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Analysis on Plant Monitoring Parameters of Sewage Treatment Plant

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Abstract

Operating data from Sewage treatment plants has generated some useful operational control strategies. Some of these control methods include: Sludge volume index, sludge retention time, sludge age, Food/Mass ratio and MLSS. Sludge Volume Index is an indication of the sludge settle ability in the final clarifier. It is a useful test that indicates changes in the sludge settling characteristics and quality. Sludge Age-The concentration of the activated sludge solids and the condition of those biological solids determines the effectiveness of an activated sludge process. Too few or too many organisms in a system will cause operational control problems, reducing treatment plant efficiency and causing an added load on the receiving waters. The Food/Mass or the Food/Microorganism ratio commonly referred to as F/M is based upon the ratio of food fed to the microorganisms each day to the mass of microorganisms held under aeration. Analysis on characteristics and design parameters of conventional activated sludge system and also calculate the production of gas by plant as well as variation of plant monitoring parameters which will increase the efficiency of plant by controlling them.

1. Sources of Samples:-

- Raw Sewage From Inlet
- Aeration Tank

- Final Settling Tank(FST)

Characterstics and Design Parameters of Conventional Activated Sludge System

MLSS	F/M	SRT	BOD REMOVAL %
1500 TO 3000	0.3 TO 0.4	5 TO 8	85 TO 92

2. Results

Following are the results obtained for each sample in the given week.

Date	pH	Alk.	Chl.	OA	Conductivity	TDS	TSS	TS	BOD	COD	NH_4	PO_4	Flow	BOD/COD
22-Jul-13	7.1	383	405	139	614	310	364	674	220	434	65	10.2	12.6	0.51
23-Jul-13	7.2	230	326	116	642	320	240	560	198	340	27	4.3	13.0	0.58
25-Jul-13	7.1	263	382	84	704	350	219	569	188	497	58	9.9	12.9	0.38
26-Jul-13	7.1	422	454	62	760	380	280	660	210	424	26	4.7	14.0	0.50
27-Jul-13	7.1	442	362	94	940	470	268	738	204	398	45	6.9	13.5	0.51
29-Jul-13	7.2	346	287	79	590	300	230	530	208	412	69	4.8	13.2	0.50
AVERAGE	7.1	347.7	369.3	95.7	708.3	355	267	622	205	418	48	6.8	13.2	0.50

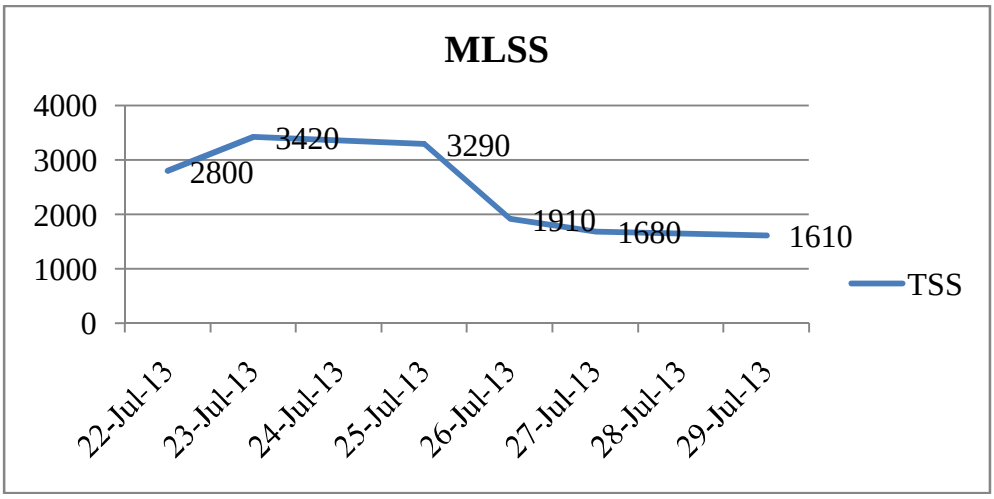
3. Observation:

Date	**Ph Value**	**T.Alk**	**DO**	**TDS**	**TSS**	**TS**	**% Settelement**	**SVI**	**Flow**	**F/M**	**S.AGE**	**SRT**
22-Jul-13	7.2	326	0.6	310	2800	3110	11	39	12.6	0.4	8	11
23-Jul-13	7.02	364	0.4	410	3420	3830	22	64	13.0	0.3	14	6
25-Jul-13	7.3	368	0.4	350	3290	3540	20	61	12.9	0.3	15	7
26-Jul-13	7.3	385	0.6	360	1910	2270	10	52	14.0	0.5	7	7

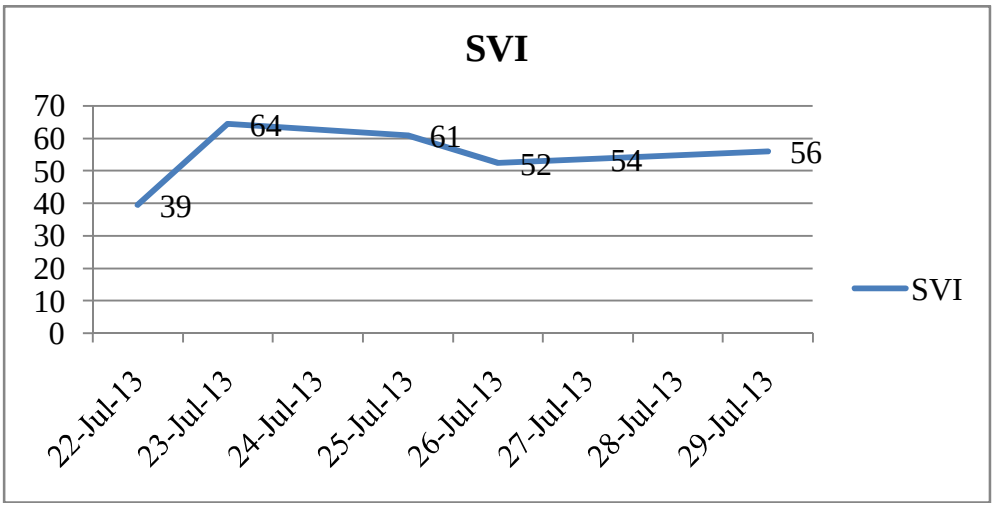
27-Jul-13	7.3	294	0.8	380	1680	3060	9	54	13.5	0.6	6`	7
29-Jul-13	7.2	479	0.4	360	1610	1970	9	56	13.2	0.6	7	7

4. Graphical Representation and Observations:

4.1 Variation of MLSS:

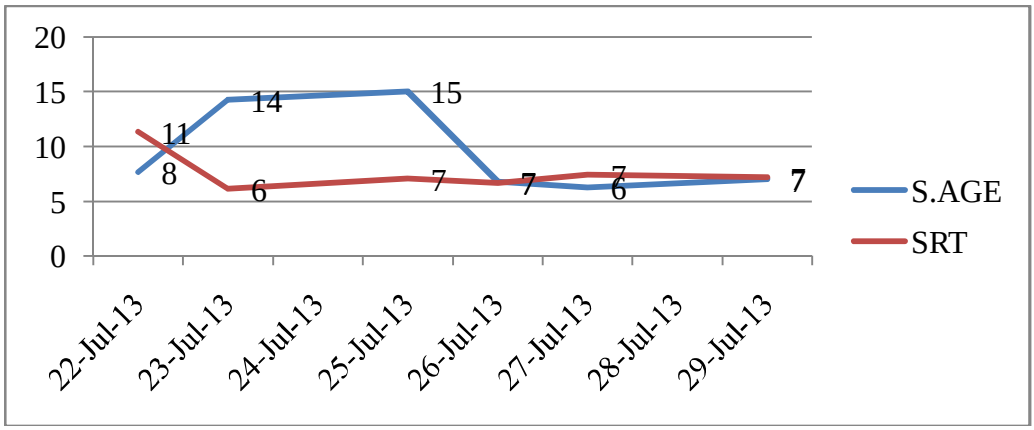


Variation of SVI



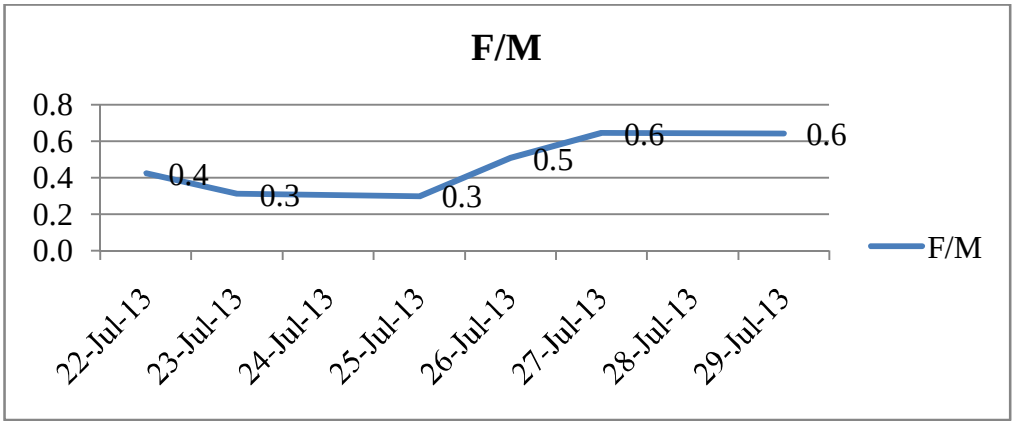
There is initial fluctuation of SVI which stabilizes around 55ml/g towards the end of the week.

Variation of SRT & Sludge Age



Sludge age has been around 6-7 days with few uncontrolled peaks due to operational loopholes.

Variation of F/M

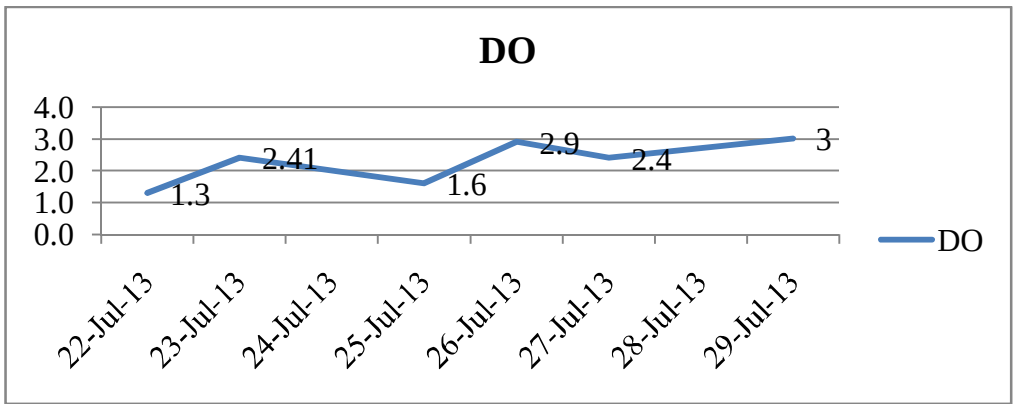


Final Settling Tank

Date	Ph Value	T. Alk	Chl.	DO	OA	Conductivity	TDS	TSS	TS	BOD	COD	Amm.	PO_4	BOD/ COD
22-Jul-13	7.34	283	216	1.3	30	615	310	32	342	28.0	69	28	0.8	0.4058
23-Jul-13	7.14	239	209	2.41	32	966	480	39	519	29.0	66	19.3	1.2	0.4394
25-Jul-13	7.23	344	273	1.6	26	710	340	31	371	25	64.0	26	3.2	0.3906
26-Jul-13	7.32	326	380	2.9	39	731	370	42	412	34	78	19.4	0.5	0.4359

27-Jul-13	7.34	340	280	2.4	28	790	400	36	436	28.0	65	24	3.8	0.4308
29-Jul-13	7	393	246	3	25	733	370	32	402	31	72	29	1.4	0.43

Variation of Dissolved Oxygen



DO is seen to improve at the end of the week.

5. Plant Efficiency

Date	BOD IN	BOD OUT	% Reduction
22-Jul-13	220	28.0	87.27
23-Jul-13	198	29.0	85.35
25-Jul-13	188	25	86.70
26-Jul-13	210	34	83.81
27-Jul-13	204	28.0	86.27
29-Jul-13	208	31.0	85.10
AVERAGE	**204.67**	**29.17**	**85.75**

6. Observation:

The Plant efficiency was found to be 85.75% in terms of BOD removal and is an acceptable value in terms of DPCC norms.

7. Conclusion:

- BOD/COD ratio falls below the permissible limit of 0.5 indicating the inflow of industrial waste in the stream.

- BOD (Biochemical oxyen demand) - The amount of oxygen required by micro-organisms to degrade the organic matter and can be calculated as BOD of diluted and Undiluted samples. The BOD values
- Depends on the dissolved organic matter in the waste water samples. More the organic matter more the demand of oxygen by microbes to degrade it.
- COD (Chemical Oxygen Demand) - In this process , Use of strong chemical agent (such as potassium dichromate) is done to degrade both the organic as well as inorganic matter present in the wastewater samples. Also, COD values are always higher than the BOD values. Because COD includes both biodegradable and non-biodegradable substances whereas BOD contains only bio-degradable.
- Sludge Volume Index (SVI) is an indication of the sludge settleability in the final clarifier. It is a useful test that indicates changes in the sludge settling characteristics and quality. By definition, the SVI is the volume of settled sludge in millliliters occupied by 1 gram of dry sludge solids after 30 minutes of settling in a 1,000 mL graduated cylinder or a settleometer. A liter of mix liquor sample is collected at or near the outlet of the aeration tank, settled for 30 minutes in a 1 liter graduated cylinder, and the volume occupied by the sludge is reported in milliliters. The common range for an SVI at a conventional activated sludge plant should be between 50 and 150. Optimum SVI must be determined for each experimentally.
- The above figure shows that MLSS remains in range of 1500-3500 which is slightly above the permissible value given In table 3.For typical domestic sewage, the MLSS value of 2000-3000 mg/l if conventional plug flow type aeration system is provided, or 3000-5000 mg/l for completely mixed types. Considerations which govern the upper limit are: initial and running cost of sludge recirculation system to maintain a high value of MLSS, limitations of oxygen transfer equipment to supply oxygen at required rate in small reactor volume, increased solids loading on secondary clarifier which may necessitate a larger surface area, design criteria for the tank and minimum HRT for the aeration tank.
- F/M ratio remains within the range initially but increases beyond it at the end of the week due to increase in the BOD load. So return sludge can be altered to bring it within the range.The Food/Mass or the Food/Microorganism ratio commonly referred to as F/M is based upon the ratio of food fed to the microorganisms each day to the mass of microorganisms held under aeration. It is a simple calculation, using the results from the influent BOD test to the aerator and the mixed liquor suspended solids test. Using the COD test may be preferred because the results are available sooner than the five day BOD. Common ranges for F/M for a conventional activated sludge plant are from 0.15 to 0.5.A disadvantage of using the constant flow approach is that the F/M is constantly changing.

- The range of F/M fluctuation due to the effect of short term variation in the MLSS (because of hydraulic loading) is generally small enough so that no significant problems arise due to using this approach. The most significant disadvantage of the second approach is that the clarifier is subjected to maximum solids loading when the clarifier contains the maximum amount of sludge. This may result in solids washout with the effluent. In general, it appears that most activated sludge operations perform well and require less attention when the constant RAS flow rate approach is used. Activated sludge plants with flows of 10 mgd.

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