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Evaluation the performance of Al-Maameera wastewater treatment plant

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Abstract:

The performance of Al-Maameera wastewater treatment plant was studied according to some parameters from August2020 to June 2021.The evaluation was Temperature(Temp.),pH, Total Suspended Solids(TSS), Nitite(NO_2), Nitrate(NO_3), Ammonia(NH_3), Phosphate(PO_4), Biological Oxygen Demand(BOD), Chemical Oxygen Demand(COD), Oil & Grease(O&G), Hydrogen Sulfide(H_2S) ,Sulphate(SO_4) and Chlorides(Cl).The Result showed was good removal efficiency for TSS, BOD, COD, O&G and H_2S, where the wastewater treatment plant was low in removal efficiency for another parameters. Finally the wastewater treatment plant is inefficient in removing some important pollutants.

Introduction:

Sewage is ultimately the community's water supply after it has been contaminated by a number of uses. The wastewater generated by the use of water by community is received a polluting potential and may be develops into a health and environmental threat. Many of waterborne illnesses may transport by unregulated wastewater disposal, hence preventing communicable illnesses and preserving from its risks is the main goal of sewage treatment. (Kumar et al.,2010)

When sewage is incomplete treatment and is left to cumulate, the organic matter in it decomposes, leading to a lot of foul gases(Horan,1991; Pescod and Arar1988) . Attention should be given to wastewater treatment and disposal to ensure that such issues are prevented or reduced.(Mara and Cairncross,1989) The effectiveness of treated sewage is a key metric for understanding how sewage plants operate.(Kaindl et al,1999). A wastewater treatment plant (WWTP) may need to be upgraded to fulfil the effluent quality standards currently in place, the harsher effluent quality standards of the future, or to increase capacity due to population development or sewerage expansion to serve more areas. (Bub et al,1994; Qasim, 1999 ;WEF 2005; Mahvi et al,2006)

The region of wastewater station employment and monitoring, is one of the key factors to be taken into account while assessing of this station. Repeated, precise sampling and laboratory analysis are important tools needed for suitable operation dominance (Kaul et al,1993). Sewage plants that fail to satisfy effluent regulations frequently have organisational issues, bad sewage system case, and bad station styling (Storhaug,1990) Another modren causes for the bad accomplished of sewage treatment facilities include the overload that caused by a growth in population and water demand, emission of commerce effluents, ...etc (Dakers and Cockburn,1990).

Within Al-Hilla city, one wastewater treatment facility was developed. One of these facilities, the Al-Maamera sewage treatment facility, started operations in 1982. The factory uses an activated sludge method to remove nitrogen and carbon compounds in untreated wastewaters organically. 50000 people are served by the Maamera sewage treatment plant, which uses a traditional activated sludge system with an average annual wastewater inflow of 12000 M^3. Both home and industrial wastewater can be disposed of through the sewage system. The Shatt Al-Hilla River then receives the treatment facility's effluent output.(Shakir,2014).

The current study aims to evaluate the efficiency of the sewage treatment plant in Al-Maamira based on some physical and chemical tests

Materials and Methods:

Comparing the parameters at the treatment unit's inlet and outlet has been used to evaluate performance. Samples with triplicate were collected in pristine polyethylene bottles of 5 liters from input

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and outlet units were analyzed in accordance with the guidelines for the analysis of water and wastewater mentioned in APHA (2017) from August2020 to June 2021.The parameters included Temperature(Temp.),pH, Total Suspended Solids(TSS), Nitite(NO_2), Nitrate(NO_3), Ammonia(NH_3), Phosphate(PO_4), Biological Oxygen Demand(BOD), Chemical Oxygen Demand(COD), Oil & Grease(O&G), Hydrogen Sulfide(H_2S) ,Sulphate(SO_4) and Chlorides(Cl).
Removal Efficiency(R.E%) was calculated as below:

$$R.E\% = \frac{A-B}{A} * 100 \text{ were:}$$

A: parameter concentration in inlet samples
B: parameter concentration in outlet samples

Results and Discussion:

To compare the overall performances of the various facilities in terms of average TSS, COD, BOD($_5$), and ammonia removal efficiencies, the general efficiency indicator was established (Colmenarejo et al., 2006). Through the results of this study, temperature fluctuations were observed depending on the time of sampling and the months of sampling. The temperature values ranged between (19.2 and 47) ºC for the inlet water samples and between (15 and 48) ºC for the water samples of outlet the station Table (1) and Figure (1).

Because most biological life depends on a small and crucial pH range, the pH directly determines how well a secondary treatment procedure works (Metcalf and Eddy, 2003). The highest values of pH ranged between the lowest value of 7.5 and the highest value was 8.1 for inlet water and the lowest value was 7.3 and the highest value was 7.9 for the outlet water. Table (1) and Figure (2). The reason for this may be due to the possibility of the presence and predominance of some acids such as carbonic acid, fulvic acids, humic, citric and others dissolved in the sewage water As a result of the decomposition of rapidly decomposing organic matter and its decrease caused by the treatment of part of those acids(Muhammad,2006)

The amount of TSS in the sewage is of relevance because it impacts how well a treatment unit removes solids and lowers its conductivity , which affects how well wastewater may be reused for many uses. (McGhee,1991).The Removal Efficiency% (R.E%) of Total Suspended Solids (TSS) was ranged between 78.43% and 99.43% in September 2020 and February 2021 respectively. This result showed the good treatment for removal of TSS according to the settling unit. Decrease of BOD is a good indicator of how well secondary treatment treatment work,which is represented by Bilogical Oxygen Demand (BOD5), ChemicalOxygen DemandCOD) , and ratio between COD to BOD5 . (1996, Sincero and Sincero) Biological Oxygen Demand(BOD) is the best indicator for biodegradation of some organic matters. The range of R.E.% was 85.45-98.60 in August 2020 and February 2021 respectively, while from the results of Chemical Oxygen Demand(COD) the low R.E.% was 29.62 in March 2021 and the high R.E.% was 95.34 in October 2020. The low and high R.E% for Oil and Grease was 77.86% in September 2020 and 97.26 % in October 2020 respectively. To explain the types of materials in studied plant, the ratio of BOD/COD if >0.6 this mean the material is easy to biodegradable, if this ratio ranged between 0.3-0.6 the material needed seed to accomplished the biodegradation and finally if the ratio <0.6 the material cannot degraded biologically(Abdallaa and Hammam,2014)

The Means of R.F% for all treatment plant through the study periods were (7.7 for NO_2, 12.9 for NO_3 and 75 for NH_3). The wastewater treatment plant appeared poor in treatment of nitrite and nitrate according to weak in biological treatment that caused by low in anaerobic bacterial content, but good in removed ammonia especially in warm months because its gas form which evaporate to atmosphere.

R.F% for removing of phosphate in present treatment plant through the study periods was20.53% as low value in January 2021 and high value was 65.21% in March 2021, this results mean that the treatment plant is less efficient in removed phosphate.H2S was efficient in removed by wastewater treatment plant , it ranged between 9.57% in August 2020 as low value and 100% in March 2021 as low value and sulphate was low value RE% (2.43%) in October 2020 and high value was 16.78%in January 2021 this mean the wastewater treatment plant was inefficient in removed sulphate this similar in case of chloride , the low value was 3.58% in January 2021and high value was24.93% in September 2020

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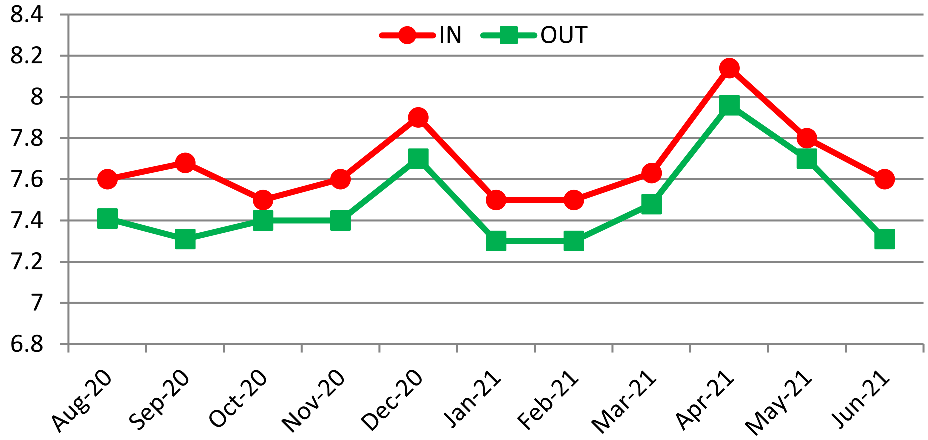

Figure1. Temperature variation in wastewater treatment plant during the study period

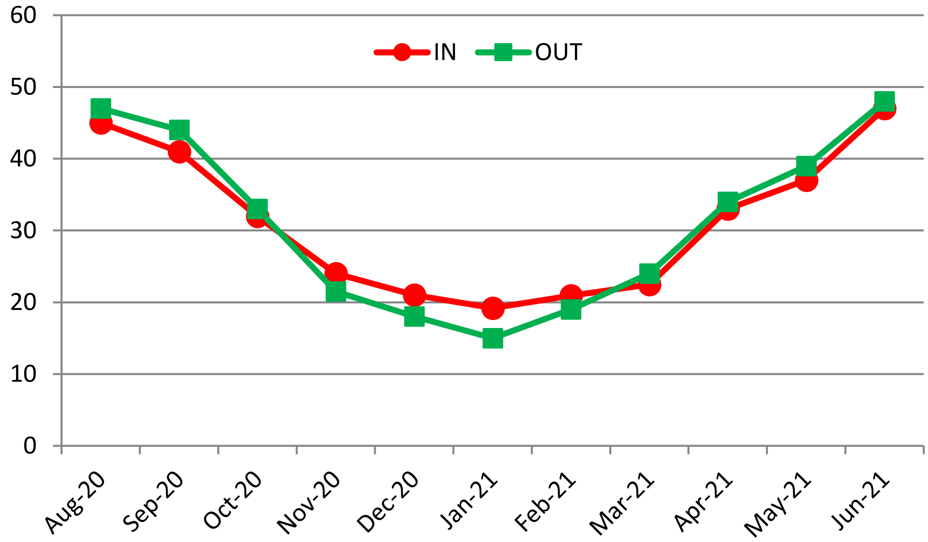

Figure2. pH variation in wastewater treatment plant during the study period

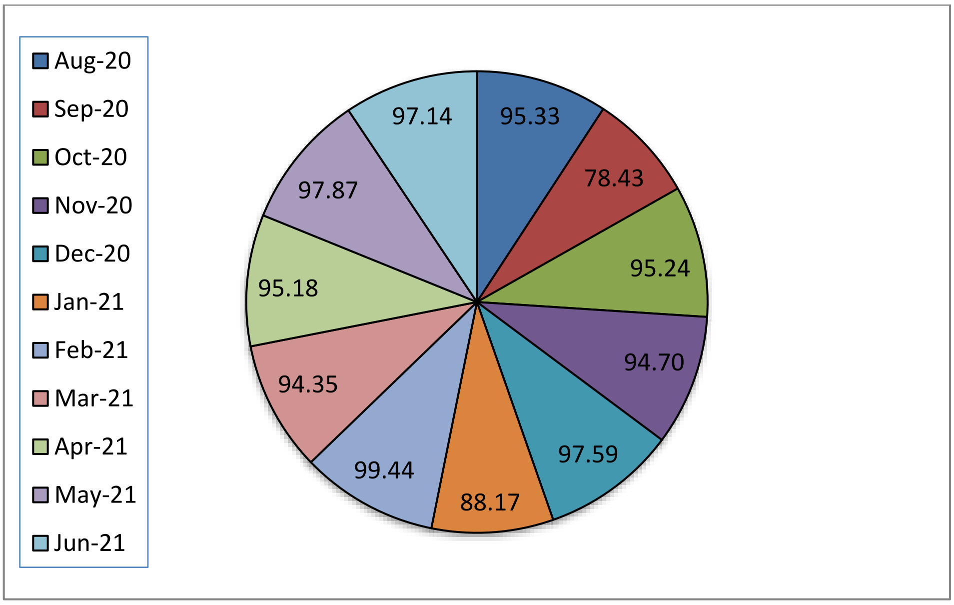

Figure3. R.E.% for TSS in wastewater treatment plant during the study period

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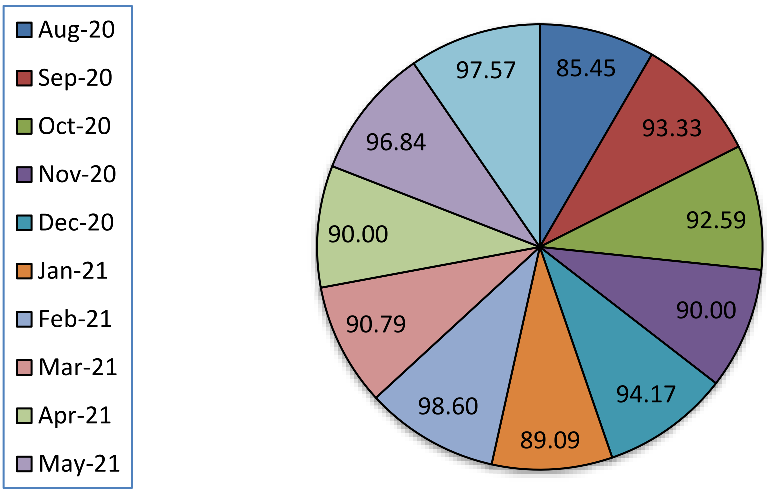

Figure4. R.E.% for BOD in wastewater treatment plant during the study period

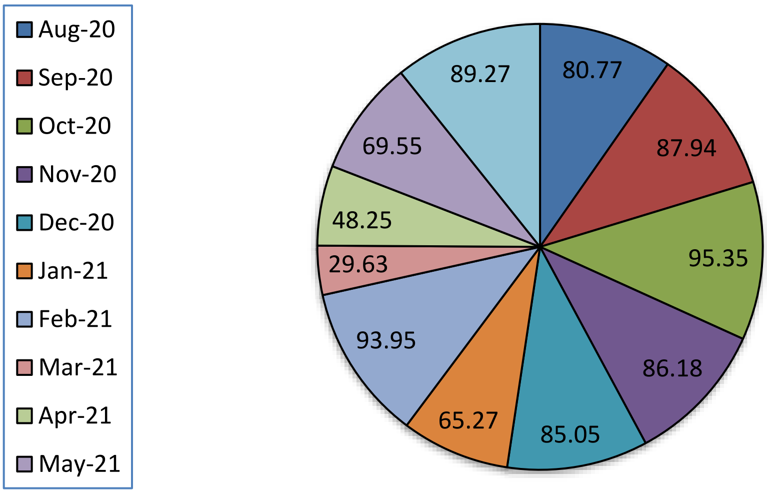

Figure5. R.E.% for COD in wastewater treatment plant during the study period

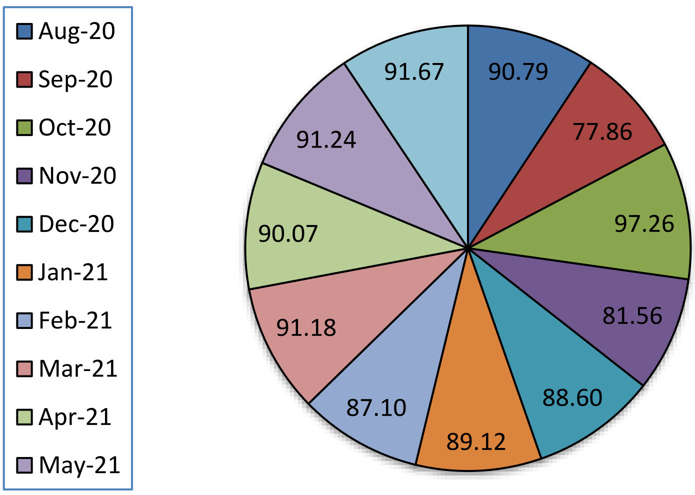

Figure6. R.E.% for O&G in wastewater treatment plant during the study period

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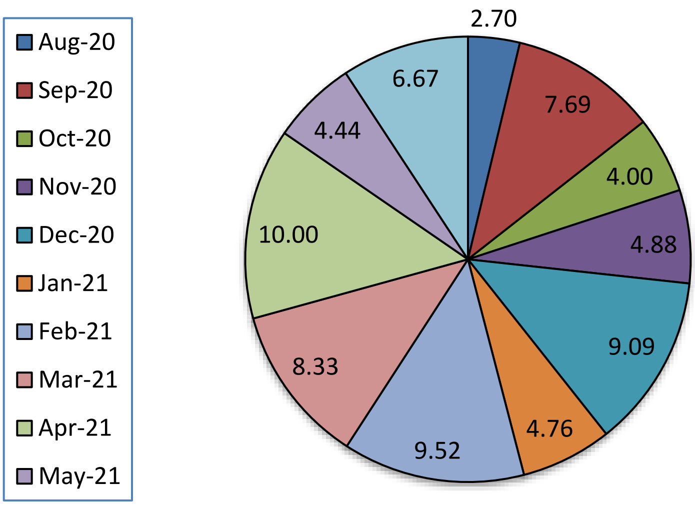

Figure7. R.E.% for NO_2 in wastewater treatment plant during the study period

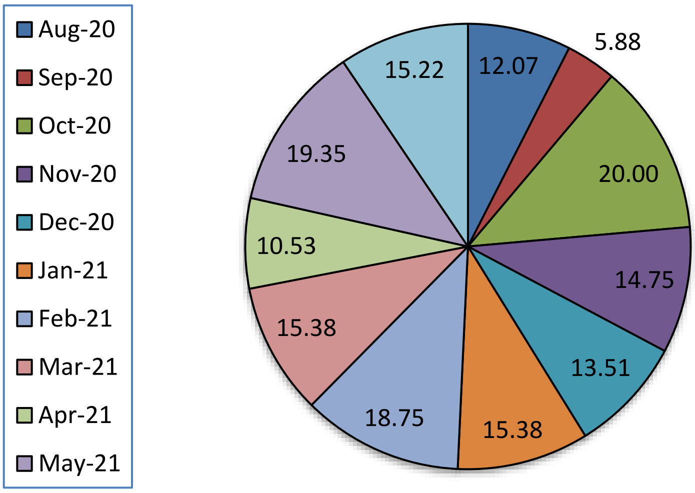

Figure8. R.E.% for NO_3 in wastewater treatment plant during the study period

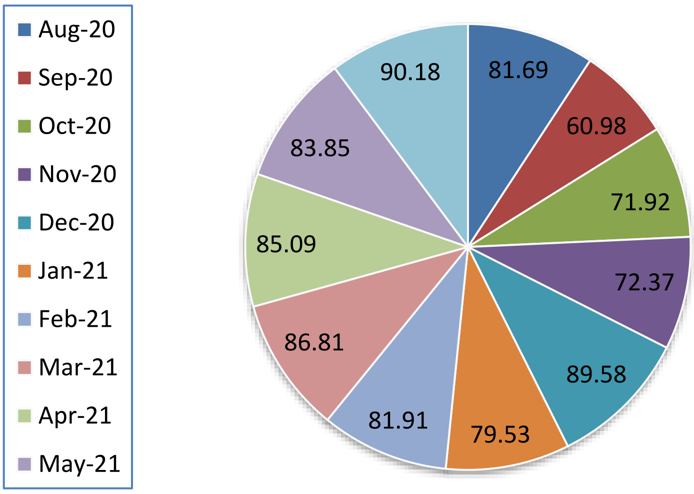

Figure9. R.E.% for NH_3 in wastewater treatment plant during the study period

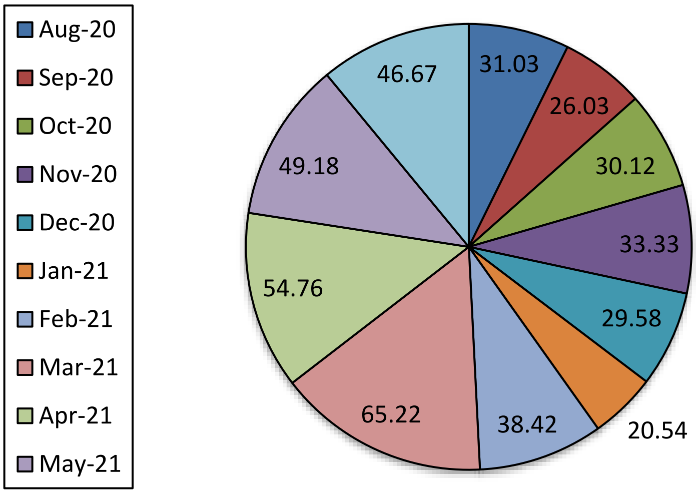

Figure10. R.E.% for PO_4 in wastewater treatment plant during the study period

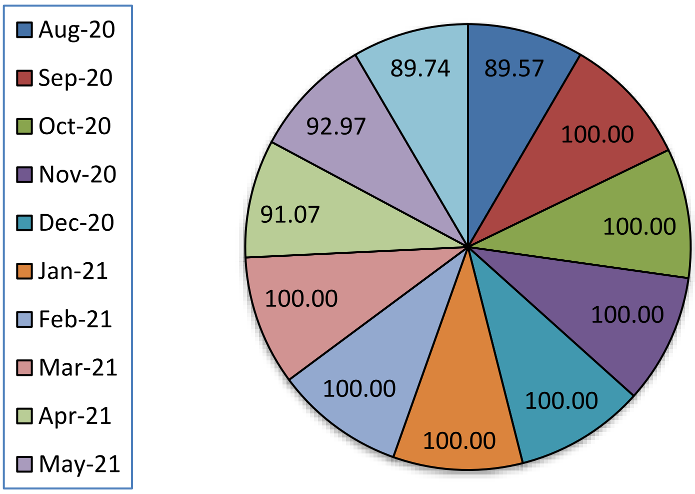

Figure11. R.E.% for H_2S in wastewater treatment plant during the study period

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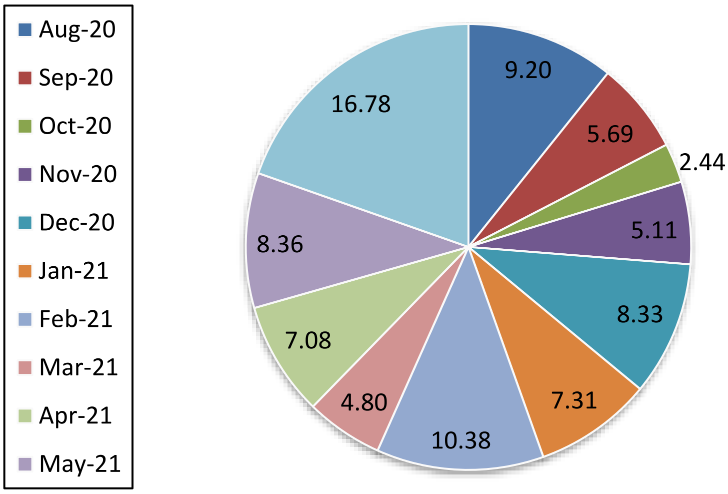

Figure12. R.E.% for SO_4 in wastewater treatment plant during the study period

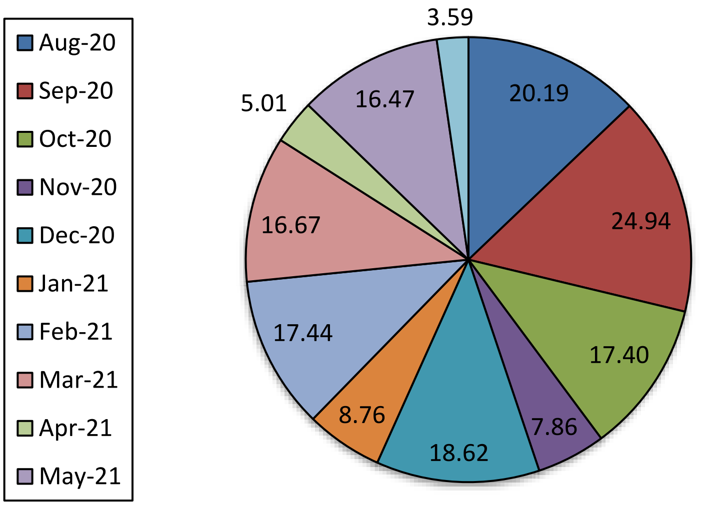

Figure13. R.E.% for Cl in wastewater treatment plant during the study period

Table1. Inlet and Outlet values for some studied parameters

Month	Temp(°C)		TSS(mg/l)		pH		BOD(mg/l)		COD(mg/l)		O&G(mg/l)	
	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT
Aug-20	45	47	150	7	7.6	7.41	110	16	156	30	22.8	2.1
Sep-20	41	44	102	22	7.68	7.31	120	8	141	17	13.1	2.9
Oct-20	32	33	126	6	7.5	7.4	162	12	301	14	7.3	0.2
Nov-20	24	21.5	151	8	7.6	7.4	120	12	217	30	14.1	2.6
Dec-20	21	18	497	12	7.9	7.7	240	14	321	48	11.4	1.3
Jan-21	19.2	15	169	20	7.5	7.3	110	12	167	58	19.3	2.1
Feb-21	20.9	19	713	4	7.5	7.3	573	8	893	54	12.4	1.6
Mar-21	22.5	24	177	10	7.63	7.48	76	7	108	76	13.6	1.2
Apr-21	33	34	166	8	8.14	7.96	110	11	143	74	14.1	1.4
May-21	37	39	235	5	7.8	7.7	190	6	266	81	13.7	1.2
Jun-21	47	48	280	8	7.6	7.31	371	9	382	41	19.2	1.6

Table2. Inlet and Outlet values for some studied parameters

Month	NO_2(mg/l)		NO_3(mg/l)		NH_3(mg/l)		PO_4(mg/l)		H_2S(mg/l)		SO_4(mg/l)		Cl(mg/l)	
	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT
Aug-20	0.037	0.036	5.8	5.1	14.2	2.6	5.8	4	16.3	1.7	913	829	411	328
Sep-20	0.13	0.12	11.9	11.2	16.4	6.4	7.3	5.4	18.7	0	861	812	413	310
Oct-20	0.015	0.0144	6.5	5.2	14.6	4.1	4.15	2.9	16.3	0	861	840	454	375
Nov-20	0.41	0.39	6.1	5.2	15.2	4.2	5.7	3.8	11.4	0	803	762	407	375
Dec-20	0.011	0.01	7.4	6.4	19.2	2	14.2	10	13.4	0	972	891	478	389
Jan-21	0.021	0.02	1.3	1.1	17.1	3.5	11.2	8.9	11.4	0	944	875	411	375
Feb-21	0.021	0.019	4.8	3.9	28.2	5.1	17.7	10.9	19.1	0	992	889	407	336
Mar-21	0.012	0.011	2.6	2.2	18.2	2.4	2.3	0.8	11.3	0	792	754	624	520
Apr-21	0.03	0.027	1.9	1.7	16.1	2.4	4.2	1.9	11.2	1	819	761	499	474
May-21	0.09	0.086	3.1	2.5	19.2	3.1	6.1	3.1	18.5	1.3	861	789	516	431
Jun-21	0.03	0.028	4.6	3.9	11.2	1.1	4.5	2.4	11.7	1.2	864	719	502	484

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