iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 11 **Issue:** VII **Month of publication:** July 2023

DOI: https://doi.org/10.22214/ijraset.2023.54525

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 11 Issue VII Jul 2023- Available at www.ijraset.com

To Examine Efficiency of Sequential Batch Reactor to Treat Domestic Wastewater

Siddhi Ramsnehi
Department of Environmental Science, Shree Ramkrishna Institute of computer Education and Applied Sciences, Gujarat, India

Abstract: ***The Study aims to examine operation effectiveness of Sequential Batch Reactor (SBR) of wastewater treatment plant in India. Sewage wastewater consists umpteen of chemical pollutants, which can be measured by chemical parameters such as Chemical Oxygen Demand (COD) and Total suspended Solid that, lead to Environmental pollution, if discharge without proper treatment. The correlation between COD and TSS-VSS removal was explored using the six on-plant SBRs, receiving medium strength domestic sewage. Samples were collected from Inlet channel and outlet channel of the Sequential Batch Reactor (SBR). Composite samples were collected for period of 15 Days and experiment of Chemical Oxygen Demand (COD) and Total Suspended Solid and Volatile Suspended Solid (TSS-VSS) were performed by Standard Methods mentioned in APHA. Result of experiments performed express that, average COD and TSS in Inlet wastewater (Influent) are 260 mg/L and 180 mg/L respectively and average COD and TSS of Effluent are 29.4mg/L and 6.2 mg/L respectively. Reduction in COD and TSS is 85-87 % and 85-90% respectively. This preliminary study shows that SBR are potential, a feasible for treatment of domestic wastewater.***

Keyword: ***Chemical Oxygen Demand, Total Suspended Solid, Volatile Suspended Solids, Sequential Batch Reactor, Influent, Effluent***

I. INTRODUCTION

Complex Environmental Problems are created by combine effect of industrialization, urbanisation, climate change, Green House effect and so on. These challenges are getting worse, with rising population especially in the countries such as India. Waste water treatment characterises major solution and reduces number of pollutants disposed in water body.

Characteristics of sewage is differed from place to place and time to time. Sewage consisted in various kind of pollutants, that can be classified as organic or inorganic pollutants.

An EPA report 1983, encapsulate by stating that “the SBR is no more than an activated sludge system which operates in time rather than in space” (ETB, 1999) . Major difference in these technologies is that SBR carry out equalization, biological treatment, and secondary clarification in a single tank using time base sequence. In the process including sedimentary remove (Suspended solids), Biodegradation, biosolid separation are archive in the same reactor but with different time period.

The main process of Sequential Batch Reactor divided into three parts; Fill & aeration, Settling and Decanting. During the fill & aeration period, gate of Inlet channel open for fixed time and water enter in the selector zone of SBR tank. Aeration through diffuser with help of blower from bottom of reaction tank. During the fixed fill & aeration time, oxygen is bubbled through the wastewater to reduces biochemical and chemical oxygen demand. The floc foaming microorganism uses pollutants as nutrition and remove it from the waste water and that creates activated sludge.

During the settling time bubbling of air and filling of wastewater is stopped and activated sludge is allowed to settles in the quiescent condition. In the normal condition, sludge settle down and get separate from the clear water.

In the end of Settling time the decanter weir moves in lower direction and touch water surface. Then Decanting start, the clear supernatant from SBR tank is removed with the help of decanter. After Decanting the weir return to it’s initial (Parked) Position. By this way the whole batch of treated influent gets treated in just one tank.

Time of each Cycle: (180 minutes)
Fill and aeration - 0 minutes
Settling - 30 minutes
Decanting - 60 minutes

ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 11 Issue VII Jul 2023- Available at www.ijraset.com

II. COLLECTION OF SAMPLES

Wastewater samples were collected on daily basis from inlet and outlet of the STP in white plastic containers that were prior cleaned with metal-free soap, rinsed repeatedly with distilled water, then soaked in 10% nitric acid for 24 h and finally rinsed with ultrapure water. All water samples were stored in insulated cooler containing ice and taken on the same day to laboratory and stored at 4 °C until processing and analysis (APHA 2005). pH was determined by pH meter, Chemical oxygen demand (COD) was determined using reflux method and Total Suspended solids and volatile suspended solids were determined by gravimetric method.

For the research purpose composite sample of effluent and effluent were collected for space of 15 days. 100 mL sample were collected in each cycle; thus 800 mL sample was collected for 8 cycle per day.

III. METHOD OF DETERMINATION

The inoculum of the three reactors studied was secondary aerobic sludge from the wastewater treatment plant (WWTP) of Surat (India). The reactors were fed with the raw domestic wastewater from the city of Surat (India). The analysis of the main parameters of the influent feeding water the chemical oxygen demand and total-volatile suspended solids of plant are given in table 1 and effluent concentration in table 2, Which were determined according to standard methods suggested by the *Standard Methods for the Examination of Water and Wastewater* manual (2005). ph was determined by pH meter, Chemical oxygen demand (COD) was determined using reflux method and Total Suspended solids and volatile suspended solids were determined by gravimetric method of volatilization.

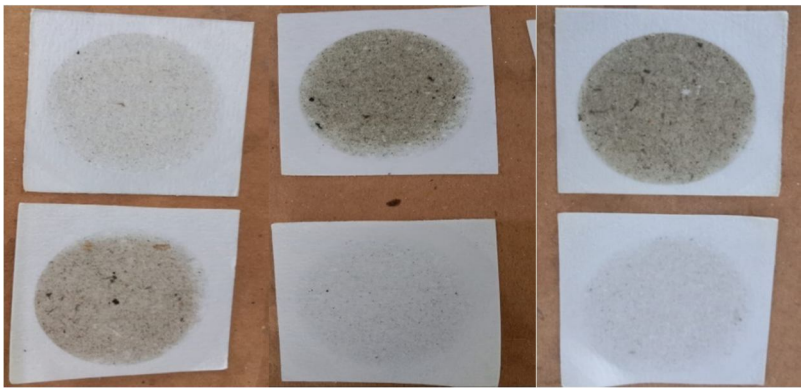
(Table-1 – Influent parameters studied from date12december 2022 to 26 December 2022)

Sr No.	Date	COD		TSS		VSS		Temperature
		SAMPLE (mL)	mg/L	SAMPLE (mL)	mg/L	SAMPLE (mL)	mg/L	°C
1	12/10/2022	5	358	50	150	50	120	6.95
2	13/10/2022	5	273	50	198	50	164	7.10
3	14/10/2022	5	206	50	204	50	174	6.90
4	15/10/2022	5	261	50	174	50	158	7.12
5	16/10/2022	5	312	50	240	50	196	7.20
6	17/10/2022	5	254	50	130	50	97	7.23
7	18/10/2022	5	255	50	132	50	110	7.25
8	19/10/2022	5	290	50	128	50	101	7.10
9	20/10/2022	5	213	50	176	50	154	6.99
10	21/10/2022	5	306	50	206	50	132	6.92
11	22/10/2022	5	317	50	167	50	181	7.01
12	23/10/2022	5	216	50	198	50	161	7.00
13	24/10/2022	5	322	50	205	50	176	7.19
14	25/10/2022	5	269	50	230	50	195	7.32
15	26/10/2022	5	254	50	169	50	129	7.30

(Table-2– Effluent parameters studied from date12december 2022 to 26 December 2022)

Sr No.	Date	COD		TSS		Temperature
		SAMPLE (mL)	mg/L	SAMPLE (mL)	mg/L	°C
1	12/10/2022	5	40	500	8	7.12
2	13/10/2022	5	32	500	12	7.23
3	14/10/2022	5	33	500	16	7.09
4	15/10/2022	5	35	500	10	7.26
5	16/10/2022	5	42	500	9	7.35
6	17/10/2022	5	32	500	11	7.30
7	18/10/2022	5	33	500	13	7.36

8	19/10/2022	5	29	500	14	7.20
9	20/10/2022	5	30	500	11	7.19
10	21/10/2022	5	28	500	12	7.09
11	22/10/2022	5	33	500	15	7.16
12	23/10/2022	5	36	500	11	7.15
13	24/10/2022	5	37	500	16	7.28
14	25/10/2022	5	39	500	12	7.40
15	26/10/2022	5	38	500	13	7.42

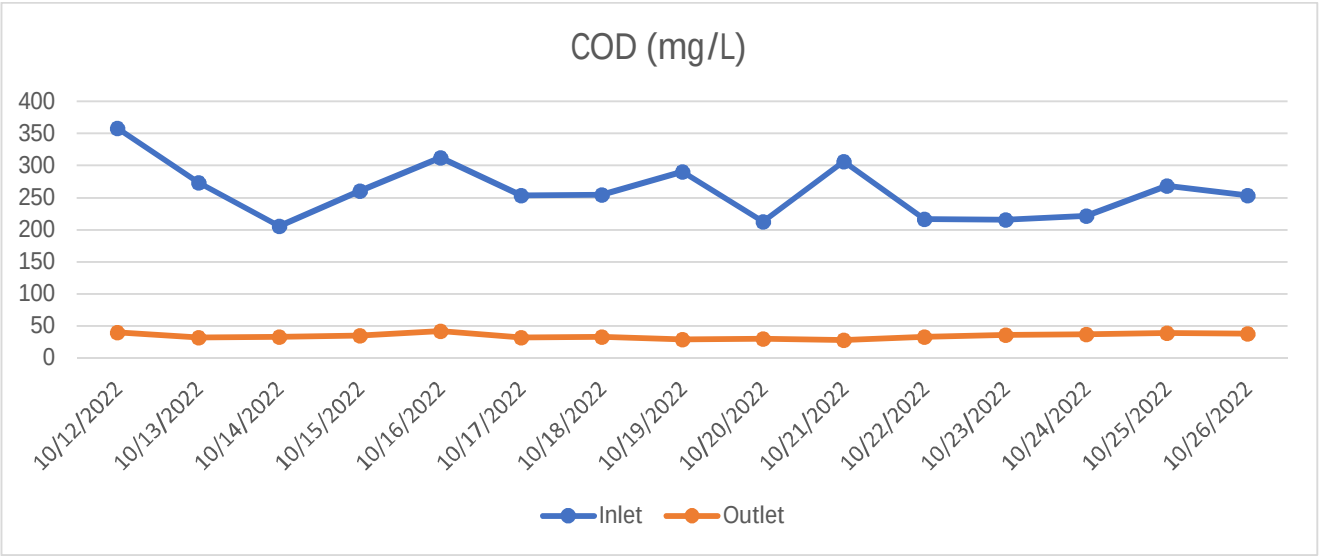


(a) (b) (c)

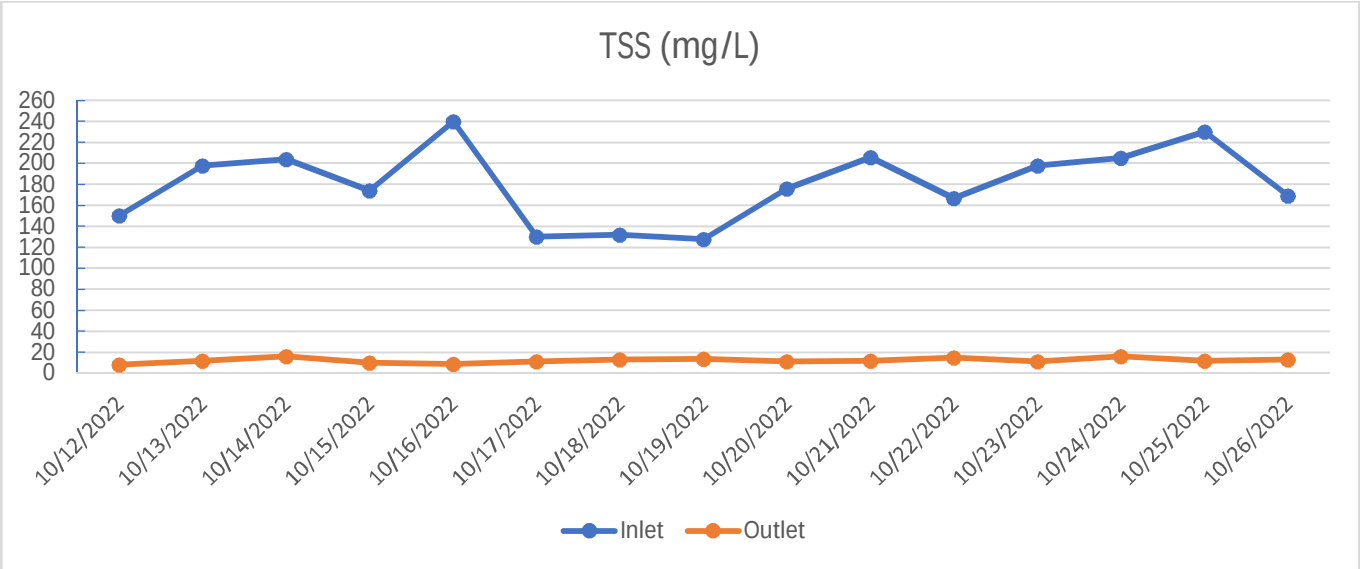
(FIGURE 1: TSS-VSS Filter paper (5.1*5.5cm/Whatman 45 µm) for influent and effluent wastewater of SBR of date 14/10/2022, 18/10/2022, 23/10/2022 respectively)

IV. RESULTS

The umpteen of samples for suspended particles and chemicals present in wastewater were studied. In figure 2, representing COD concentration over-time, average values in the feed water of 260 mg/L can be observed, while in the effluent these were of 35 mg/L, which indicates reduction in COD value after treatment. In figure 3, representing TSS-VSS concentration over-time, average values in the feed water of 180 mg/L can be observed, while in the effluent these were observed 12.2 mg/L. COD reduced in process of Sequential Batch Reactor is 80-85% while Reduction in TSS was 85-90 %. Figure 2 and 3 demonstrates efficiency of Sequential batch reactor to remove different pollutants in form of Chemical Oxygen Demand and Total solids.



(FIGURE 2: blue dots indicate COD in mg/L for period of 15 days of influent wastewater and red dots indicates COD in mg/L for period of 15 days of effluent wastewater)



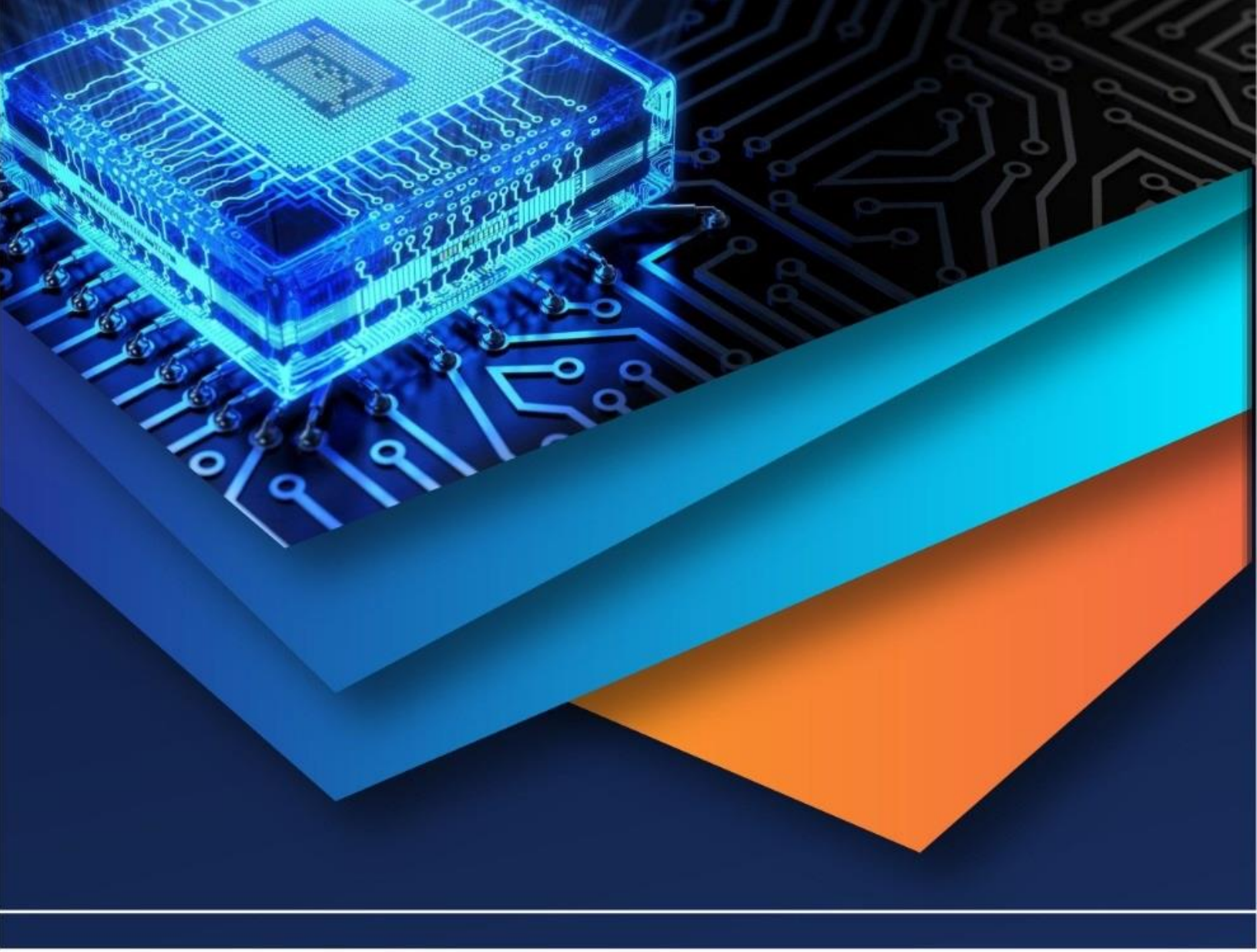
(FIGURE 3: blue dots indicate TSS in mg/L for period of 15 days of influent wastewater and red dots indicates TSS in mg/L for period of 15 days of effluent wastewater)

V. CONCLUSION

Study revealed that SBR-based treatment plant significantly removed the disagreeable physiochemical properties of wastewater before its discharge into water body. Optimum concentration could be removed if all operational conditions were well maintained.

REFERENCES

[1] Wastewater Technology Fact Sheet Sequencing Batch Reactors, EBT, Washington DC https://www3.epa.gov/npdes/pubs/sbr_new.pdf
[2] (P1) https://kyocp.wordpress.com/2016/04/08/sequencing-batch-reactor-process-gaining-popularity
[3] APHA, AWWA & WEF 2005 Standard Methods for the Examination of Water and Wastewater, 21st edition American Public Health Association/American Water Works Association/Water Environment Federation, Washington, DC, USA



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY