Treatment of Dairy Wastewater Using Natural, Chemical And Slow Sand Filtration Process

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Abstract- *Dairy wastes contains high concentrations of organic material such as proteins, carbohydrates, and lipids, high concentrations of suspended solids, high suspended oil and/or grease. The dairy industry discharge large volume of wastewater. These dairy waste emits bad odour this cause main problem while disposing in land or water. We are going to remove the suspended solids and reuse the wastewater by using chemical, natural and filtration process. Treatment aim mainly at removing suspended solid. The comparative study of different low cost adsorbents in treatment of wastewater from dairy industry is carried out, the goal being to remove organic pollutants and procedure water that can be reused in the production process this study focus on removal of BOD, COD, Turbidity, TOC, Conductivity, and pH in wastewater of dairy industry using adsorbents sugar bagasse ash and fly ash. The activated carbon are evaluated for reduction in BOD, COD, Turbidity, TOC, Colour, TDS, Conductivity and pH of a dairy industry waste water*

Keywords- Dairy wastewater, Treatment, BOD, COD, pH, Suspended solids

I. INTRODUCTION

Dairy is a building or room for the processing, storage and storing and distribution of milk and milk products. Dairy wastewater are water after cleaning the storage tank, milk trucks,processing water and sewage water.

The dairy industry includes the transformation of raw milk into pasteurized and sour milk, yoghurt, hard, soft and cottage cheese, cream and butter products, ice cream, milk and whey powders, lactose, condensed milk, as well as various types of desserts. The general distinctions among these foods are due to the reuse of non- -fat milk and whey (a by-product in cheese manufacturing) and the evaporation of the free water from the coagulum as well as from milk and whey powders. With the rapid industrialization observed in the last century and the growing rate of milk production (around 2.8% per annum), dairy processing is usually considered the largest industrial food wastewater source, especially in Europe. Moreover, in around 50% of the world's whey production, especially concerning acid whey, it is untreated prior to disposal. The effluents originating from various production technologies are not discharged simultaneously, thus forming a stream with wide qualitative and quantitative variations. Notwithstanding the differences in composition, attributable to the manufactured product and technological operations, dairy effluents are distinguished by their relatively increased temperature, high organic content and a wide pH range, which requires special purification in order to eliminate or reduce environmental damage. Treatments of dairy wastewaters include the application of mechanical, physicochemical and biological methods. Mechanical treatment is necessary to equalize volumetric and mass flow changes. It also reduces parts of the suspended solids. Physicochemical processes are effective in the removal of emulsified compounds, but reagent addition increases water treatment costs. Another disadvantage is the very low elimination of soluble chemical oxygen demand (COD). Therefore, biological wastewater treatment systems are preferred due to the highly biodegradable contaminants.

II. OBJECTIVES

The objectives of this study are specifically given as the following points,

- Elimination of pollutant, toxicants content in wastewater.
- Avoidance of water supply contamination.
- Reduce the organic content of the wastewater.
- Increase the water quality.
- Remove or reduce nutrients that cause pollution of receiving surface water or ground water.
- Remove or inactive potential pathogenic microorganism.

III. LITERATURE REVIEW

ChaitaliBangar et al, (2009) Global environmental pollution is one of the serious problem affecting on earth. The dairy industry effluent was the second most important single source of pollution in streams. Wastewater discharge which characterized by High COD, BOD, TSS, TDS, Turbidity, pH etc. Such untreated dairy wastewater if discharge into natural resources, then it pollute the water resources. Natural coagulant consider safe and more economical alternative for developing countries. The present study was undertaken to compare, under the same analytical conditions, the efficiency of Different Chemical Coagulant (alum) and Natural coagulant (moringaoleifera).There is reduction the value of pH of and removesturbidity-68.985%,TDS-69.73%,COD-52.38%,BOD 85.28%,respectively bymoringaoleifera and reduce the value of pH of(moringaoleifera and removes turbidity-75.86%,TDS-73.68%,COD-59.52%,BOD-91.70%,respectively by the chemical coagulant alum. Hence the alum is more effective than moringaoleifera.

L.Gayathri et al,(2017) The dairy industry is one of the major source of food processing. These industries produce a huge amount of wastewater. Such wastewater is to be treated by using naturally and easily available coagulants and then tests are to be carried to check the water different characteristics of waste water like BOD, COD, pH and turbidity etc. Natural coagulants to be used are Moringaoliefera, Azadirachtaindica, Trigonellafoenumgraecum and cicerarietinum . Natural coagulant is a naturally occurred. plants based coagulant that can be used in coagulation-flocculation process of wastewater treatment for reducing turbidity. The objectives of this study were to assess the possibility of using natural coagulants as an alternative to the current commercial synthetic coagulant such as aluminium sulphate. The final effluent can be readily used for irrigation and sludge itself becomes a good fertilizer. The efficiency of reducing of turbitidy by Moleifera, Azadirachtaindica, T.foenumgraecum, c.arietinum are 61.60%, 71.74%, 58.20% and 78.33% respectively.

IV. TEST CONDUCTED ON DAIRY WASTEWATER

The following are the various tests to be conducted before and after treatment, there are:

- pH
- Turidity
- Suspeded solids
- BOD
- COD
- Oil and grease

V. TREATMENT OF DAIRY WASTEWATE

The following are the treatment conducted on dairy wastewater,

1. Natural process
2. Chemical process
3. Slow sand filtration

1. NATURAL PROCESS

Natural coagulants are coagulants which are naturally available in the environment. These coagulants are non-toxic, non-corrosive and good for human health. Cost of these coagulants are very low when chemical coagulants. It provides the sustainable and economical water treatment. No skilled labours are required for water treatment. Maintaince cost will be very low when compare to the chemical water treatment. In this experiment we are going to use the Manilkarazapota fruit seed. Manilkarazapota (chiku fruit) seeds were dried in oven at 40^0c temp. Seeds were powered and sieved through a 150 mm sieve. Two gram of powder was soaked in distilled water, blended and the volume was made up to 100 ml. This suspension was used for the coagulation study

2.1. ALUM

Alum [Al 2 (SO 4) 3] has been commonly used to chemically treat water and wastewater. The reactions are dependent upon several factors such as alkalinity, pH, trace elements and ligands found in wastewater, thus necessitating bench scale and if possible full-scale tests to determine the required dosages (Metcalf and Eddy, 2002). Laboratory tests conducted by Jones and Brown (1999) showed that 99% of ortho-phosphorus (initial concentration was 13.86 mg P/L) was reduced by treating dairy wastewater with a dosage of 3 g/L of alum but beyond this dosage, removal efficiency actually decreased. When alum is added to solution, it will begin to form hydrated reaction products, which means that one or more hydrogen ions are released

2.2. LIME

Lime is often used to treat wastewater to remove solids and phosphorus. Control pathogenic microorganisms in wastewater is also possible when lime is applied due to its high pH which destroys the cell membranes (National Lime Association, 2004). In addition, when pH is high, calcium ions react with odorous sulfur species such as hydrogen sulfide and organic mercaptans, thereby reducing odor (National Lime

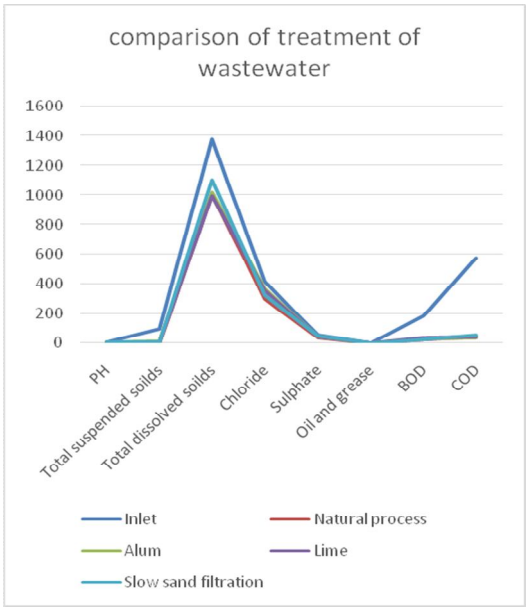
Association, 2004). When lime is added, it reacts with the natural bicarbonate alkalinity of wastewater forming CaCO3. Above pH 10, calcium ions react with phosphate ions precipitating hydroxyapatite [Ca 10 (PO 4) 6 (OH) 2] (Metcalf and Eddy, 2002). Thus, the alkalinity of wastewater is important in determining the chemical dosage of lime rather than the amount of phosphate present. Metcalf and Eddy (2002) suggest that lime dosage required to precipitate P is about 1.4 to 1.5 times the total alkalinity expressed as CaCO3. A study by Barrow et al. (1997) showed that the addition of hydrated lime to simulated dairy flush waters reduced total solids by about 70%. In batch level jar tests, Karthikeyan et al. (2002) showed that lime was effective in removing total phosphorus (TP) and dissolved reactive phosphorus (DRP) by 96% and 92%, respectively, for dairy wastewater with 1.6% total solids (TS). Vanotti et al. (2002) reported the removal of almost 100% of P from swine wastewater using lime after a nitrification pre-treatment

3. SLOW SAND FILTERATION

Slow sand filters were first devised when the process of filtration was invented in England by James Simpson in 1829.They were widely used since then, till the last decade of the 19th century, when rapid gravity filter were invented. Their use has since decreased and they are becoming obsolete these days. However, they may still preferred on smaller plants at warm places, where covers on filters are not required to protect the filter from freezing. Slow sand filters normally utilize effluents from the plain sedimentation tanks, and are used for relatively clearer waters.

VI. RESULT

S.NO	Parameter	Units	Inlet	Outlet			
				Manilkara zapota seed powder	lime	alum	Slow sand filtration
1	PH	mg/l	7.98	6.85	7.43	7.1	7.23
2	Total suspended solids	mg/l	98	3	7	10	5
3	Total dissolved solids	mg/l	1378	1003	997	1017	1104
4	Chloride	mg/l	420	302	359	365	323
5	Sulphates	mg/l	55	39	41	43	48
6	Oil and grease	mg/l	<1	<1	<1	<1	<1
7	BOD at 27c for 3 days	mg/l	186	22	34	30	26
8	COD	mg/l	576	45	42	38	53



VII. CONCLUSION

Slow sand filtration was observed that the reduction efficiency of turbidity is about 70% and the reduction in pH and electrical conductivity is also noticeable. Thus it can be concluded that the slow sand filter is efficient in treating dairy wastewater from a particular source. Sapota seed (Manilkarazapota) were used as coagulant for water treatment resulting removal of turbidity, total solids, suspended solids, colour and increase the pH. Cost of these materials very low and cheap. ManikaraZapota seed is waste materials they not fit for other purposes so costs of these materials are NIL. By comparing all experimental results of each coagulant,ManikaraZapota seedis considered as a Best coagulant**,** removal of turbidity, total solids, suspended solids, colour and increase the pH. It could be concluded that the neem seed could be an important in water treatment where neem trees are available and easy to cultivate. This method is low cost compare to chemical treatment. These materials are easily and naturally available. Low maintenance and no skilled labour require. The natural coagulants are non-toxic and non-corrosive. By using these natural coagulants for water treatment we will make the happy and healthy environment.

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