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Performance Evaluation of Industrial Wastewater Treatment Plant at Taloja, Navi Mumbai, Maharashtra, India

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Abstract: This study has been done for the performance evaluation of industrial effluent treatment plant of a chemical industry located at Taloja MIDC, Navi Mumbai. The effluent treatment plant is designed with full fledged capacity of 340 m³/day with 100 % recycle and reuse.

The effluent is analyzed for various waste water parameters majorly such as Chemical oxygen demand (COD), Biological oxygen demand (BOD), Total Dissolved solids (TDS), pH, Total Suspended solids (TSS) etc. The effluent samples were collected from December 2018 to June 2019 of various streams.

Results of raw water of COD and BOD were on higher side. It observed that at the end of treatment plant the COD, BOD, TDS, TSS were reduced with high efficiency. Parameters were within the permissible limit as prescribed by Maharashtra pollution control board (MPCB), India.

Keywords: Industrial effluent treatment, chemical industry, COD, BOD, TDS, MBR

I. INTRODUCTION

The chemical industry is one of the leading industries in the Indian market sectors. As the production is increasing day by day of chemical industries, the effluent generation also has increased on a large scale. This effluent has a high COD, High BOD, also pH which is mostly alkaline in nature.

This effluent has to be treated with proper effluent design system, otherwise it can harm the local environment by the discharging the untreated effluent. Monitoring of this effluent can be done, such as what type of treatment is required for this effluent. Monitoring can help you identify the characteristics of the effluent. Performance evaluation is needed for the whole systems which installed in the treatment plant. With the help of this we can understand the problems in treatment plant, so that we can minimize the problems with it. The obtained results from the performance evaluation can be very useful for improvement in operational and maintenance area if needed and also for the waste reduction strategies.

A. Need of Study

Performance evaluation is an important part after the erection and commissioning of the effluent treatment plant for discharge standards given by MPCB or CPCB. Many manufacturing industries generate effluent from their process activity which can be highly polluted to the environment, for that much industry doesn't have proper treatment for treating effluent. So inlet and outlet parameters should be studied to be done for upgradation of the plant with the help of the performance evaluation of the Industrial ETP.

B. Objectives of Work

To monitor the performance of the Industrial effluent treatment plant and also to evaluate the efficiency of treatment plant.

II. MATERIALS AND METHOD

The project involved establishing sampling locations at the study area, sample design and sample analysis. The first step of the project is to conduct a reconnaissance survey in the study area to identify and establish suitable sampling locations. The sample design includes ascertaining sample size, sampling duration, methods of sampling, duration of sampling and preservation techniques. Sample analysis involves the method used for analyzing each of the parameters.

A. Sampling Methods

The methods used for sampling will be grab sampling. This technique of sampling is particular sample or measurement is taken at a exact time or over a minimum period of time which would be feasible. This is the most common method of sampling used in various environmental laboratories. The person required for grab sampling should have sufficient knowledge of sampling and should be skilled.

B. Analysis of Sample

The sample of effluent will be collected from different unit of effluent treatment plant. For this performance evaluation study the pollution parameters such as such as BOD, COD, TSS, pH, TDS etc. are taken. Analysis of this sample have done and depend on that results the efficiency has been decided.

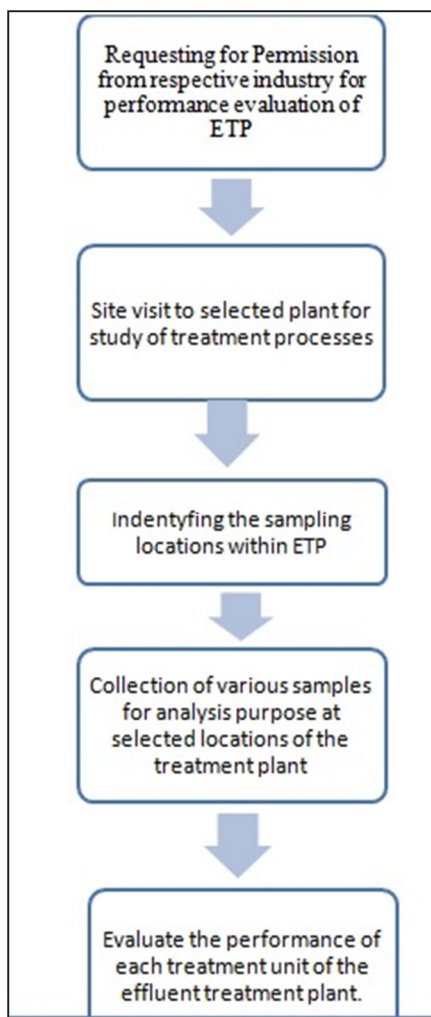


Fig: Flow chart of Methodology

Sr.No	Units of ETP	No of units
1.	Equalization Tank	1
2.	Settling Tank	1
3.	Aeration Tank	2
4.	MBR Tank	2
5.	Reverse Osmosis	1

Table: Units of Effluent Treatment Plant



Figure: Satellite image of Effluent Treatment Plant

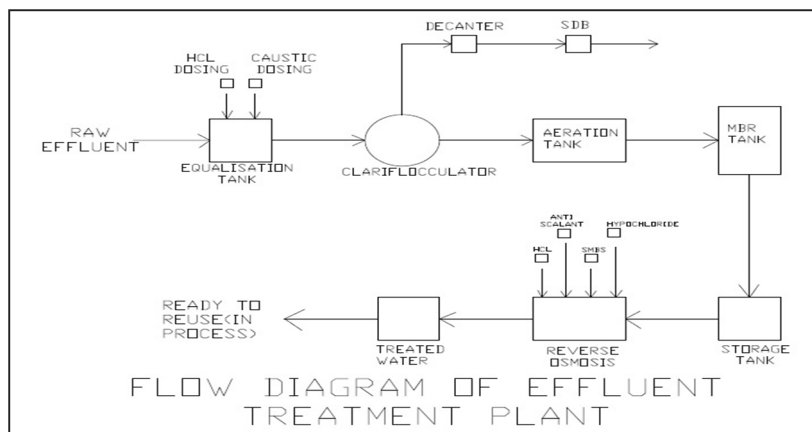


Figure: Schematic Diagram of Existing Effluent Treatment Plant

III. RESULTS AND DISCUSSION

A. Results of pH

Sr.no	Sampling locations			
	Inlet Tank	Outlet Clariflocculator	MBR Permeate	RO Permeate
1.	10.51	--	7.24	7.04
2.	9.78	8.27	7.28	7.03
3.	8.26	7.98	7.43	7.10
4.	10.24	8.79	7.56	7.24
5.	9.38	8.41	7.51	7.14
6.	9.76	6.67	6.94	7.19
7.	8.98	8.02	7.24	7.11
8.	9.41	8.52	7.67	7.32
9.	8.04	7.65	7.22	7.14

Table : Results of pH

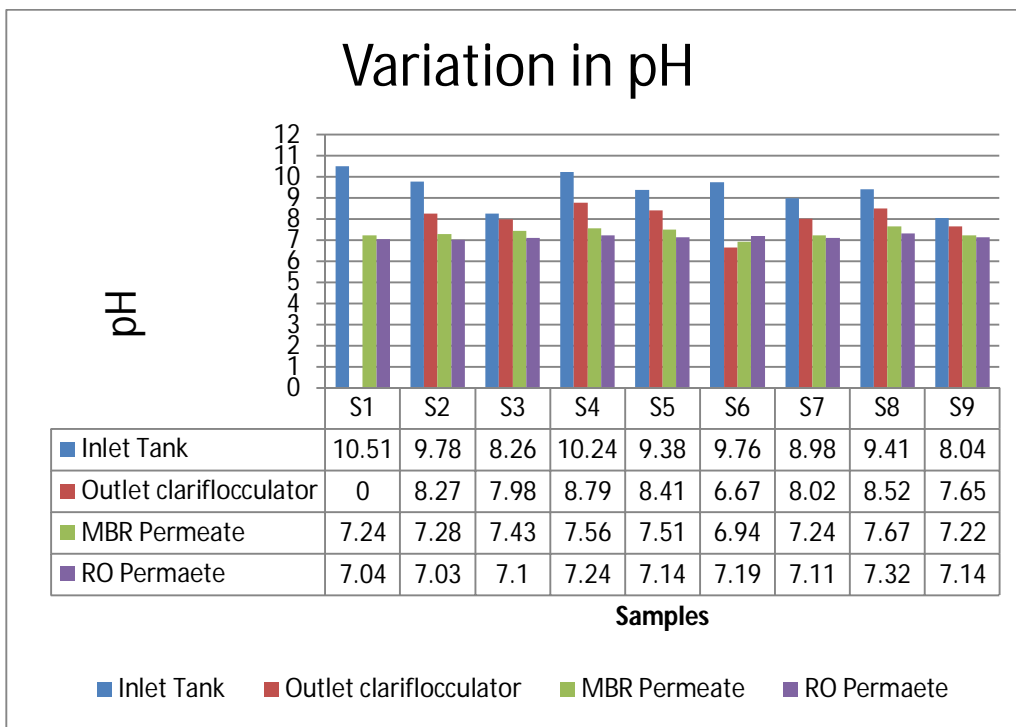


Figure: Variation in pH

B. Results of COD

Sr.no	Sampling locations				Removal Efficiency (%)
	Inlet Tank	Outlet Clariflocculator	MBR Permeate	RO Permeate	
1.	12972	--	132.8	75.2	99.28
2.	11844	12220	338.4	131.6	98.88
3.	7990	8554	112.8	54.3	99.32
4.	9547	9985	147.7	62.8	99.34
5.	8268	8579	198.5	84.3	98.90
6.	5452	3083	75.2	56.4	98.96
7.	3984	1267	158.4	97.9	97.54
8.	5287	2656	549.0	171.5	96.75
9.	2341	821	178.2	108.9	95.34
Average Removal Efficiency					98.25

Table: COD Results

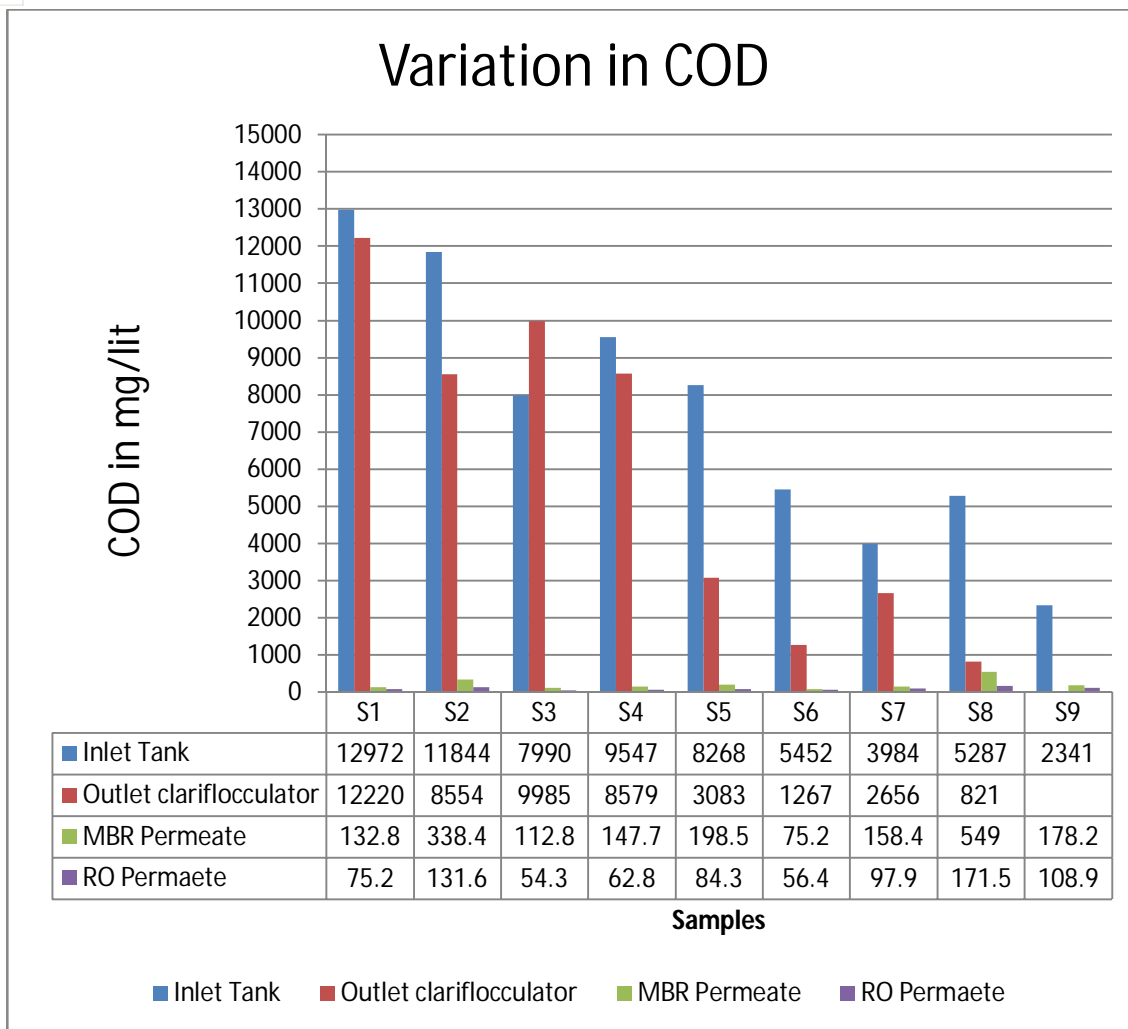


Figure: Variation in COD

C. Results of BOD

Sr.No	Sampling locations				Removal Efficiency (%)
	Inlet Tank (mg/lit)	Outlet Clariflocculator	MBR Permeate	RO Permeate	
1.	320	--	40	16	95.00
2.	920	632	113	38	95.86
3.	294	579	97	26	91.11
4.	598	887	69	31	94.81
5.	1258	1749	138	53	95.78
6.	1040	1840	123	45	95.67
7.	774	1278	147	76	90.18
8.	841	1262	162	64	92.39
9.	532	424	77	20	96.24
Average Removal Efficiency					94.11

Table: BOD Results

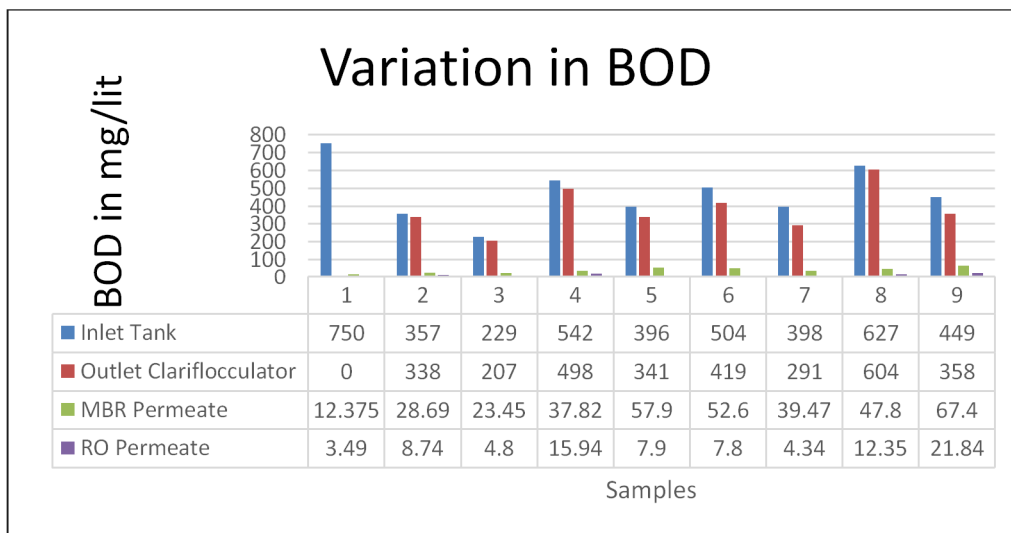


Figure: Variation in BOD

D. Results of TSS

Sr.No	Sampling locations				Removal Efficiency (%)
	Inlet Tank (mg/lit)	Outlet Clariflocculator	MBR Permeate	RO Permeate	
1.	320	--	40	16	95.00
2.	920	632	113	38	95.86
3.	294	579	97	26	91.11
4.	598	887	69	31	94.81
5.	1258	1749	138	53	95.78
6.	1040	1840	123	45	95.67
7.	774	1278	147	76	90.18
8.	841	1262	162	64	92.39
9.	532	424	77	20	96.24
Average Removal Efficiency					94.11

Table: TSS Results

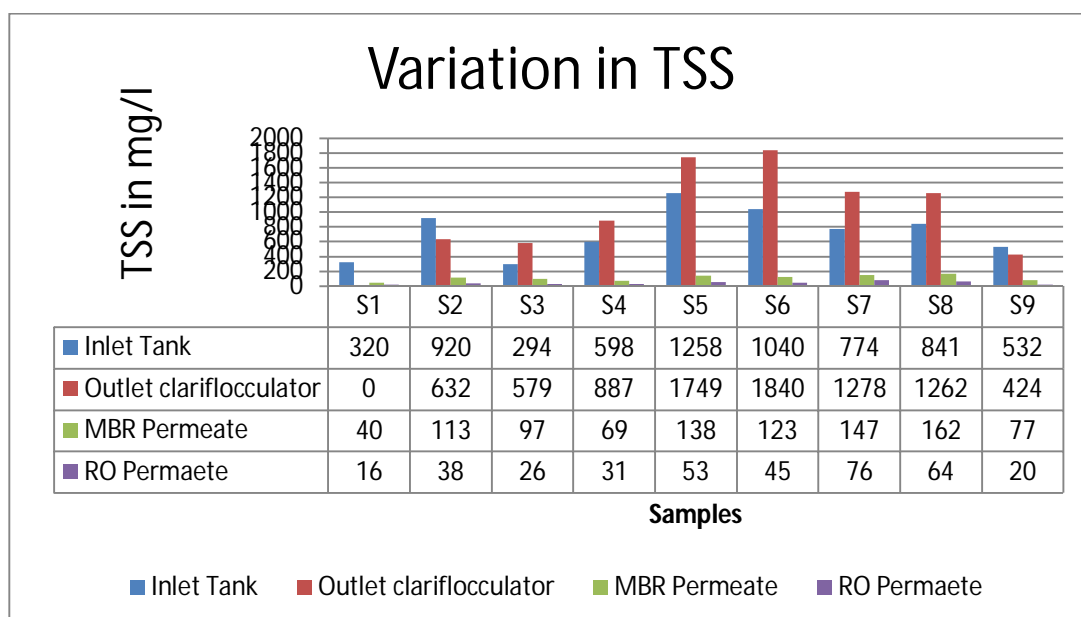


Figure: Variation in TSS

E. Results of TDS

Sr.no	Sampling locations				Removal Efficiency (%)
	Inlet Tank (mg/lit)	Outlet Clariflocculator	MBR Permeate	RO Permeate	
1.	3600	--	1658	260	92.77
2.	3820	3900	1400	254	93.35
3.	3430	3510	1359	247	92.79
4.	3640	3790	1574	332	90.87
5.	2274	2890	1622	271	88.08
6.	1438	2314	1498	158	89.01
7.	4274	4698	1979	376	91.20
8.	3847	4178	1628	304	92.10
9.	2485	2144	879	247	90.06
Average Removal Efficiency					91.13

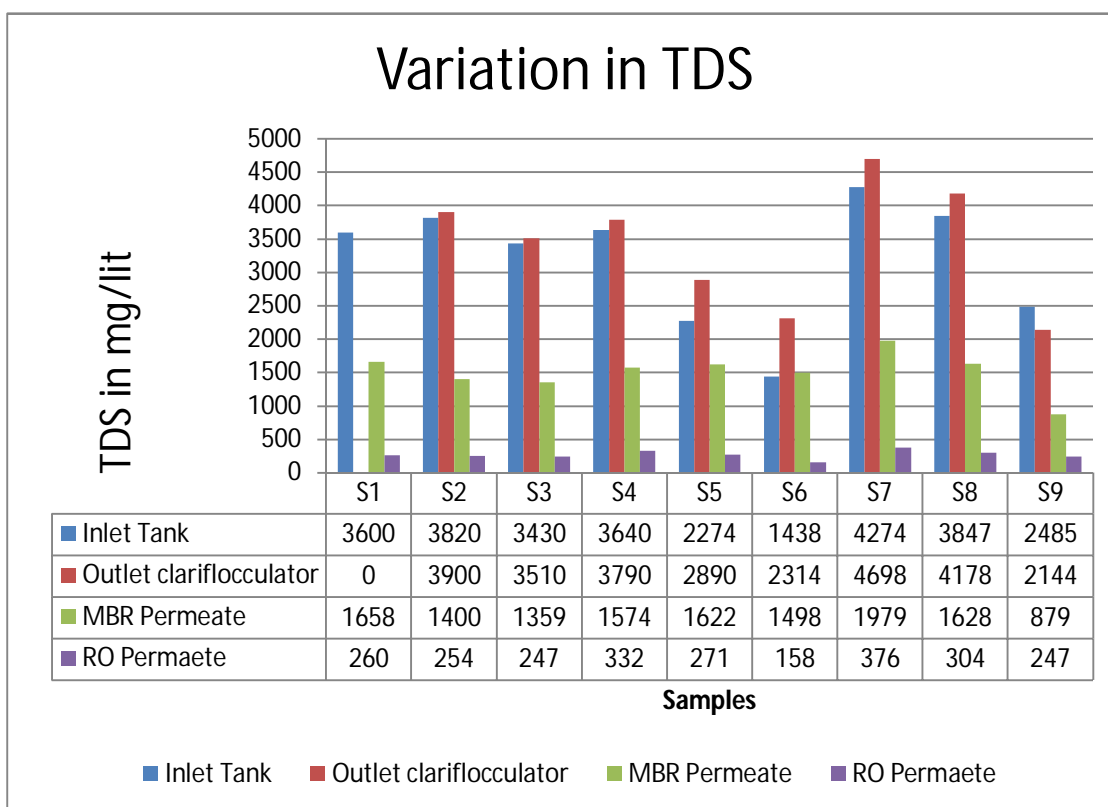


Figure: Variation in TDS

IV. SUMMARY AND CONCLUSION

The pH of Overall plant varies from 7-7.4 during the study period. The COD removal Efficiency of Overall plant varies from 95.34% to 99.28% during the study period. The Overall Average COD removal efficiency of the treatment plant is 98.25%. The BOD removal Efficiency of Overall plant varies from 95.13 % to 99.53 % during the study period. The Overall Average BOD removal efficiency of the treatment plant is 97.83 %.. The TSS removal Efficiency of Overall plant varies from 90.18 % to 96.24 % during the study period. The Overall Average TSS removal efficiency of the treatment plant is 94.11 %. The TDS removal Efficiency of Overall plant varies from 88.08% to 93.35% during the study period. The Overall Average TDS removal efficiency of the treatment plant is 91.13 %.



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