Impact of Dairy Effluent on Environment

Roll No - 2219

Dairy industry is among the most polluting of the food industry in regard to its large water consumption. Dairy is one of the major industry causing water pollution. Considering the increased milk demand, the dairy industries in India is expected to grow rapidly and have the waste generation and related environmental 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. The dairy industry handles large volume 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.

Wastewater and Their sources.

Wastewater from milk product manufacture contain milk solids due to varying concentration and in dilute condition. These solids enter the waste from almost all of the operations. In general, the wastes generated from dairy industry are as follows.

- The washing and cleaning out of product remained in the tank, trucks, cans, piping, tanks and other equipment is performed routinely after every processing cycle.
- Spillage is produced by leakage, overflows, freezing on, boiling over and careless handling

- Processing losses include, sludge discharge from settling Tank; discharges from bottles and washers, splashing and container breakage in automatic packaging equipment.
- Detergents and other compounds are used in the washing and sanitizing solution that are discharged as wastes.

Effects on Water

- The organic components of the wastewater from dairy processing operations can be classified as protein, lactose and fats. These will affect the environment in different ways depending on their biodegradability and their solubility.

- River oxygen level and BOD

Fully aerated rivers at temperature of 15-25°C contain oxygen concentration of at least $8 g/m^3$. It is therefore essential that discharges to the rivers maintain an oxygen concentration of at least $6 g/m^3$. In order for this, the discharge to the river must not increase the river BOD by more than $3 g\, m^{-3}$. The organic components in dairy processing wastewater are highly biodegradable. In waterways, bacteria will consume the organic components of the waste.

$$\text{Organic material} + O_2 \rightarrow CO_2 + H_2O + \text{Bacteria}$$

- Sewage fungus

Low Molecular weight Organic compounds promote growth of certain filamentous slimes in waterways. The bacterial colonies are collectively known as sewage fungus. The most common bacterial species in this category is sphaerotilus natans. One of the major constituent of dairy factory wastewaters is lactose, a

low molecular weight sugar that is known to promote sewage fungus growth.

$$\text{Growth } /g/m^2 = 0.333 + 2.479\, m(\text{lactose}) / g/m^3$$

- The Inorganic component

One of the main aims of industry is to recover the protein (organic nitrogen component) of the waste and convert it to saleable products. Nitrogen is, therefore, a very important component of the dairy factory wastewaters. Some protein will be lost to the waste streams. Bacteria convert the nitrogen in protein to the inorganic form including ammonia, and the ammonium, nitrite and nitrate ions. Each of these inorganic forms of nitrogen has different environmental effects. Nitrate ions are toxic in high conc. to both humans and livestock. In young infants nitrate can be converted into nitrite form, absorbed into the bloodstream and converts haemoglobin to methaemoglobin. It cannot transport oxygen. It basically affects infants less than six months because they lack necessary enzyme to reconvert the methaemoglobin back to haemoglobin. To protect humans the usual limit placed on drinking water supplies is $10 g\, m^{-3}$ of nitrate- nitrogen.

1. Wastewater Treatment

- Anaerobic treatment

Considerable experimental work has been undertaken on the anaerobic digestion of the whey from casein and cheese plants. Various forms of high rate anaerobic digestion system have been investigated with whey. However, few anaerobic system treating whey have been installed, despite such systems being operationally viable and the value of methane produced from these system as the industry values the component of the whey more highly.

- Mechanical treatment

This is preliminary stage of dairy waste, treatment and in this screens, grit chamber, skimming tank and primary sedimentation tank or clarifier are used. The large material which are floating in nature are removed by screens, otherwise matter may choke the pipes while further effluent processing. Chambers are used to remove heavier inorganic matter such as sand, grit etc. Skimming tanks are installation purpose is to remove oil, grease, wood pieces, fruit skins etc. Settling tank or clarifier allows matter at very lower velocity or at rest in the sedimentation tank to settle down at the bottom of sedimentation tank. The collected material at the bottom is known as sludge. Sludge and effluent require further additional treatment to make them harmless.

- Suldge treatment:- Each treatment stage generate suldge and that suldge is colleeted in thickening tanks to Lhich chemicls are added to further facilitate the aggregation of solid particles. suldge is a homogeneous, psacticlly odourless, dark-coloured suldge Contains high amount of orgenic material so it has fusther break down so that foul smell reduced down. The eventually pumped into a digester Lhere the organic substances are broken down under anaerobic Conditions into methane and CO_2. Suldge has high moisture content of 94-97%. it is therefore dewatered most efficiantly in a decanter centrifuge Lhich discharge a solid phase of about $1/8^{th}$ of original volume

- Chemical treatment:- It is also known as precipitation. The precipitation is done by adding flocculation material called as flocculants material called as flocculants to waste water and mixed vigorously by agitators. The process precipitate insoluble phosphate in the form of very fine particle then the particle aggregate into larger flocks. the larger flocks settle down in the pre-sedimentation basins as primary sludge, where a clear effluent overflows into a basin for biological treatments. sedimentation basin are equipped with devices that continously scraps the sediment into a sump and oblique gutters that carry off water from the clarified surface layer.

The textile Industry is primarily concerned with the design, production and distribution of cloth, yarn etc. it's out put are denim, cotton cloth etc.

Pollution due to textile Industry:- Textile mills generate 1/5 of the world's Industrial water pollution and use 20,000 chemicals, many of them are carcinogenic, to make cloths. Chinese textile factories alone produce about 3 billion tons of soot. that cause respiratory and heart disease.

Water pollution:- The toxic chemicles used to create textiles are major sources of pollution from textile factory operations. factories use poly vinyl chloride to size fabrics, chlorine bleach to lighten a fabric's color, benzidine and toluidine as dying agents and flame retardants that are known as cancer-causing agents. Some others are formaldehyde, lead and mercury. Releasing this untreated chemical wash water brew can pollute water ways and ground water sources.

Air pollution :- As textiles move through the production process, numerous life-threatening pollutants left untreated can contaminate the air. factory boilers that heat the water release nitrous oxides and Sulphar di oxides. Carbon monooxide is released from factory sizing operations. Bleaching operations release chlorine dioxide and fabric printing releases hydrocarbons and ammonia. fabric-finishing operations can release formaldehyde into the air.

Solid-Waste pollution :- Textile manufacturing operations create large amount of toxic and nontoxic solid waste. for ex - storge drums and plastic containers used to hold hazardus chemicals and solvents. Leftover powdered dyes and dye containers, oily cloths and wash water sludge can contaminate the soil and ground water sources.

Treatment of Waste water :- After every effort that may be made to reduce waste strength and volume, there still remains the problem of desposing the final remains of polluted waste into any water stream, thus the waste may be treated in various method either singly or in combination and the best combination of methods differs from plant to plant. The various type of treatment are as follows.

⇒ Segregation.
⇒ Storage
⇒ Screening
⇒ mechenical filtration.
⇒ pre-aeration and post-aeration.
⇒ Neutralization
⇒ chemical precipitation
⇒ chemical oxidation
⇒ Biological oxidation.

Reducing air pollution:-

Some steps to reduce the emissions to air include:-

⇒ Decreasing emmision of organic solvents by changing to Water based products
⇒ using scrubbers to collect particulate matter
⇒ optimising boiler operations to reduce the emmisions of nitrous and Sulphar oxides.
⇒ pre-screening chemicals using the material Safty data sheets to ensure that chemical are not toxic.
⇒ Identifying sources of air pollution and quantifying emmission.

⇒ Designing and manufacturing products that do not produce toxic or hazardous air pollutents.

⇒ Avoiding fugitive air emmision from chemical spills through Improved work.

Reducing Solid - Waste :-

⇒ Reducing the amount of packaging material By improved purchasing practices such as ordering raw materials in Bulk or returnable intermediate bulk containers (IBCs). This reduce spill bags, handling costs.

⇒ purchasing chemicals in returnable drums.

⇒ purchasing yarn on reusable plastic cones rather than cardboard cones.

⇒ Reducing seam Waste through effective training programme.

⇒ Selling Waste fibers, sweeps, rags, yarn and cloth scraps.