Performance Evaluation of Sewage Treatment Plant in Kanpur City

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ABSTRACT-The goal of the current study was to assess how well kanpur City's existing sewage treatment facilities (STPs) were performing. Two STPs, based on ASP each having an operating capacity of 130 MLD and 36MLD, respectively, are now in operation in Kanpur. The amount of biogas produced by the ASP reactor is also less than its design value since the wastewater is mixed with household effluent as it travels through the STPs, resulting in a relatively low BOD concentration. To ascertain the plants' efficiency, by the method of artificial neurons network(ANN) have been applied. Graphical interpretations have been used for all the outcomes. The study's findings show that the ASP reactor performs more efficient..

Key words: Sewage treatment, life cycle analysis, pollution, ASP, land cost, influent, effluent, Kanpur City, India.

INTRODUCTION

The varying quality of the raw water available in India necessitates changes to the traditional

An aeration and chemical water treatment plan filtration, sedimentation, flocculation, coagulation, and disinfection. Sludge and backwash water production environmental issues arise from water treatment facilities. when it comes to disposal. Consequently, chemical process optimization Dosing and filter runs are crucial to lowering the waste products from water treatment facilities. There is also the necessity to research water treatment facilities for their operating state and to investigate the most practical technique to assure optimal production of drinking water with as few rejections as feasible and its administration. Due to this the Central Pollution Control Board as a backdrop (CPCB), analysed water treatment facilities nationwide, for the currently available raw water quality.

Historical context

The release of wastewater into the environment resulted in unfavourable conditions, which prompted the development of extensive sewage treatment techniques. Sedimentation one of the initial procedures was chemical precipitation. used to treat wastewater. In 1865 the early The microbiology of sludge digesting experiments were carried out in England. The first experiments on intermittent wastewater filtering was done, while early studies on intermittent sand were conducted in 1870. In England, filtration were produced. First septic tank built in 1876 in the United States of America. Initially, in 1882 Aeration experiments were conducted in England. United In 1884, States used bar racks for the first time. in the U.S. The state's first facility for treating chemical precipitation was erected in 1887. Filtration in contact beds was invented in 1889. Septic tanks were used because the offensive nature of the sludge created by sedimentation made the solids there more or less inoffensive, although challenges of many kinds prompted the widespread adaptation of In 1904, Travis built a two-story septic tank in England.

Germany granted a patent for the Imhoff tank in 1904. The process of disinfecting wastewater via chlorination was Phelps gave a demonstration of it in 1906 in the United States. In the United States, a trickling filter was installed for the first time in a municipal setting in 1908, and regulations governing Chick developed disinfection in the United States. The first Imhoff tanks were built in the United States in 1911.

1912–1913: Aeration of Slate-filled tanks with wastewater were used at Experiment Station Lawrence. There were experiments in 1914. that produced the study by Arden and Lockett creation of the activated sludge method, which uses a There is a great degree of cleansing. The method was utilised at a municipal sewage treatment facility at 1916 in San Marces, Texas. Contact aerators debuted in 1925 developed in the US by Buswell.

The numerous changes occurring in the world today are caused by the changing features of wastewater as a result of the release of several toxins treatment of wastewater. Treatment of sewage or waste is one such option, where numerous processes created and run to closely resemble the natural procedures to treat pollutants to a certain level the capacity of nature. In this regard, particular focus is required to evaluate how existing practises affect the environment Facilities for treating wastewater.

OBJECTIVE OF STUDY

This project's primary goal is to assess the effectiveness of each parameter and the overall effeciency of the sewage treatment facility during the summer and winter months.

The study's objectives are as follows:

- To research the significance of every parameter in engineering of wastewater.
- To assess the effectiveness of TSS and BOD removal of a sewage treatment facility in the summer.
- To assess the effectiveness of TSS and BOD removal of a sewage treatment facility in the winter.

Methodology for Taking Performance Evaluation Parameters

First of all, compared to conventional aeration without medium, the BOD5 (testing for BOD after taking an incubation period) water quality metric maximises the development of microorganisms in a given volume of aeration tank. The media in FAB technology is kept still and fluidized in the aeration tank. Results for a total capacity of 43 MLD have been published. In this instance, the sludge produced was dried in sludge drying beds before being disposed of as waste or given away for free to nearby farmers. In this instance, the treated water is released into the Holy Ganga River. It is difficult to determine if it is more efficient to construct a single plant that treats a huge volume or numerous plants that treat different minor flows when designing a plant. As a result, it's important to evaluate a sewage treatment plant's potential effects on the environment while taking its capacity into account. Sewage treatment system evaluation tools include the Artificial neural network (ANN). The ANN's input should be a dataset of COD, BOD, and TSS variation data that was chosen as a response for both the modelling of STPs and the variation of waste water quality data (factors). Finally, multivariate modelling using ANN necessitates the production of a diverse set of data demonstrating response variation as a function of the components.. pH and operational temperature were kept between 28 and 32 oC and 7 and 0.5, respectively. The analysis of the samples that were taken provided the primary data, while U.P. Jal Nigam's Ganga Pollution Control Unit in Kanpur city provided the secondary data. The sampling process involved composite sampling, and the samples were kept chilled between collection and analysis. The samples were analysed the day they were collected.

ANN RESULTS

This study employs an artificial neural network (ANN) as its modelling method. The COD, BOD, and TSS variation data dataset that was selected as a response for both the modelling of STPs and the fluctuation of waste water quality data serves as the ANN's input (factors). An analytical modelling technique known as an artificial neural network (ANN) may identify and generate complicated non-linear correlations between independent and dependent variables.

- In this work, the Levenberg-Marquardt algorithms were chosen, and an optimised ANN architecture was created. The following input variables are used to compute the input to the hidden layer U:
- $\{U\} = (W)\ \{I\}$ ……..(1)

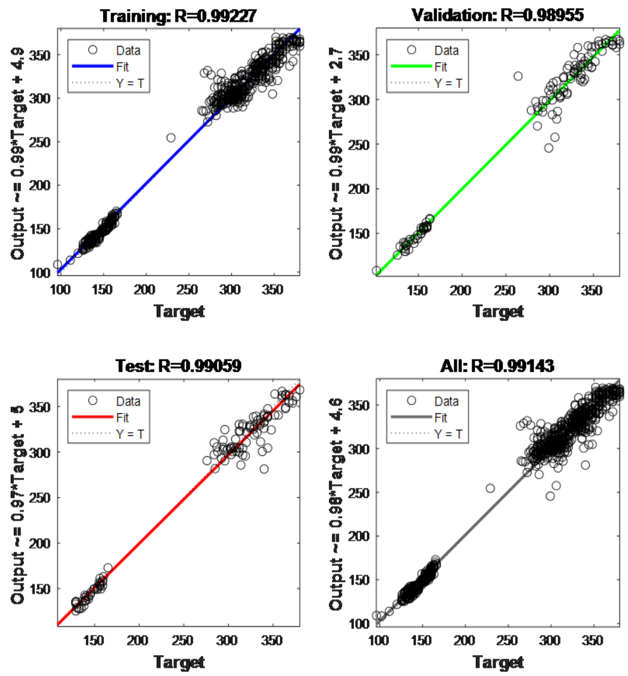
where, W is the weight and I is the input. Each term of U matrix can be presented as follows:

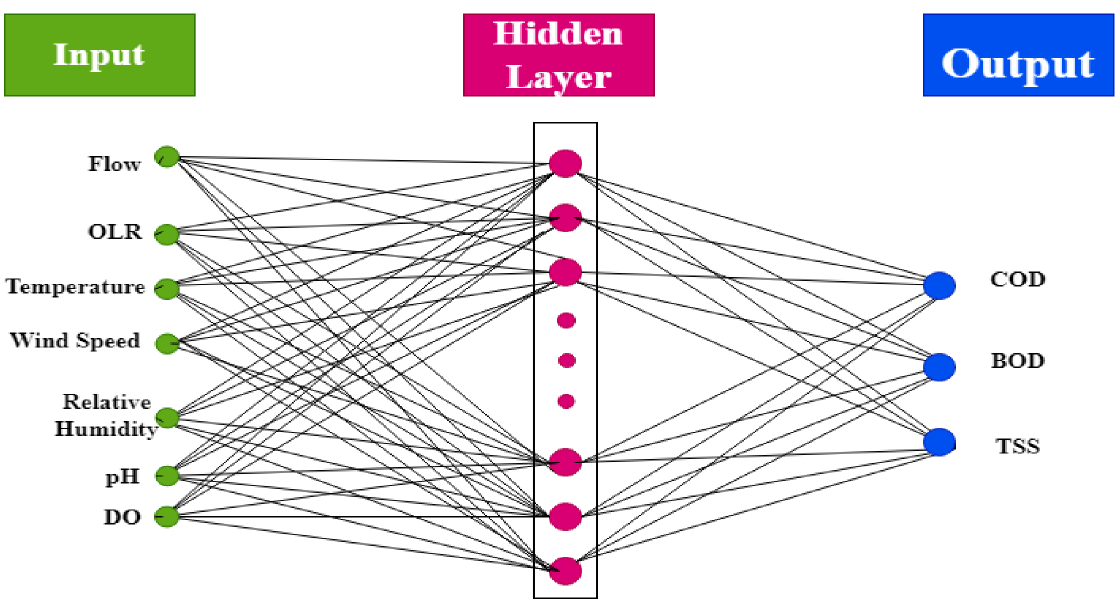
$u_j = \sum_{i=1}^{n} w^i i_i - \theta$ ………….(2)

where, θ is the associated bias.

Number of neurons in the hidden layer

The number of neurons in the hidden layer is one of the most crucial ANN parameters. When there are either an excessively high or an excessively low number of neurons, the network gets complex or underperforms. The network must have an ideal distribution of neurons for it to function effectively. The number of neurons in the ANN varied between 7 and 21 in STP Jajmau Kanpur.



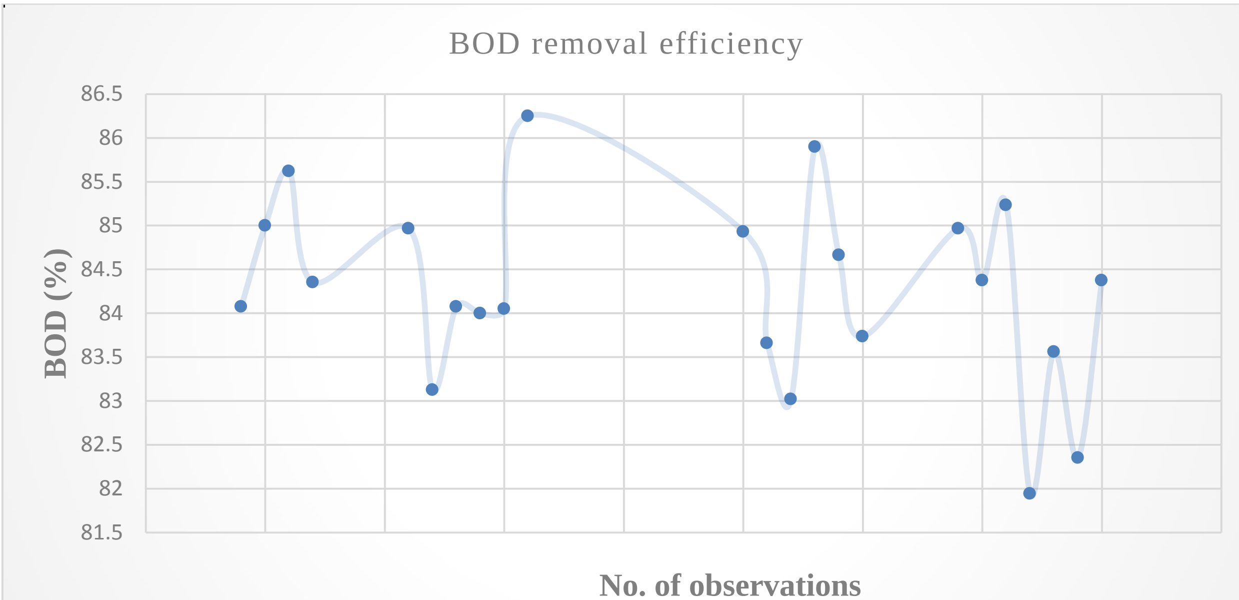


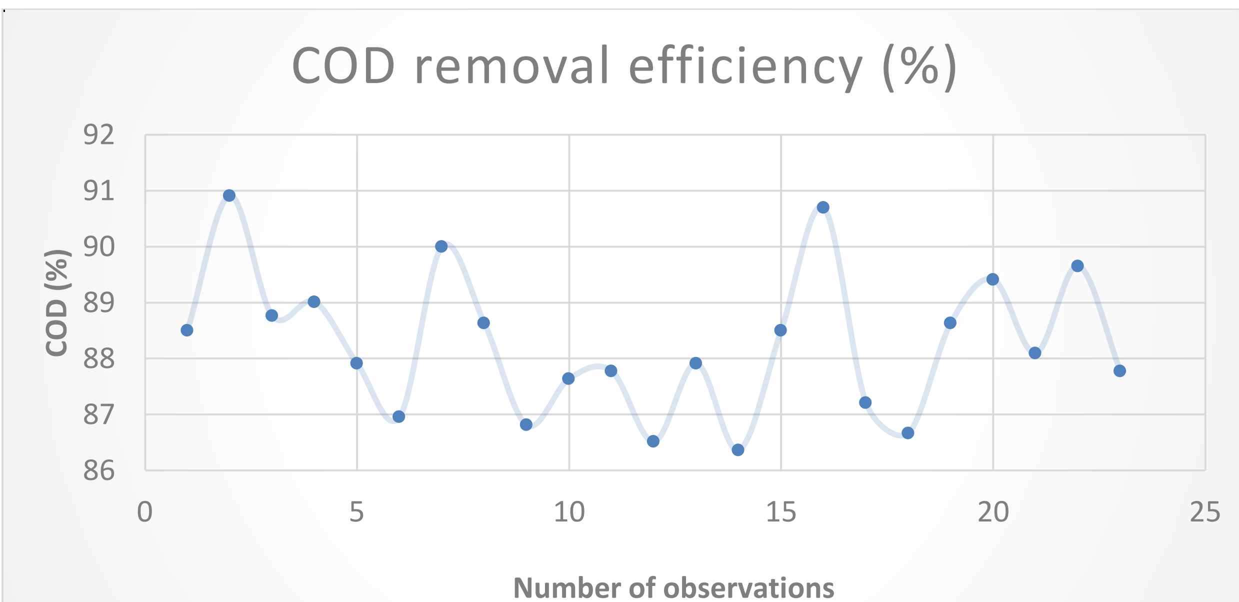
ANN architecture with the multilayer feed forward back propagation algorithm for modeling of parameters in STP Jajmau kanpur

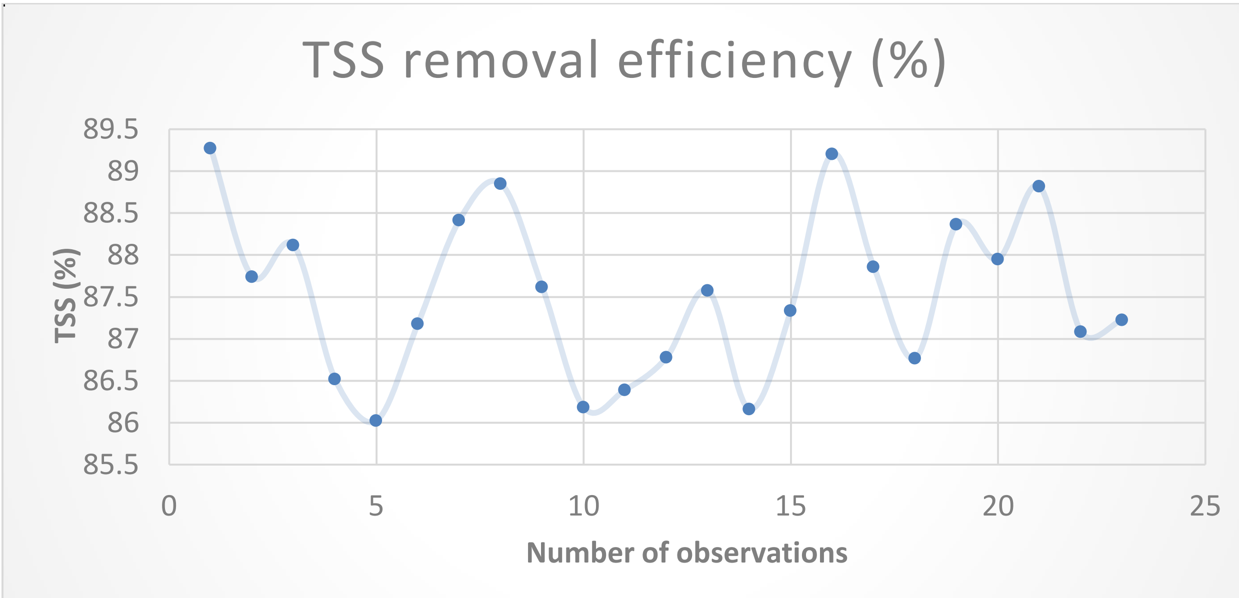
S. No.	Date	Influent			S. No.	Effluent		
		TSS (mg/ l)	BOD (mg/l)	COD (mg/l)		TSS (mg/ l)	BOD (mg/l)	COD (mg/l)
1.	01/06/2022	296	294	332	2.	160	80	268
3.	02/06/2022	301	300	344	4.	98	60	208
5.	03/06/2022	300	295	332	6.	76	66	160
7.	04/06/2022	301	308	340	8.	64	55	140
9.	05/06/2022	310	306	332	10.	62	46	128
11.	06/06/2022	311	305	348	12.	60	38	96
13.	07/06/2022	307	302	336	14.	58	30	92
15.	08/06/2022	309	302	340	16.	60	29	88
17.	09/06/2022	310	310	352	18.	56	28	76
19.	10/06/2022	302	300	328	20.	53	29	72
21.	11/06/2022	299	300	344	22.	51	30	76
23.	12/06/2022	305	301	336	24.	50	28	64
25.	13/06/2022	299	300	328	26.	52	24	64
27.	14/06/2022	308	302	348	28.	50	29	56
29.	15/06/2022	309	302	344	30.	49	24	50
31.	16/06/2022	300	298	328	32.	48	28	48
33.	17/06/2022	301	299	344	34.	45	26	46
35.	18/06/2022	290	300	336	36.	47	28	42
37.	19/06/2022	292	301	352	38.	43	27	44
39.	20/06/2022	304	310	346	40.	42	25	40
41.	21/06/2022	298	284	368	42.	40	24	36
43.	22/06/2022	310	310	324	44.	42	26	44
45.	23/06/2022	315	304	356	46.	39	28	40
47.	24/06/2022	312	303	340	48.	41	25	48
49.	25/06/2022	303	290	332	50.	39	27	42
51.	26/06/2022	300	310	328	52.	37	25	40
53.	27/06/2022	307	308	344	54.	42	26	46
55.	28/06/2022	304	310	328	56.	46	29	48
57.	29/06/2022	307	307	340	58.	40	30	44
59.	30/06/2022	312	130	336	60.	160	80	268

S. No.	Date	Influent			S. No.	Effluent		
		TSS (mg/ l)	BOD (mg/l)	COD (mg/l)		TSS (mg/ l)	BOD (mg/l)	COD (mg/l)
61.	1/07/2022	314	132	352	62.	24	35	40
63.	2/07/2022	316	133	340	64.	21	37	44
65.	3/07/2022	318	130	336	66.	20	35	36
67.	4/07/2022	320	136	348	68.	22	36	40
69.	5/07/2022	336	139	344	70.	19	34	36
71.	6/07/2022	229	142	332	72.	18	30	32
73.	7/07/2022	303	146	340	74.	20	33	40
75.	8/07/2022	306	153	352	76.	19	32	36
77.	9/07/2022	313	149	360	78.	21	35	44
79.	10/07/2022	316	146	348	80.	18	33	40
81.	11/07/2022	324	153	360	82.	19	32	36
83.	12/07/2022	328	160	374	84.	17	30	32
85.	13/07/2022	328	156	368	86.	20	35	40
87.	14/07/2022	309	159	376	88.	18	37	44
89.	15/07/2022	332	156	380	90.	19	34	36
91.	16/07/2022	340	149	372	92.	22	36	40
93.	17/07/2022	344	145	368	94.	18	30	32
95.	18/07/2022	335	150	360	96.	16	33	36
97.	19/07/2022	340	153	376	98.	17	35	40
99.	20/07/2022	340	160	360	100.	19	36	44
101.	21/07/2022	336	156	352	102.	22	34	36
103.	22/07/2022	348	159	364	104.	17	33	44
105.	23/07/2022	352	156	380	106.	20	34	40
107.	24/07/2022	316	155	352	108.	22	32	36
109.	25/07/2022	328	160	372	110.	24	30	44
111.	26/07/2022	344	153	356	112.	21	33	40
113.	27/07/2022	336	156	364	114.	23	32	44
115.	28/07/2022	332	159	378	116.	24	34	40
117.	29/07/2022	352	165	360	118.	25	36	44
119.	30/07/2022	328	163	380	120.	26	35	40

RESULT AND ANALYSIS







Conclusion

Performance evaluation has been given consideration for a waste water treatment facility that uses the biological treatment technology known as the Activated Sludge Process. Overall effectiveness of the current was acceptable. According to UP JAL NIGAM Data, BOD had a removal effectiveness of 94.84% and TSS had a removal efficiency of 90.75%. According to laboratory tests on samples, the removal effectiveness of BOD was 94.04% and that of TSS was 92.68% in winter season.

The calculated values for BOD and TSS for the summer were 93.08% and 88.68%, respectively. Additionally, the individual units are operating effectively, and their removal efficiencies are acceptable. The primary clarifier's removal efficiency for BOD and TSS are 57.38% and 53.42%, respectively.

The activated sludge plant's (Aeration tank + Secondary clarifier) BOD and TSS removal efficiency are 87.90% and 86.50%, respectively. According to the laboratory test sample, the elimination effectiveness of TSS was 90.61% and 93.42% for BOD, respectively. Thus, the plant and its various units are operating satisfactorily when the data from Authority and the laboratory sample are compared.

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