A Case Study on Effluent Treatment Process Using Aavin Dairy Waste At Madhavaram

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Abstract- *Dairy industry is among the most polluting of the food industries in regard to its large water consumption. Dairy is one of the major industries causing water pollution. Considering the increased milk demand, the dairy industry in India is expected to grow rapidly and have the waste generation and related environ-mental problems are also assumed increased importance. Poorly treated wastewater with high level of pollutants caused by poor design, operation or treatment systems creates major environmental problems when discharged to the surface land or water. Various operations in a dairy industry may include pasteurization, cream, cheese, milk powder, etc. The dairy industry handles large volumes of milk and the major waste material from processing is the water. The water removed from the milk can contain considerable amounts of organic milk products and minerals. In addition cleaning of plant, results in caustic wastewater. This review article discusses the impact of wastewater released in the environment, methods to minimize the amount of both the organic and in organic material in the wastewater and waste water treatment.Tamilnadu cooperative milk producers federation limited, Madhavaram milk colony, the installed capacity of dairy was originally 50,000 liters/day which was increased stage by stage to 2.00 lakh liters/day and at present it is equipped to pack and dispatch 3.5 lakhs liters of milk per day, the effluent produce from these are 4.5 LLPD, in fact a survey made by environmental protection agency in 1999.*

Keywords- Dairy effluent, Pollution, Impact

I. INTRODUCTION

GENERAL

The food industry have one of the highest consumptions of water and is one of the biggest producers of effluents per unit of production, in addition they generate a large volume of sludge during biological treatment. The dairy industry is one of those sector, in which the cleaning silos, tanks, homogenizers, pipe sand, heat exchangers other equipment, engenders a large amount of effluents with a high organic load. This organic load is basically constituted of milk (raw material and dairy products), reflecting an effluent with high levels of chemical oxygen demand (COD), biochemical oxygen demand (BOD), oils and grease, nitrogen and phosphorus. The automatic cleaning system – CIP (cleaning in place) – discard rinse waters with pH varying between 1.0 and 13.0, further complicating the question of treatment. BOD is directly related to milk wastes (90% to 94% of the effluent BOD), and in some cases losses can reach 2% of the volume processed by the industry

In order to reduce the effects of industrial sector pollutants, the end-of-pipe treatment techniques have been improved at the same time prevention measures are being implemented in order to minimize the production of residues. End-of-pipe control captures wastewater after its generation, enabling its discharge into environment. These are peripheral solutions that focus primarily on the chemical, biological and physical treatment of terminal streams. However, they address the symptoms and not the true causes of the source generation reduction refers to any processor technology that seeks the reduction or elimination environmental problems, and therefore they are not cost effective or sustainable. The essential feature of the pollution prevention program is the concept of reduction at sources, based on the idea that the generation of pollutant can be reduced or eliminated by increasing efficiency in the use of raw materials, energy, water and some other resources. Cleaner production intends to integrate the production aims in order to reduce the quantity and toxicity of residues and discharges. Pollution prevention or of the volume, concentration or toxicity of generating source residues. The concept of cleaner production involves the reduction of negative environmental impacts throughout the products life cycle, from extraction of raw material to its final use.

The dairy is a multiproduct factory and its wastewater treatment process is based on steps: (a) screening; (b) oil and grease separation chamber; (c) collection tank (d) flow equalization in a tank; (e) primary aerator stage; (f) tertiary treatment in three facultative lagoons. However, the process is almost overloaded and requires a more complete diagnosis. On the other hand, minimization of the pollution index indicator must be evaluated, not only in terms of final treatment, but also as an opportunity to reduce production costs, by optimizing them and increasing process efficiency and profit. The purpose of this work was to identify operations or processes in which there were opportunities for reducing the impacts of load and volume in effluent treatment at a dairy factory.

II. OBJECTIVE

- To identify the sources of wastewater generation
- Reduce the organic content of the wastewater.
- Remove or reduce nutrients that could cause pollution of receiving surface waters or groundwater.
- Remove or inactivate potential pathogenic Microorganisms.
- Dairy effluent requires a specialized treatment to prevent or minimize environmental problems, as it contains high biodegradable organic complexity of the treatment process.

III. DAIRY TECHNOLOGY

Milk treatment is a series of operations from the collection point of raw milk to the final stage of the required product. The treatment of milk is always carried out in the specially prepared room with the arrangements of the processing units. The treatment of milk is always with an orientation of further activity based on the products to be produced. The dairy industry is characterized by the multitude of products and therefore production techniques also vary. Many dairies are not promoting themselves bottling pasteurized milk and making ghee from scoured milk. However, in India the production of skimmed and toned milk and cheese making is seen increasing due to the increased demand

Treatment Levels & Mechanisms of ETP. –

- Treatment levels: Preliminary
- Primary
- Secondary
- Tertiary (or advanced)

Preliminary Treatment level Purpose: Physical separation of big sized impurities like cloth, plastics, wood logs, paper, etc. Common physical unit operations at Preliminary level are: Screening: A screen with openings of uniform size is used to remove large solids such as plastics, cloth etc. Generally maximum 10mm is used. Sedimentation: Physical water treatment process using gravity to remove suspended solids from water. Clarification: Used for separation of solids from fluids.

Secondary Treatment Level Methods: Biological and chemical processes are involved in this level. Biological unit process to remove, or reduce the concentration of organic and inorganic compounds. Biological treatment process can take many forms but all are based around microorganisms, mainly bacteria. Aerobic Processes Aerobic treatment processes take place in the presence of air (oxygen). Utilizes those microorganisms (aerobes), which use molecular/free oxygen to assimilate organic impurities i.e. convert them in to carbon dioxide, water and biomass. Anaerobic Processes the anaerobic treatment processes take place in the absence of air (oxygen). Utilizes microorganisms (anaerobes) which do not require air (molecular/free oxygen) to assimilate organic impurities. The final products are methane and biomass.

Tertiary / Advanced Treatment Purpose: Final cleaning process that improves wastewater quality before it is reused, recycled or discharged to the environment. Mechanism: Removes remaining inorganic compounds, and substances, such as the nitrogen and phosphorus. Bacteria, viruses and parasites, which are harmful to public health, are also removed at this stage. Methods: Alum: Used to help remove additional phosphorus particles and group the remaining solids together for easy removal in the filters. Chlorine contact tank disinfects the tertiary treated wastewater by removing microorganisms in treated wastewater including bacteria, viruses and parasites. Remaining chlorine is removed by adding sodium bisulphate just before its discharge

IV. CHECKING OF DAIRY EFFLUENT

PH: -

It is a term used to express the intensity of the acid or alkaline condition of a solution. It is a way of expressing the hydrogen-ion measuring the organic strength of concentration or the hydrogen-ion activity. Pure water is said to be neutral, with a pH close to 7.0 at 25 °C (77 °F). Solutions with a pH less than 7 are said to be acidic and solutions with a pH greater than 7 are said to be basic or alkaline.

Chemical Oxygen Demand (COD):-

The COD test is widely used as a means of effluents. This test allows measurement of waste of a waste in terms of the total quantity of oxygen required for oxidation to CO_2 and H_2O. During the determination of COD, organic matter is converted to carbon dioxide and water regardless of the biological assimilability. The dichromate reflux method is preferred over procedures using other oxidants (e.g. potassium permanganate) because of its superior oxidizing ability, applicability to a wide variety of samples and ease of manipulation.

Biochemical Oxygen Demand (BOD):-

It is defined as the amount of oxygen required by bacteria while stabilizing decomposable organic matter under aerobic conditions. The BOD test is widely used to determine the pollution strength of domestic and industrial wastes in terms of oxygen that they will require if discharged into natural water courses in which aerobic condition exist. It is not a precise quantitative test, although it is widely used as an indication of the organic quality of water. It is most commonly expressed in milligrams of oxygen consumed per liters of sample during 5 days of incubation at 200C. The BOD is used for measuring the oxygen consumed by living organisms (mainly bacteria) while utilizing the organic matter present in waste water.

Total Dissolved Solids (TDS):-

It is a measure of the combined content of all organic and inorganic substances present in a liquid in molecular, ionized or micro-granular (colloidal sol) suspended form. Generally the operational definition is that the solids must be small enough to survive filtration through a sieve the size mm of two micrometer. The principal application of TDS is in the study of water quality for streams, rivers and lakes, although TDS is not generally considered a primary pollutant. It is used as an indication of aesthetic characteristics of drinking water and as an aggregate indicator of the presence of a broad array of chemical contaminants.

Suspended Solids (SS):-

It refers to small solid particles which remain in suspension form in water as a colloid. It is used as one of the indicator of water quality. It is sometimes abbreviated SS, but is not to be confused with settle able solids, which contribute to the blocking of sewer pipes.

Oil and Grease:-

Dissolved or emulsified oil and grease is extracted from water by intimate contact with an extracting solvent. Some extractable, especially unsaturated fats and fatty acids oxidize readily; hence special precautions regarding temperature and solvent vapor displacement are included to minimize this effect. Organic solvents shaken with some samples may form an emulsion that is very difficult to break. This method includes a means for handling such emulsions.

Sulfate:-

In inorganic chemistry, a sulfate (IUPAC-recommended spelling; also sulphate in British English) is a salt of sulfuric acid. The sulfate ion is a polyatomic anion with the empirical formula SO2-4 and a molecular mass of 96.06 Daltons (96.06g/moll); it consists of a central sulfur atom surrounded by four equivalent oxygen atoms in a tetrahedral arrangement. Many examples of ionic sulfates are known, and many of these are highly soluble in water.

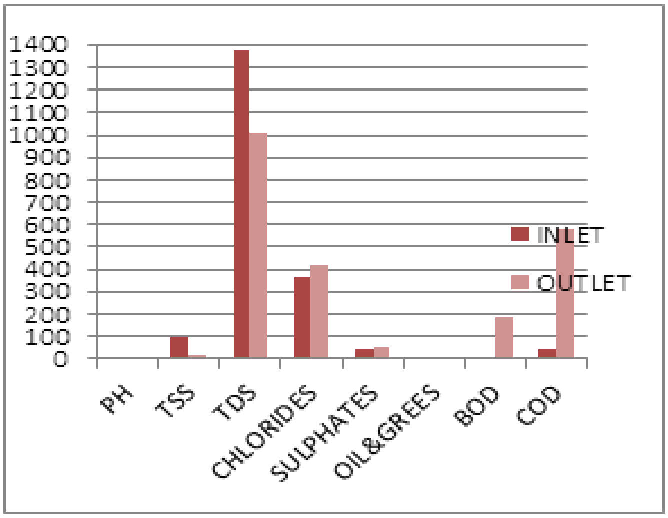
Exceptions include calcium sulfate, strontium sulfate, lead (II) sulfate, and barium sulfate, which are poorly soluble.

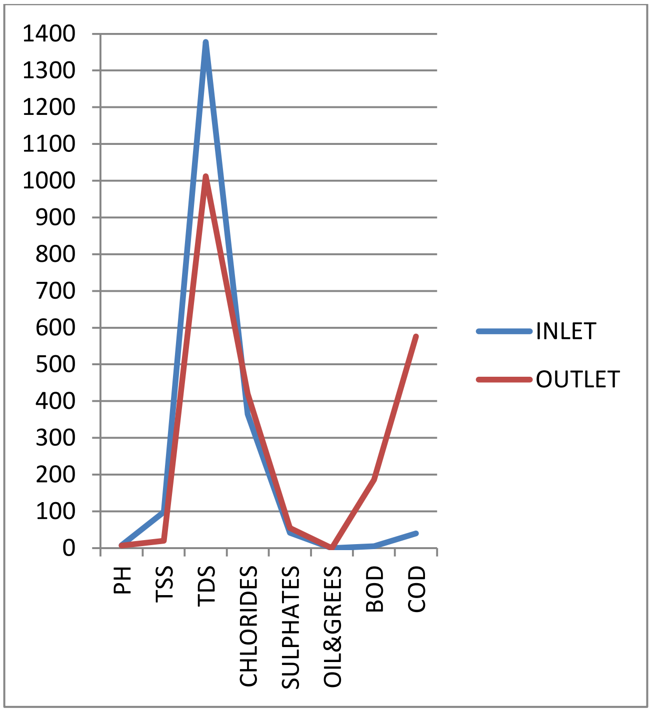
Chloride:-

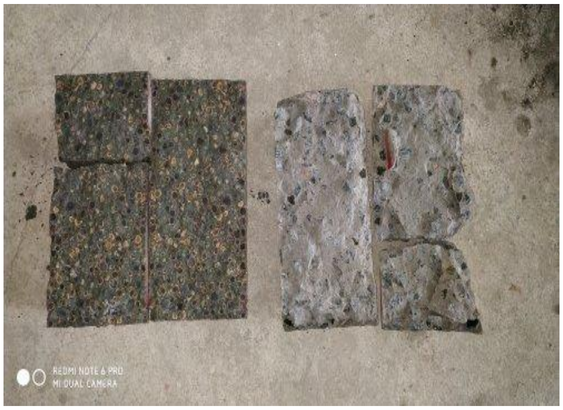
The chloride ion is formed when the element chlorine picks up one electron to form an anion (negatively-charged ion) CL −. The salts of hydrochloric acid HCL contain chloride ions and can also be called chlorides. The word chloride can also refer to a chemical compound in which one or more chlorine atoms are covalently bonded in the molecule. This means that chlorides can be either inorganic or organic compounds. The simplest example of an inorganic covalently-bonded chloride is hydrogen chloride, HCL. A simple example of an organic covalently-bonded (an organ chloride) chloride is chloromethane (CH3Cl), often called methyl chloride.

V. CHARACTERISTICES OF COMPOSITES WASTE WATER VS TREATED EFFLUENT

SL.NO	Parameter	Units	Inlet	Outlet
1	PH	mg/l	7.98	6.76
2	Total suspended solids	mg/l	98	20
3	Total dissolved solids	mg/l	1378	1012
4	Chloride	mg/l	420	365
5	Sulphates	mg/l	55	42
6	Oil and grease	mg/l	<1	<1
7	BOD at 27c for 3 days	mg/l	186	5
8	COD	mg/l	576	40







FLEXURE STRENGTH TEST

V. CONCLUSION

Based on the experimental results obtain from the investigation on sintered fly ash aggregate, the following conclusions are drawn.

The compression strength of concrete cube at 3-days, the sintered fly ash aggregate concrete cube is found has 10% lesser strength than conventional concrete cube and the strength gain for 3-days is 49.36% for the conventional concrete and 44.43% for the sintered fly ash aggregate concrete. The compression strength of concrete cube at 14-days, the sintered fly ash aggregate concrete cube is found has 0.60% greater strength than conventional concrete cube and the strength gain for 14-days is 81.93% for the conventional concrete and 82.43% for the sintered fly ash aggregate concrete. The compression strength of concrete cube at 28-days, the sintered fly ash aggregate concrete cube is found has 9.190% lesser strength than conventional concrete cube and the strength gain for 28-days is 121.5% for the conventional concrete and 110.33% for the sintered fly ash aggregate concrete.

The split tensile strength of concrete cylinder at 28-days, the sintered fly ash aggregate concrete cylinder is found has 0.40% lesser strength than conventional concrete cylinder.

The flexural strength of concrete prism beam at 28-days, the sintered fly ash aggregate concrete cylinder is found has 3.57% higher strength than conventional concrete cylinder.

After 100% replacement of coarse aggregate by SFA, the material property of SFA and mechanical testing of SFA concrete can be used as structural concrete (column, beam and slab), since the SFA material is an environmentally friendly and reduce the dependence of natural coarse aggregate and also handle the industrial fly ash waste management by using it in construction reduce dumping of fly ash.

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