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## Anaerobic-Aerobic Activated Sludge Treatment to Dairy Effluent.

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### ABSTRACT

Human being have entered in twenty-first century along with the rapid industrialization which is progressive at breakneck speed of pollution. While we consistently sought the path to industrialization, we over exploited our natural resources and generated so much waste that its disposal became harmful to our environment and have guided new eras of research. The Dairy effluent direct or indirect disposal into the natural water bodies generates Eutrophication, serious health effects on aquatic animals and human health also. So resolves this problem by efficient treatment using Anaerobic-aerobic Activated Sludge Treatment for the Dairy effluent. The microbes of endogenous origin treat the Dairy effluent and show the reduction of the BOD, COD, TS, Sulphate, Chloride are 85%, 88%, 96%, 79%, 92% respectively, which relatively greater reduction percentage which is very higher percentage of reduction and covers the safe disposal standers of Dairy effluent for irrigation purpose.

**Keywords:** Dairy Effluent; Anaerobic-aerobic Activated sludge, physicochemical analysis.

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## INTRODUCTION

India has achieved spectacular growth in Dairy industry to reach a level of million tones milk and milk products .Dairy effluent management is wriest problem is larger due to expand the demand to absorb incremental production of milk products, so all milk is processed industrially. So With the exponential increase in the number of industries, there has been a substantial increase in generation of industrial wastewater, which is discharged either into open land or nearby aquatic ecosystems [1]. Due to direct disposal of dairy effluent discharged in to streams without treatment result, in rapid depletion of dissolved oxygen (DO) and encourage growth of sewage fungi to cover the entire bottom of the stream i.e. Eutrophication [2] and effluent rich in organic matter and thus leading to creation of odorous and high COD containing water [3]. The dairy industry on an average has been reported to generate 6-10 liters of waste water per liter of the milk processed [4]. Quality of effluent also plays an important role in design and construction of various treatment units so for that purpose effluent collected and performs physicochemical analysis and endogenous culture isolation for Anaerobic-aerobic Activated Sludge Treatment. Then efficiency of treatment checked by performing physicochemical characterization using parameters TS (Total Solids), BOD (Biological Oxygen Demand), COD (Chemical Oxygen Demand), Chloride and Sulphate.

## MATERIAL AND METHOD:

Scientific Research Study Performed in Definite and Proper Design and following are the steps in detail to carry out the current study.

### Collection and physicochemical analysis of Dairy Effluent

The effluent samples were collected from" Shivamrut Dairy" 75<sup>o</sup> East and 17<sup>o</sup> North and near about 25 km. away from the National Highway number nine. Asia's number one Gram Panchayat Akluj Vijaynagar (Vizori) Tal: Malshiras, Dist: Solapur. Maharashtra (India). The effluent sample was collected in duplicate by composite sampling at the time 9, 12, 3, 6 o'clock in a clean sterile plastic container and stored at 4°C until the analysis was carried out according to the methods of APHA [5]. The flow rate of effluent average daily is 14 MGD. The samples were analyzed physically for parameters such as pH, DO (dissolved Oxygen), TDS (Total dissolved Solids), TS (Total Solids), TSS (Total Suspended Solids), BOD (Biological Oxygen Demand), COD (Chemical Oxygen Demand), chloride, Sulphate, oil and Grease [5,6]. The pH of samples was determined by pH meter and temperature in Degree Celsius on scientific thermometer. TS, TDS and TSS estimated by gravimetric method. Chloride, DO determined by titration method. Chemical oxygen Demand (COD) analyzed and Biological Oxygen Demand (BOD) analyses form incubation at 20°C for 5 days.

### Isolation of bacteria and Anaerobic-aerobic Activated Sludge Treatment to Dairy Effluent:

Isolation of bacteria from dairy effluent which previously analyzed by physicochemical parameters. The Selective dilutions were spread on nutrient agar and incubated for 24 hours at room temperature and randomly colonies are selected for the characterized (cultural, morphological and Biochemical) and identified according to Bergey's Manual of Determinative Bacteriology[7].These isolated organisms which is used in Activated Sludge Treatment, before treatment the Dairy Effluent samples were stabilize in stabilization tank (10 liter plastic) to remove oil and grease using Grease traps and screens and 700 ml broth culture of isolate with density 10<sup>8</sup> organism/ml is mixed with 7000 ml of Dairy effluent in 10 liter plastic container as reactor[8]. Diammonium phosphate (DAP) and urea is used as additional nitrogen source, anaerobic conditions for one day (24hrs) under by total sealing with Plaster of Paris (POP) and then followed by Aerobic Activated sludge treatment using small mechanical aerator with capacity 2 lb. O<sub>2</sub>/ hp-hr and for aerobic conditions and then physicochemical parameters are analyzed. To maintain the flow rate 1ml/min, the hydraulic retention time (HRT) of Activated sludge treatment was 24 hrs., p<sup>H</sup> (7.31 ± 0.10)and temperature (26 ± 5°C) were maintained during the anaerobic digestion while in aerobic digestion sludge volume index (SVI) and mix liquor suspended solid (MLSS) were maintained to an average value of 64 ± 2.6 ml/g (61.1 ± 2.6 mL/g ) and 3 ± 2.5 g/L (2.72 g/L ) respectively.

**RESULTS AND DISCUSSION**

All the research work carried out in every day of year Jan- May 2015 then monthly average converted into yearly and all the data represented in this paper briefly arranged. The Current study site is Shivamrut Dairy, Solapur(India) with total Milk and Milk Products processing about 41851986 liter/year and each and every one liter milk processing required 6-10 liters water [4] so total effluent 16,74,07,944 ( $\pm 34123204$ ) liter/year effluent equal to about 643876 per person per day water requirement(per person/Day water requirement is about 26 liter).

**Physicochemical analysis of Dairy Effluent**

The Dairy effluent collected by composite sampling in five replicates and mean values of physicochemical parameters analyzed like values of physical characteristics such as Temp., pH, T.D.S, T.S.S. and T.S. are 32.47°C, 9.97, 1539mg/L, 232.3mg/L, 1766mg/L respectively and mean values of chemical characteristics such as D.O. B.O.D., C.O.D., Sulphate, oil & Grease and chloride are 1.35mg/L, 743mg/L, 1489mg/L, 1217mg/L, 12.67mg/L and 253.2mg/L, respectively and represented in Table 1. These values are greater than Standard limits for Agriculture Irrigation given by the Maharashtra pollution control board (India). A research study from Department of Zoology and Environmental Science, Gurukula Kangri University, Haridwar (Uttarakhand), India Also comparatively about similar record like our analysis mean values of physical characteristics such as Temp., pH, T.D.S., T.S.S. and T.S. are 34°C, 9.8, 1222mg/L, 290mg/L, 1837mg/L respectively and mean values of chemical characteristics such as D.O.B.O.D., C.O.D., Sulphate, oil & Grease and chloride are 1.2 mg/L, 650 mg/L, 1448 mg/L, 223mg/L, 2 mg/L and 153 mg/L, respectively by Vinod Kumar and A.K. Chopra in 2009[9].In fig.1 represents the mean valve of parameter analysis of Shivamrut Dairy Effluent of Bar graph with standard percent error bar.

**Isolation of bacteria and Anaerobic-aerobic Activated Sludge Treatment to Dairy Effluent**

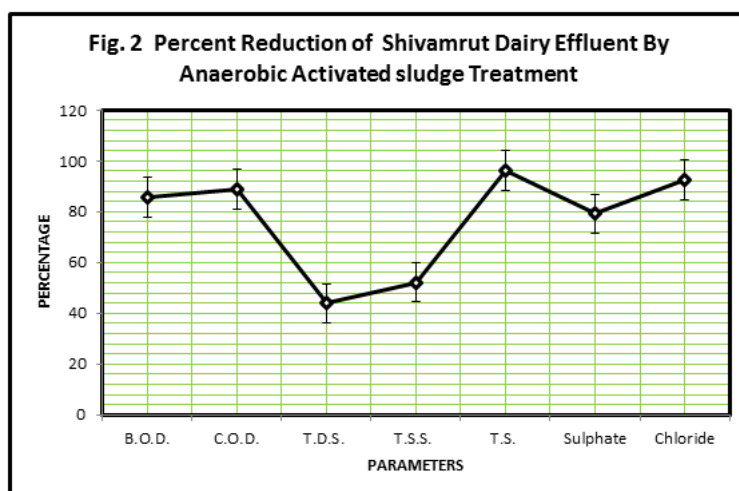
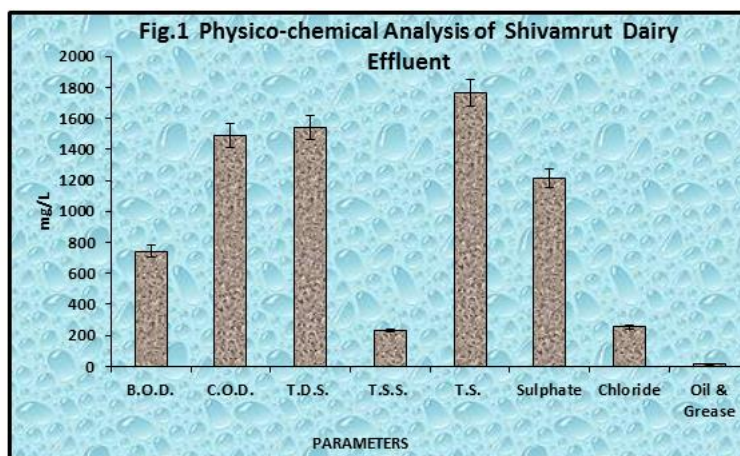
From the dairy effluent endogenous cultures are isolated and perform their cultural and biochemical characterization results compare with Bergey’s Manual of Determinative Bacteriology [7] then isolates are identified like *Bacillus subtilis*, *Staphylococcus aureus*, *Arthrobacter globiforms* and *Zoogloea ramigera* etc.. These organism as consortiums treat Shivamrut Dairy Effluent during the Jan-Apr 2015 and mean valves are BOD, COD, T.D.S., T.S.S., T.S., Sulphate and Chloride 85.60%, 88.89%, 43.96%, 52.24%, 96.20%, 79.16%, 92.52% respectively which is represented in Table 2. The line graph with percent error bar of Anaerobic-aerobic activated Sludge Treatment plotted in Fig. 2. A research paper of Tawfik. *et.al.* [10] recommended to use treatment of a combined dairy and domestic wastewater in an up-flow anaerobic sludge blanket reactor followed by activated sludge produce a good effluent quality complying with the standards for discharge into agricultural drains.

**Table 1: Physico-chemical Analysis of Shivamrut Dairy Effluent.**

Collection Year Parameter	Jan.	Feb.	Mar.	Apr.	Mean	Variance	SD( $\sigma$ )	SD Error
Temp. (°C)	29.20	32.10	36.10	36.50	32.47	12.00	3.46	2.00
p <sup>H</sup>	9.90	10.00	10.00	10.00	9.97	0.00	0.06	0.03
D.O. (mg/L)	1.36	1.42	1.28	1.26	1.35	0.00	0.07	0.04
B.O.D. (mg/L)	842	788	600	608	743	16137.33	127.03	73.34
C.O.D. (mg/L)	1468	1501	1500	1488	1489	352.33	18.77	10.84
T.D.S. (mg/L)	1402	1600	1616	1820	1539	14209.33	119.20	68.82
T.S.S. (mg/L)	298	199.0	200.0	260	232.3	3234.33	56.87	32.83
T.S. (mg/L)	1700	1799	1800	2180	1766	3300.33	57.45	33.17
Sulphate (mg/L)	1222	1226	1204	1224	1217	137.33	11.72	6.77
Chloride (mg/L)	256	240.8	262.6	262.4	253.2	126.17	11.23	6.49
Oil & Grease (mg/L)	12.80	12.40	12.80	12.60	12.67	0.05	0.23	0.13

Table 2: Anaerobic-aerobic Activated Sludge Treatment of Shivamrut Dairy Effluent

Parameters collection date	B.O.D. (%)	C.O.D (%)	T.D.S. (%)	T.S.S. (%)	T.S. (%)	Sulphate (%)	Chloride (%)
Jan-15	47.39	13.74	23.31	61.73	85.04	53.02	83.06
Feb-15	44.44	15.53	24.27	89.29	113.56	48.69	83.61
Mar-15	52.08	15.08	14.84	69.93	84.77	62.58	82.37
Apr-15	40.98	13.91	8.73	55.56	64.28	50.43	76.57
Mean	85.607	88.892	43.962	52.245	96.2075	79.1675	92.52



**CONCLUSION**

- Dairy effluent nature is Slightly alkaline, High Temperature, unpleasant rancid odours, Bitter or medicinal taste, Hard, scaly deposits etc. shows adverse effect like affects fish growth, reproduction and immunity in water bodies, harmful effect on beneficial microorganism’s growth and on plant growth due to decrease micronutrients solubility, serious problems of health and hygiene, eutrophication and adhering to aquatic weeds leading to ugly sight, due to anaerobic decomposition Fly breeding on the sludge rafts floated etc. when the effluent dispose without treatment.
- Anaerobic-Aerobic Activated Sludge reduces the BOD, COD, TS, Sulphate, Chloride are 85%, 88%, 96%, 79%, 92% respectively, which relatively greater reduction percentage which is very higher percentage of reduction and covers the safe disposal standers of Dairy effluent for irrigation purpose. But further study is also necessary to be carried out the research work for any harmful effect of this treated effluent on the environment.

- So this treated effluent is used for irrigation purpose and thus the waste water is recycled, resolve the water pollution problem also the serious problems of health and hygiene.

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