



## Chapter 11

# Effluent Treatment and Dairy Plant Waste Disposal

### Objective

*The purpose of this chapter is to provide knowledge about effluent treatment plant*

### Introduction

Conventionally, the dairy and food processing industry has been a large water user. Water is used in the milk processing plant for processing, cleaning etc. The waste water generated from any industry is known as effluent. Environmental pollution by food or related industries via effluent discharge has become a threat to plants and animals. It pollutes ground water and water resources. Therefore effluent has to be treated before it leaves the plant.

**Effluent:** *The waste water generated from any industry is known as effluent.*

**Sewage:** *Sewage is a water-carried waste, in solution or suspension and is also known as wastewater*

### Principle

Effluent is the wastewater and sewage that flows out from any processing plant. Effluent refers to waste which may consist one or more of the following:



- Wastewater from milk processing plant due to washing of equipments, cleaning of floors etc.
- Biological waste from milk, cream, product spillage etc
- Chemicals, cleaning solutions etc.
- Lubrication oil, grease etc
- Other organic waste

Dairy processing units handle large volumes of milk, and the major waste material from processing is water. The volume of effluent may vary from 1.5-10 litres of milk processed depending upon the product manufactured. Untreated effluent will cause pollution if it is discharged into the drainage system, wastewater or river. Environment and pollution control agencies have issued mandatory guidelines for treatment of effluent before it is discharged from the plant site.

## Methods

Effluent is normally treated by a combination of physical-chemical and biological operations. However, it is possible to treat waste waters solely with physical-chemical methods.

- Physical methods:** Some of the physical methods used for effluent treatment are screening, sedimentation, filtration etc
- Chemical methods:** Chemicals are added to change the properties of effluent. Lime or ion exchange is used for softening. If the effluent is acidic or alkaline, it has to be treated to adjust the pH. Limestone is generally used for neutralization of acidic waste water and sulphuric acid is commonly used for alkaline waste water.
- Biological methods:** Biological treatment is an important and integral part of any wastewater treatment plant that treats wastewater having soluble organic impurities. Biological methods can be further classified as:
  - Aerobic treatment:** Microbial treatment of effluent takes place in the presence of oxygen. In the aerobic treatment process, aerobic microorganisms use free oxygen to assimilate organic impurities and convert them into carbon dioxide, water and biomass.

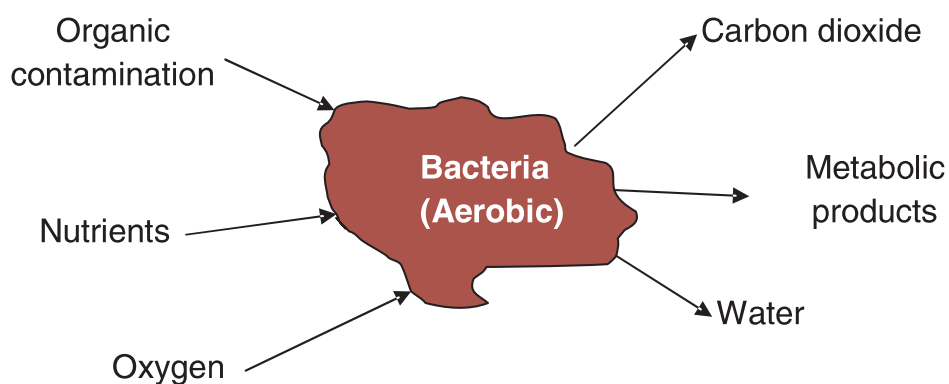


**Aerobic microorganisms:**

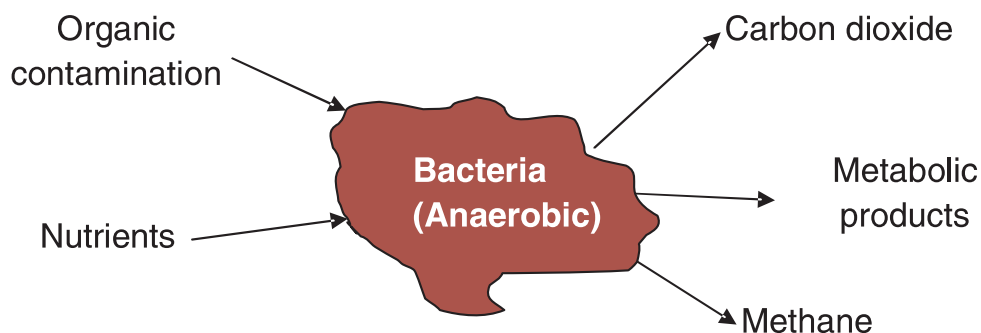
*An aerobic organism or aerobe is an organism that can survive and grow in an oxygenated environment.*

**Anaerobic microorganisms:**

*An anaerobic organism or anaerobe is any organism that does not require oxygen for growth.*



**a. Aerobic bacteria**



**b. Anaerobic bacteria**

**Fig.11.1. Difference between aerobic and anaerobic microorganism**

- ii. **Anaerobic treatment:** Microbial treatment of effluent takes place in the absence of oxygen. In this treatment anaerobic microorganisms assimilate organic impurities in the absence of oxygen. The end products of in this treatment are methane, carbon dioxide gas and biomass.



## Equipments

Effluent treatment plant (ETP) is designed on the basis of volume and nature of effluent generated by the processing plant. A general design of ETP for dairy processing plant is shown in fig.11.2.

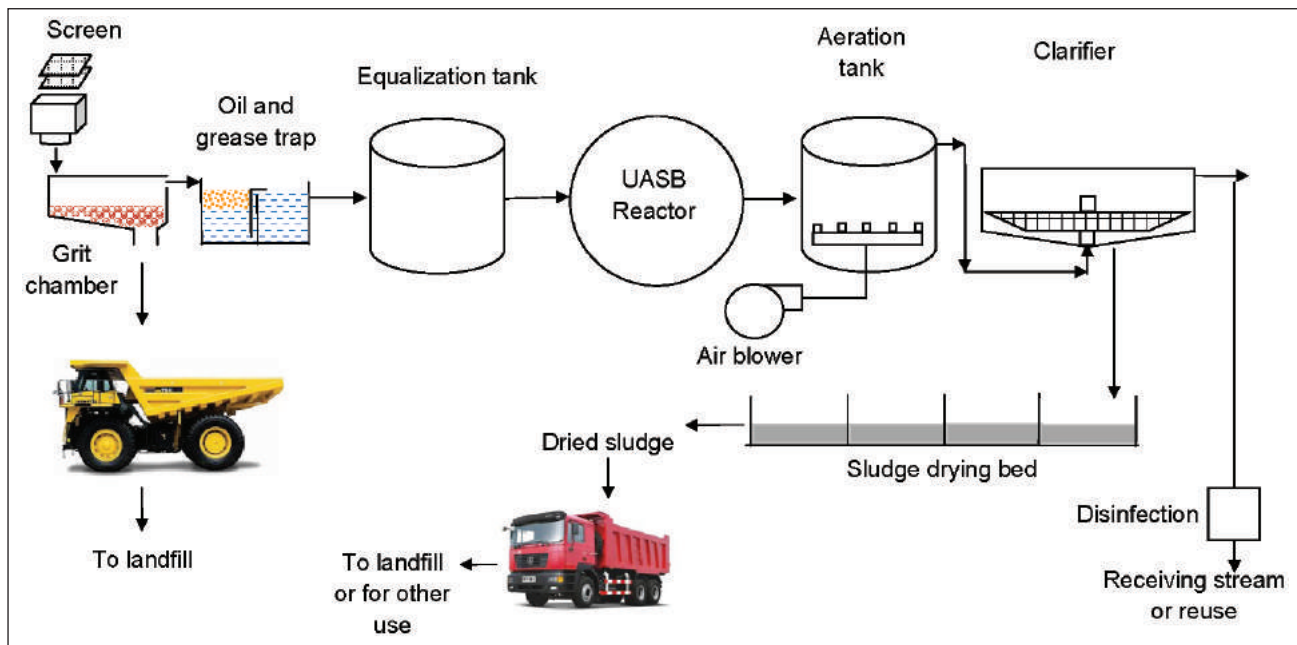


Fig.11.2. General design of effluent treatment plant



Fig.11.3. Effluent treatment plant



## ETP comprises of the following components:

|                             |                                                                                                                                                                                                                                                                                                                                                                              |
|-----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Screen:</b>              | For removal of large size solids like packaging material, spare parts etc from the effluent while it passes through the screen.                                                                                                                                                                                                                                              |
| <b>Grease and oil trap:</b> | Removes the grease and oil floating on the surface of the effluent stream.                                                                                                                                                                                                                                                                                                   |
| <b>Equalization tank:</b>   | Collects and equalizes the raw effluent. The flow of effluent from the processing plant varies during the 24 hour operation period. The quality and properties may varies. ETP is designed for a particular flow rate and nature of incoming effluent. Therefore equalization tank is required to mix the effluent and to maintain a constant feed rate to treatment plant.  |
| <b>UASB reactor:</b>        | Upflow anaerobic sludge blanket (UASB) reactor is a form of anaerobic digester that is used in the treatment of wastewater.                                                                                                                                                                                                                                                  |
| <b>Aeration tank:</b>       | Air is pumped into the tank which provides oxygen and aids in mixing. In presence of oxygen, aerobic bacteria oxidize and degrade the organic matter present in dissolved or suspended form.                                                                                                                                                                                 |
| <b>Clarification tank:</b>  | The suspended solids are separated in the clarification tank. Separates suspended biological material. The wet sludge is conveyed to the sludge drying bed.                                                                                                                                                                                                                  |
| <b>Sludge drying bed:</b>   | Drying bed consists of 20-30 cm bed of sand and has drainage system beneath the sand layer. Sludge is distributed over the sand bed and is left to dry under sun. Drying is accomplished by evaporation and drainage of excess water over a period of several weeks depending on climatic conditions. The dried sludge is removed from the bed and may be used as land fill. |
| <b>Disinfection unit:</b>   | At disinfecting stage, chlorine or similar disinfectant is mixed with the water stream to reduce the microbial load. The disinfecting stage is optional, and is used where a sterile effluent is required.                                                                                                                                                                   |



### REVIEW QUESTIONS

1. What is effluent?
2. Why effluent has to be treated before it is discharged from a processing plant.
3. What is the purpose of grit chamber.
4. Why oil/grease trap is used in a effluent treatment plant?
5. List differences between aerobic and anaerobic treatment.
6. What is the purpose of equalization tank?