and its seasonal variations", *J Applicable Chem.*, **2014**, 3(2), 776-782.
[25] Veena et al "Physico chmical analysis of packaged mineral water bottles floating in and around central Karnataka" *J Applicable Chem.*, **2016,** 5(5), 1191-1198.
[26] K.Sudhakar Babu et al "selective characterization of sluge waste generated in the common effluent treatment plant and suitable evaluation for land application-an investigations", *J Applicable Chem.*, **2013**, 2(4), 869-875.
[27] Someswara Rao et al "Assessment of quality of ground and surface water at selected locations in surroundings of BARC complex around Visakhapatnam", *J Applicable Chem.*, **2015**, 4 (2), 578-586.

AUTHOR ADDRESS

1. **Snehal D.Kale**
Department of Environmental Science,
Dr.Babasaheb Ambedkar Marathwada University Aurangabad, Maharashtra, India.
Email: patilsnehalk@gmail.com