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Research Paper

Minimization of Sludge of Dairy Industry Waste Water by Activated Charcoal

Science

KEYWORDS : Dairy industry, COD, BOD , Wooden based activated charcoal(WBAC), laterite, waste water

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ABSTRACT

For the determination of COD and BOD in waste water from sludge can be reduces to using low cost adsorbent like Wooden based Activated Charcoal(WBAC)& laterite in a column used as a stationary phase. The parameters like specific gravity ,viscosity total suspended solids pH are reduces with grate effect by using WBAC & Laterite as a permanent adsorbent. The fixed bad efficiencies can be compared by changing the bed ration of adsorbent. The whole study of optimizing parameters has been done in column chromatography to compare the result of after treatment and before treatment. The fixed bed of WBAC and Laterite reduces COD and BOD value up to 70% and 75% respectively .The ration of WBAC and Larerite in 2:3, 2:1,1:3,1:2,1:1 which reduces the COD percentage as 66%,67%,71% 75% & 65% respectively and the BOD value reduces as 71%,72%,73% 74% & 67 respectively. This is the maximum value of minimization of COD and BOD from waste water of dairy industry. So that it is a chipper method for minimizing the excess sludge of wastewater treatment in various sectors.

INTRODUCTION

Dairy plants are found all over the world, but because their sizes and the types of manufactured products vary tremendously, it is hard to give general characteristics. The dairy industry can be divided into several production sectors. Each division produces wastewater of a characteristic composition, depending on the kind of product that is produced. Wastewater from dairy industry may originate from the following sources

1.Milk receiving:-Wastewater results from tank, truck and storage tank washing, pipe line washing and sanitizing. It contains milk solids, detergents, sanitizers and milk wastes.

2. Whole milk products:-Wastewater is mainly produced during cleaning operations. Especially when different types of product are produced in a specific production unit, clean-up operations between product changes are necessary. In developing countries, the main problem is pollution through spoilage of milk.

3. Cheese/Whey/Curd:-Waste results mainly from the production of whey, wash water, curd particles etc. Cottage cheese curd for example is more fragile than rennet curd which is used for other types of cheese. Thus the whey and wash water from cottage cheese may contain appreciably more fine curd particles than that from other cheeses. The amount of fine particles in the wash water increases if mechanical washing processes are used.

4. *Butter/Ghee*:-Butter washing steps produce wash water containing butter milk. Skim milk and butter milk can be used to produce skim milk powder in the factory itself or itself or these materials may be shipped to another dairy food plant by tank truck.

5. *Milk powder*:-Environmental problems are caused by high energy consumption (= emission of CO_2, CO etc.), by cleaning and by emission of fine dust during the drying process. *Condensed milk/Cream/Khoa* . Environmental problems related to the production of condensate and khoa are mainly caused by the high energy consumption during the evaporation process. The main suspended solids mentioned in the literature are coagulated milk and fine particles of cheese curd.

Activated carbon is a carbon material mostly derived from charcoal. The unique structure of activated carbon produces a very large surface area: 1 lb of granular activated carbon typically provides a surface area of 125 acres (1 Kg =1,000,000 sq. m.). The activated carbon surface is non-polar which results in an affinity for non-polar adsorbents such as organics. Activated carbon is very effective in applications requiring air or water purification as well as precious metal recovery or removal.

MATERIAL & METHODS

Experimental Setup

For the minimization of sludge from dairy industry , an adsorption study with wooden based activated charcoal is done on wastewater to maintain the conditions in dairy industry .

Separating column For the column chromatography experimentation following experiment set up is used Acrylic pipe of 70 cm height & diameter 6.4cm is having top inlet tap is there to entry of wastewater in ratio 1:1 of wooden based activated charcoal to laterite is 5 min interval of five run & in ratio 1:2 of wooden based activated charcoal to laterite is 5 min interval for five run & in ratio 1:3 of wooden based activated charcoal to laterite is 5 min interval for five run& in ratio 2:1 of wooden based activated charcoal to laterite is 5 min interval for five run & finally in ratio 2:3 wooden based activated charcoal & laterite is 5 min interval of five run & a bottom outlet tap is to collect treated wastewater as shown in figure.

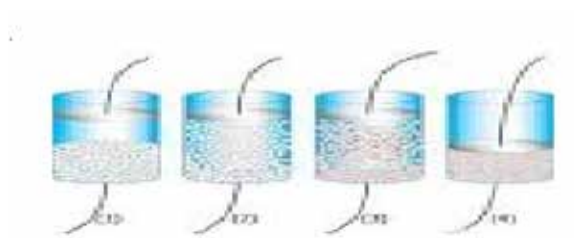

Figure: Adsorption Column

Selection of Adsorbent

The adsorbent particle size must be spherical and uniform; it should be pure and does not react with waste water.

Material Used

In the study the following two materials is used as adsorbents

1. Wooden based activated carbon (WBAC)
2. Laterite

Dairy Wastewater Treatment Using Wooden based Activated Carbon & Laterite as Low Cost Adsorbents"

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Preparation of Activated Carbon from wood

Powder activated carbon produced by steam activation of wood. This wood based activated carbon has high porosity and purity. Majority is being used in the water and wastewater treatment, decolonization and vapor phase injection systems. it has advantages compared to material because of its ability to adsorb colour or aroma.

Figure: Wooden Based Activated Charcoal

Available Wood Based Activated Carbon Types

Powder Wood Based Activated Carbon

Product Unit Description	Product Range Available
Mesh Size (US Sieve)	Passing 100 Mesh (99%) Passing 200 Mesh (95%) Passing 300 Mesh (90%)
Surface Area (m^2/g) Minimum	1000
Iodine (mg/g) Minimum	1000
Methylene Blue (ml) Minimum	180
Moisture (%)	10
Fe (%) Maximum	0.07 - 0.1
CI (%) Maximum	0.1

Preparation of Laterite

Laterites are a source of aluminum ore; the ore exists largely in clay minerals and the hydroxides, gibbsite, boehmite, and diaspore, which resembles the composition of bauxite. In Northern Ireland they once provided a major source of iron and aluminum ores. Laterite ores also were the early major source of nickel.

Figure: Laterite Soil

The soil contain laterite is collected and wash with the tap water to remove the impurities and this soil particles are dried in the sunlight for 24 to 48 hours . than crushed to make adiffrent size of particles than washed with water to remove from red colorization ,finally this powder is dried in Oven at 110°C. than this powder are used for the acidic adsorption

Sampling & Preservation of Effluent :-

The sample is collected in a clean air tight plastic barrel have the capacity five liter & For analysis fresh sample is required so collect the sample twice in a week & some times preserved sample (preserved in refrigerator at 4°C)are used for analysis. The wastewater from dairy industry first are filtered to remove the soil particles; than this filtered wastewater is used for further analysis

Optimization of Various Operating Parameters

Optimization of Surface Area

Fine powder of Activated Charcoal and Laterite having 1 mm & 2 mm size are used in preparation of adsorbent in column

Optimization of Ratio

For the analysis the adsorbent used as in the portion as 1:1, 1:2, 1:3,2:1,2:3 respectively WBAC: Laterite, to maintain the flow rate of effluent is 5min at the same time effective removal of suspended particles from waste water .Most suitable size of adsorbent is used for the preparation of adsorbent in column chromatography .

Optimization of Contact B Time

For the study of effect of contact time of 1000ml of wastewater from dairy in column chromatography .There is variation in flow time & it is found to be 60 sec /5 min approximately. In tnis column chromatography the effective treatment obtained from 1:2 (WBAC: laterite) ratio.The chemicals are used LOBA sample which are out at ambient temperature in column chromatography method.

Analytical Methods

For the analysis of various parameters standard methods of water and waste water analysis are follows

METHODOLOGY

Procedure

The adsorbent materials namely Wooden Based Activated Carbon (WBAC) & laterite are taken in different ratio by weight of WBAC is much less compared to laterite. Number of particles in half of kg of WBAC is much more compared to laterite. i.e. surface area for adsorption by WBAC is more than laterite. All the experiments are carried out at room temperature (27.5°C±2.5°C). The column chromatography is conducted in 5 different columns of 100 cm height & diameter (6.5cm). Columns are run in different ratio of WBAC & Laterite as a stationary phase for all the experimental conditions like pH, viscosity, COD, specific gravity, & total suspended solids of solution. The influences of various operating parameters are studying by varying ratio of adsorbents WBAC & laterite. Surface area of adsorbents namely WBAC & laterite are choosen, considering the rate of flow of waste water. WBAC & laterite particles size to be 1mm, which gave satisfactory out flow of wastewater at rate 0.215 m/min. When the ratio by weight 2:3 (WBAC: Laterite). Column prepared, using mixed bed material & wastewater samples collected at different intervals of time. Than filter water can be analysis for different parameters as maintion above and tabulate the result as given below

RESULTS

Table-2 Production of wastewater is highly influenced by management practices

Type of product	Wastewater volume		BOD	
Average	Range	Average	Range	
(1)				
Milk	3250	100 - 5400	4.2	0.20 - 7.8
Condensed milk	2100	1000 - 3000	7.6	0.20 - 13.3
Butter	800		0.85	
Milkpowder	3700	1500 - 5900	2.2	0.02 - 4.6
Cottage cheese	6000	800 - 12400	34.0	1.30 - 71.2
(2)				
Milk (canned)		320 - 1870		0.02 - 1.13
Condensed milk		800 - 7290		0.17 - 1.48
Butter		800 - 6550		0.19 - 1.91
Natural cheese		200 - 5850		0.30 - 4.04
Cottage cheese		830 - 12540		1.30 - 42
(3)				
Milk				0.2 - 4.0
Cheese			0.9	
Butter/ milkpowder			0.3	
Total	4000			

Table-3 Management attitude towards waste control.

Product	Milk processed (kg/day)	BOD (kg/ton)	Wastewater (kg/kg)	Management level
Milk	181,600	0.3	0.4	excellent: 19, 25, 26
	227,000	0.2	0.1	excellent: 19, 21, 26, 27
	113,500	0.7	1.0	good: 8, 10, 18, 20
	68,100	7.8	5.2	poor: 1
Cottage cheese	272,400	2.0	0.8	good: 8, 15, 16
	135,200	1.3	4.7	good: 8, 17
	295100	71	12.4	poor: 2
Milk, cottage cheese	454,000	4.1	1.2	good: 2, 19
	211,110	1.8	1.1	good: 21, 22
	408,600	3.3	1.1	fair: 8, 9
	454,000	8.6	2.0	poor: 8, 3, 4
Milk, butter	135,200	0.9	0.8	good: 23, 24, 28
Whey powder	227,000	0.2	5.9	good-fair: 11, 12, 13
Milk powder, butter	90,800	3.0	2.5	fair: 14, 7, 3

Table-4 Observation for average row waste water and treated wasted water as follows s

Sr.No	PertiCulars	Row Weaste Water	Treated Wasted Water				
			1:1	1:2	1:3	2:1	2:3
1	Colour	Light Milky	Transparent	Transparent	Transparent	Transparent	Transparent
2	Odour	Milky Smell	No test	No test	No Test	No Test	No Test
3	Total Suspended Solid	370	85	80	75	70	65
4	COD	1320	452	320	374	423	439
	Viscosity	6.2	9.1	9.75	9.40	9.34	9.26
5	Specific Gravity	0.63	0.85	0.87	0.89	0.95	0.97
6	pH	4.8	5.1	6.9	7.6	7.2	7.1
7	BOD	467	153	119	127	131	135

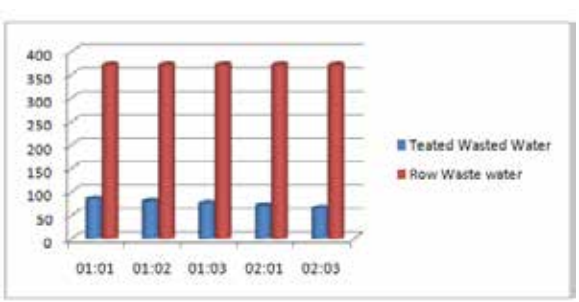

Figure: Total Suspended Solid

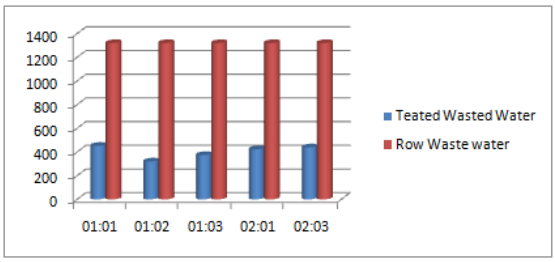

Figure: Chemical Oxygen Demand (COD)

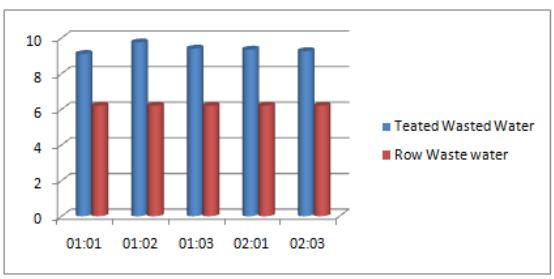

Figure: Viscosity

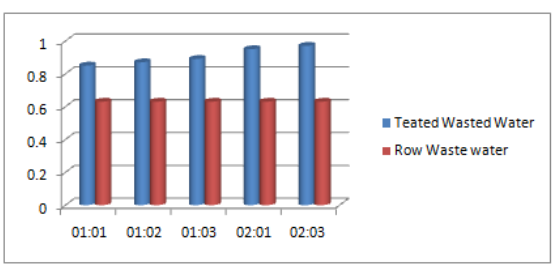

Figure: Specific Gravity

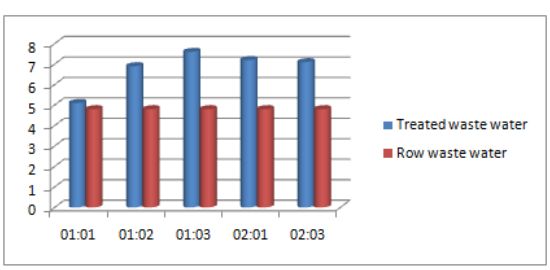

Figure: pH

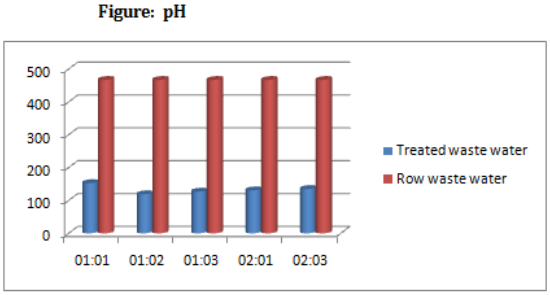

Figure: Biological Oxygen Demand (BOD)

CONCLUSIONS

By the experimental data , WBAC and laterite are the low cost ,easily available adsorbents for the minimizing the sludge from the dairy industry . Laterite is an acidic in nature and WBAC have good adsorbing ability to adsorbed neutral as well as basic components in the waste water . The WBAC and Laterite are chiefly available materials for the preparation of mixed bed in adsorption column and it also having the low cost and obtained

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from agriculture by products. The ratio 1:2 (WBAC & Laterite) is more effective than other rations in this ration adsorbed all the acidic and basic impurities particle from waste water ,it also help to reduces the COD and BOD upto 75.75% and 74.51% . The other parameters like pH, Viscosity, Total suspended Solids also effectively reduces, this techniques also used in various industries for the treatment of waste water .

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