Anaerobic Treatment of Dairy wastewater by UASB reactor Integrated with Advanced Oxidation process

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***Abstract*- In recent years we have been moving towards more and more industrial development. Dairy industry extremely polluting food industry as the Dairy industry forms strong waste water which is describe by high BOD, COD, Nutrients, inorganic content and biodegradable material that can disrupt aquatic and terrestrial ecosystems. The waste water coming out from this highly processed industrial processes which are rotten in nature. Hence treatment of such waste water is essential before disposal in to river, stream etc. The UASB study gives the approximate idea about the usability and function of the treatment of the waste water of industry by UASB method. The Up flow Anaerobic Sludge Blanket process is one of the recent developments in field of anaerobic treatment. The UASB process is one of the most beneficial & efficient anaerobic treatment. In order to upgrade the quality of an aerobically treated effluent to a level recommended for irrigation, integration of a UASB reactor with AOPs (advanced oxidation processes) could be a better option for almost complete colour, COD removal, and disinfection of pathogens.**

***Index Terms*- COD, BOD, Hydrogen peroxide, advanced oxidation processes, dairy wastewater.**

I. INTRODUCTION

Milk may be defined as the whole, fresh, clean, lacteal secretion obtained by the healthy milk animals. Dairy industry contains high amount of organic constituents. This may result in affecting the quality of aquatic and human life. There are large numbers of milk dairies in India, which play a key role in the economy of our nation.[1] These milk dairies generate huge quantity of dairy waste water which carries a high organic load.

The wastewater generated by the dairy industries includes:

- Washing and cleaning operations in the tanks, trunks, pipes etc.
- Spillage by leaks and overflow.
- Processing loss involves, discharge from bottles and washer, sludge discharge from clarifiers, splashing and container breakage in automatic packing equipment. and, evaporator entrainment
- Spoiled products, returned products or by products
- Detergent and other compound used in washing and sanitizing solution that are discharge as waste.
- Entrainment of lubricants from conveyers, stackers and other equipment. Milk products are some time deliberately wasted sometime whey and butter [2]

II.OBJECTIVES

In these works following objectives have been set to study the Anaerobic Treatment of Dairy wastewater by UASB reactor Integrated with chemical Oxidation process

- To study the present waste water treatment Process in Dairy
- To study physico-chemical characteristics of dairy waste water
- Selection of the Post treatment methods for Removal of BOD, COD, P from effluent
- To study the Advanced oxidation process for dairy waste water.

III. ADVANCED OXIDATION PROCESS

For the treatment of wastewater, a group of chemical oxidative technologies classified as advanced

oxidation processes (AOPs) has garnered a significant level of interest academically and industrially over the last three decades [3]. All Advanced oxidation process are characterized by the production of highly non-reactive and reactive hydroxyl radicals, which are the strongest oxidants in an aqueous medium.[4]Hydrogen peroxide (H2O2) is a strong oxidant and its application in the treatment of various inorganic and organic pollutants is well established. [5]The molecules of H2O2 consist of two hydrogen molecules and two oxygen molecules

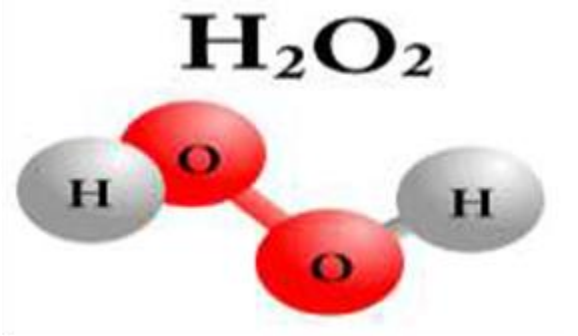

Fig. 1 Molecular Arrangement of Hydrogen Peroxide

IV. MATERIAL AND METHODS

The treatment given to waste water in dairy is UASB, In the UASB (Up flow Anaerobic Sludge Blanket) reactors, the COD removal and production of Biogas take place.

The influent enters at the bottom via special distribution system which ensures good contact between the influent and the biomass. This system has to be flushed regularly. As the influent flows up, organic matter is converted to methane, carbon dioxide. Three mechanisms occurring

1) Hydrolysis process
2) Acidogenesis process
3) Methanogenesis process

A. Experimental setup

- AOP is used for the treatment of dairy effluents after UASB process. The Reservoir is made up of glass with a total working volume of 55L.
- Six beakers of one liter capacity are taken and in each beaker waste water quantity of 1 liter is added.
- Temperature of Reservoir was maintained at 25 0 c
- pH of waste water is adjusted to 3 and dose of H2O2 varying from 0.5 to 3 ml is added to each beakers .
- After addition of H2O2 a reaction time of 1Hr is maintained for experiment. pH was controlled with solutions of NaOH and H2SO4.
- After reaction time of 1 hr the readings of TDS, BOD, Oil & Grease, Chlorides, Phosphate and COD were observed

Fig. 2 Experimental Setup

V. RESULTS AND DISCUSSION

- The experimental work is carried out for various doses and various parameters are controlled to optimize them for increasing efficiency of advanced oxidation process. By the dissociation into water and oxygen, H2O2 can also supply oxygen for microorganism in biological treatment facilities and in bioremediation of contaminated sites. It can be used as a disinfecting agent in the control of undesirable bio-film growth. H2O2 can be decomposed into water and oxygen by enzymatic and non-enzymatic routes.

Table I. Physico-Chemical Parameters of Wastewater Influent &Effluent from the UASB Tank.

Sr.no	Date of Sampling	pH		TDS mg/l		Cl mg/l	
		Influent	Effluent	Influent	Effluent	Influent	Effluent
1	11/04/2017	8.6	7.4	2400	1350	75	63
2	13/04/2017	8.5	7.3	2360	1330	80	65
3	15/04/2017	8.3	7.4	2390	1350	75	64
4	13/08/2017	8.6	7.2	2380	1290	78	63
5	18/08/2017	8.4	7.2	2370	1300	80	64
6	20/08/2017	8.3	7.3	2360	1420	76	65
7	11/01/2018	8.6	7.3	2390	1380	78	66
8	13/01/2018	8.3	7.4	2400	1380	76	64
9	17/01/2018	8.9	7.3	2300	1380	75	63

Table II. Physico-Chemical Parameters of Wastewater Influent &Effluent from the UASB Tank

Sr.no	Month of Sampling	BOD		COD		P		Oil and Grease	
		Influent	Effluent	Influent	Effluent	Influent	Effluent	Influent	Effluent
1	11/04/2017	510	100	2544	280	7	6	14	10
2	13/04/2017	580	110	2272	290	7	5	16	12
3	15/04/2017	590	118	2496	270	8	6	13	10
4	13/08/2017	470	95	2455	310	8	6	12	9
5	18/08/2017	490	98	2272	300	8	5	9	7
6	20/08/2017	500	96	2448	310	7	6	10	8
7	11/01/2018	570	100	2278	280	8	5	8	9
8	13/01/2018	530	96	2450	286	7	5	7	6
9	17/01/2018	560	95	2480	288	8	5	8	7

Table III. Variation in various parameters after post treatment with H2O2

Sr No.	Dose in ml	pH	P	COD	BOD	TDS	Oil &Grease	Chlorides
1	0.5	6.9	5	260	50	950	7	63
2	1	6.8	3	254	32	948	6	58
3	1.5	6.8	2	246	28	930	5	54
4	2	6.7	1	244	26	930	4	51
5	2.5	6.7	1	242	25	900	3	50
6	3	6.7	1	242	25	890	3	49

Table IV. Percentage removal (%) change in various parameters after post treatment

Sr.no	Dose in ml	Percentage removal (%)						
		pH	TDS mg/l	COD	BOD	P	Cl	Oil &Grease
1	0.5	4.16	26.35	3.70	47.36	16.66	3.76	30
2	1	5.55	26.51	5.92	66.31	50	10.76	40
3	1.5	5.55	27.90	8.88	70.52	66.66	16.92	50
4	2	6.94	27.90	9.62	72.63	83.33	21.53	60
5	2.5	6.94	30.23	10.37	73.68	83.33	23.07	70
6	3	6.94	31	10.37	73.68	83.33	24.61	70

Table V. Efficiency change in various parameters after post treatment

Sr.no	Dose in ml	Efficiency (%)						
		pH	TDS mg/l	COD	BOD	P	Cl	Oil &Grease
1	0.5	95..03	73.64	96.24	52.63	83.33	96.92	70
2	1	94.44	73.48	94.07	33.68	50	89.23	60
3	1.5	94.44	72.09	91.11	29.47	33.33	83.07	50
4	2	93.05	72.09	90.37	27.36	16.66	78.46	40
5	2.5	93.05	69.76	89.72	26.31	16.66	76.92	30
6	3	93.05	68.99	89.72	26.31	16.66	75.38	30

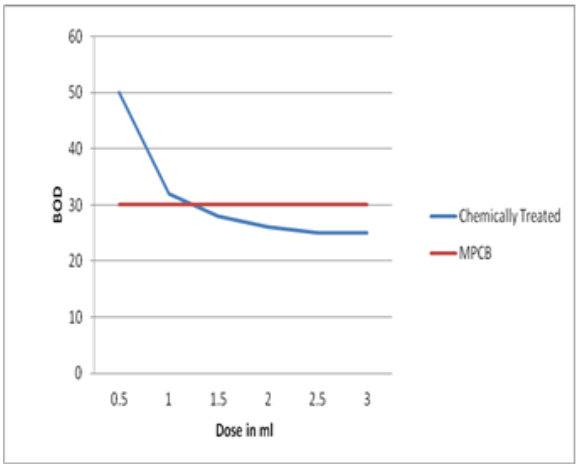

Fig.3 BOD Reduction rate at various doses

Variation of BOD: The BOD values were measured After 1 hr from the addition of H2O2.The Graph Doses v/s BOD shows that values ranged from a high of 50 to a low of 25.After the 2 ml the values of BOD does not shows any variation.

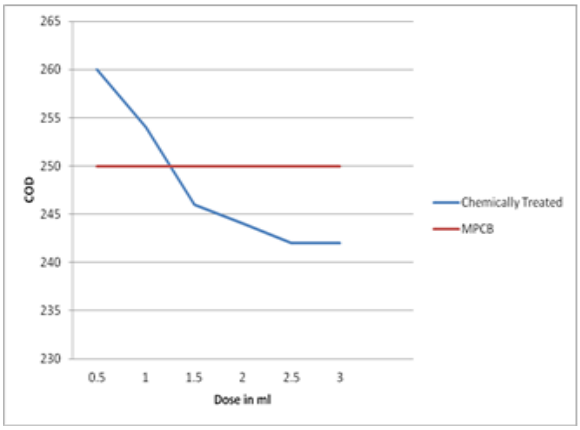

Fig.4 COD Reduction rate at various doses

Variation of COD: The COD values were measured After 1 hr from the addition of H2O2.The Graph Days v/s COD shows that values ranged from a high of 260 to a low of 242.After the 2 ml the values of COD does not shows any variation

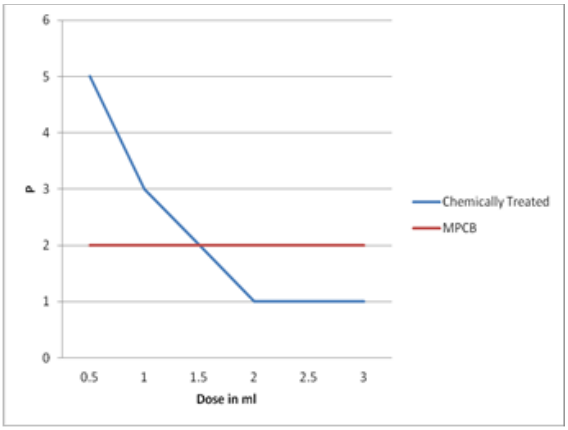

Fig.5 P Reduction rate at various doses

Variation of P: The P values were measured After 1 hr from the addition of H2O2.The Graph Days v/s P shows that values ranged from a high of 5 to a low of 1.After the 2 ml the values of P does not shows any variation

VI. CONCLUSIONS

The Advanced Oxidation processes study was investigate the efficiency of H2O2 to treat dairy waste water and then optimization of various experimental operating parameters on the removal of removal of pollutants from dairy effluents.

- For post treatment in terms of BOD and COD removal of UASB-treated effluent, AOPs are highly efficient and feasible for removing both the parameters quickly.
- The results of this study show that the parameters were in acceptable limit of MPCB
- The problems of odor, well water contamination, are eliminated.
- COD reduction was highly significant which suggests that H2O2 is efficient and, therefore AOPs are efficient methodologies that can be used in dairy effluent treatments

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