DAIRY WASTEWATER SOURCES, CHARACTERISTIC &TREATMENT

SOURCES OF WASTEWATER:

1. Processing waters

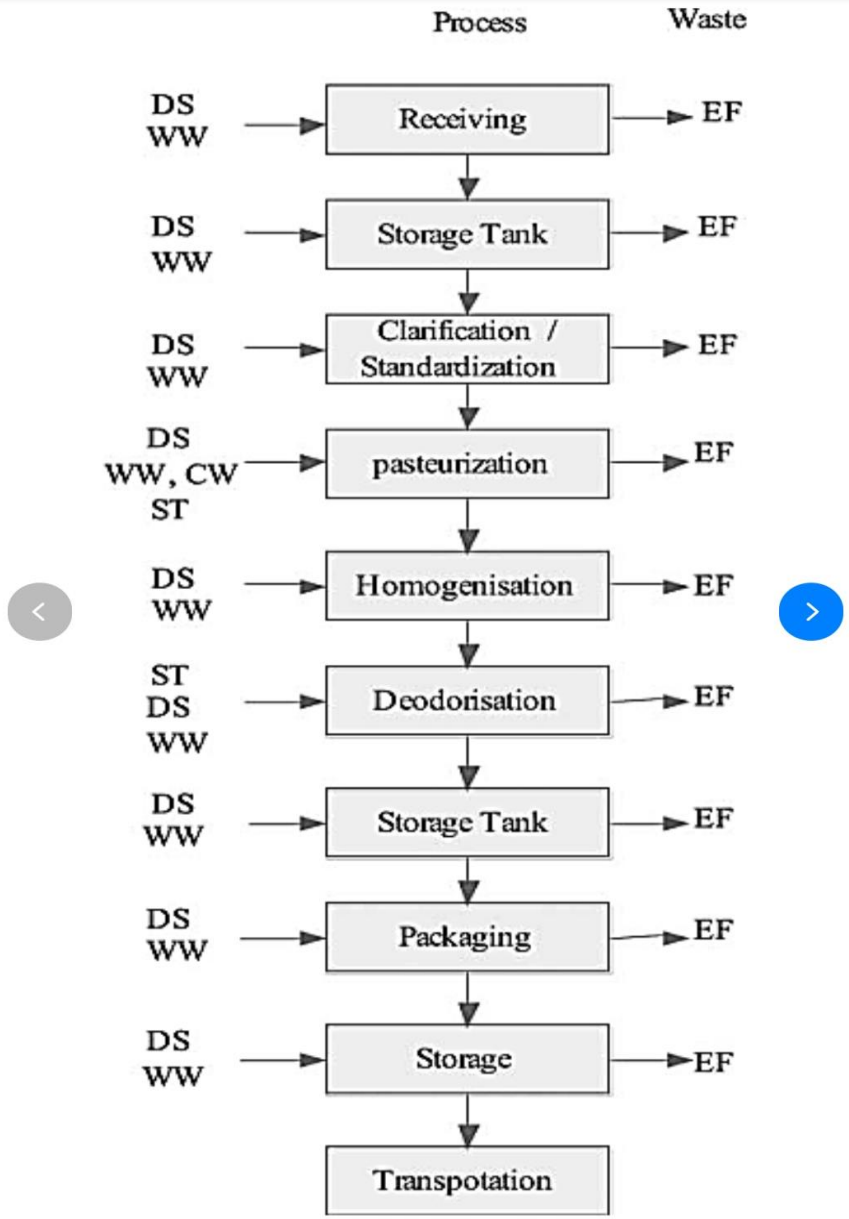
It include water used in the cooling and heating processes. These effluents are normally free of pollutants and require minimum treatment.

2. Cleaning wastewaters

Which emanate mainly from the cleaning of equipment that has been in contact with milk or milk products, this water contain milk, cheese, whey, cream & has high BOD load, require proper treatment.

3. Sanitary wastewater

which is normally piped directly to a sewage works.



Effluent sources from various units of milk processing. DS-Detergents and Sanitizing Agents, WW- Wash Water, ST-Steam, CW-Cooling Water.

CHARACTERISTICS OF DAIRY WASTE

- Dairy effluents contain dissolved sugars proteins and fats and possibly residues of additives.
- The key parameters are biochemical oxygen demand (BOD), with an average ranging from 0.8 to 2.5 kilograms per metric ton (kg/t) of milk in the untreated effluent; chemical oxygen demand (COD), which is normally about 1.5 times the BOD level; total suspended solids, at 100–1,000 milligrams per liter (mg/l); total dissolved solids: phosphorus (10– 100 mg/l), and nitrogen (about 6% of the BOD level).
- Cream, butter, cheese, and whey production are major sources of BOD in wastewater.
- The wastewater may contain pathogens from contaminated materials or production processes.
- Dairy effluents decompose rapidly and deplete the dissolved oxygen level of the receiving streams immediately resulting in anaerobic conditions and the release of a strong foul odour due to nuisance conditions.

CHARACTERISTICS OF DAIRY WASTE

- The casein precipitation from dairy waste decomposes further into a highly odorous black sludge.
- At certain dilutions the dairy waste is found to be toxic for fish and other aquatic living beings and becomes the breeding place for flies and mosquitoes.
- Dairy effluent contains soluble organics, and suspended solids, they degrade to promote the release of gases, and odour, impart colour or turbidity, and promote eutrophication.

Objectives Of treating dairy waste:

- To reduce the organic content of the wastewater.
- To remove or reduce nutrients that could cause pollution of receiving surface waters or groundwater.
- To remove or inactive potential pathogenic micro-organisms or parasites.

Parameters	UNITS	GUIDELINE VALUE
pH	-	4-12
Suspended solids	mg/l	24-5700
BOD5	mg/l	450-4,790
COD	mg/l	80 - 95000
Total nitrogen	mg/l	15-180
Total phosphorus	mg/l	11-160
Oil and grease	mg/l	10
Total coliform bacteria	Mpn/100ml	400
Magnesium	mg/l	25-49
Potassium	mg/l	11-160
Chloride	mg/l	48-469
Calcium	mg/l	57-112

TREATMENT METHODS

- **Primary:**

i. Physical Treatment

- **Secondary:**

i. Biological Treatment
ii. Chemical Treatment
iii. Membrane Method
iv. Electrolytic Method

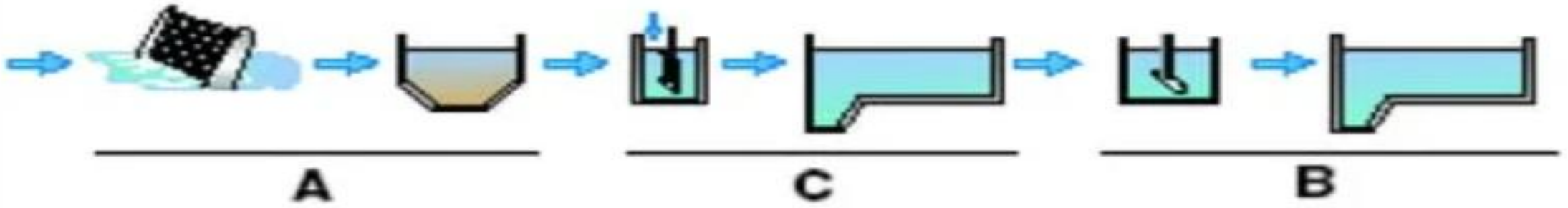
Primary Treatment

Type	Method	Principal pollutants removed
Flotation (e.g. dissolved air flotation)	This treatment separates pollutants by removing solids that rise to the surface due to their lower density, where they can be concentrated and then skimmed off. Temperature can have a major bearing on the efficiency of this process. In most systems the wastewater is pressurised by the addition of air. The very small air bubbles attach to the solids and reduce their density so that they rise.	Suspended solids or oils and grease
Gravity separation/ sedimentation	This treatment separates pollutants with different densities. Some solids, such as oils and grease, float and can be skimmed off; other solids settle to the bottom. In some cases chemicals such as lime or polyelectrolytes are used to help coagulate and agglomerate smaller particles into larger particles, thereby increasing their density and associated settling rates.	Suspended solids or oils and grease

Secondary Treatment

Type	Method	Principal pollutants removed
Anaerobic (e.g. anaerobic ponds and digesters)	This treatment duplicates nature by allowing bacteria in the absence of oxygen to convert high-strength waste organic material into more inert biological cells, carbon dioxide, water and methane. This methane can then be used in the plant as an alternative energy source, depending on the amount that is generated.	BOD
Aerobic (e.g. aerobic ponds, activated sludge and tricking filters)	This provides an environment where bacteria in the presence of oxygen convert low-strength wastewater into more cells (as biomass), water and carbon dioxide. The micro-organisms then settle as sludge in a secondary clarifier or pond. Oxygen needed by the system is usually provided by an artificial aeration system. In the case of aerobic filter treatments the micro-organisms grow on filter media as wastewater trickles over the surface medium.	BOD

Aerobic Process of Treatment

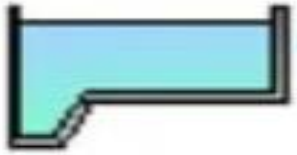


Pre-precipitation A, in the first stage, which results in high-grade phosphorus reduction as well as about 70% BOD reduction. This relieves the load on the biological stage, B, which thus requires much less basin volume and energy input than with conventional post-sedimentation.


Grid


Sand trap


Chemical treatment


Sedimentation


Aeration

ANAEROBIC PROCESS OF TREATMENT

- Conventional Anaerobic Digester
- Anaerobic Contact Digester
- Anaerobic Fixed Film Reactor
- Up flow Anaerobic Sludge Blanket
- Two Phase / Hybrid Reactor
- Combined - Anaerobic & Aerobic Process

Chemical Treatment

- It can reduce COD by 78% and BOD by 84%.

Membrane Method:

- It can reclaim Valuable milk solids or chemicals for resale, reuse or less expensive method.

Electrolytic Method

Miscellaneous and Modified Method

Biological Treatment Technique	Advantages	Disadvantages
Activated Sludge Process	1)Aeration Provided via atmosphere 2)Cost Efficient	1)Bulking of Sludge 2)Quantity of sludge to be regulated
Upflow fixed film Anaerobic Reactor	Eliminates mechanical mixing	Anaerobic atmosphere is difficult to maintain at low cost
Hybrid Upflow anaerobic Sludge Blanket	Very High COD Removal	High Cost of Equipment and Process
Rotating Biological Contractor	1)Aeration through atmosphere 2)Based on the principle ASP and Trickling Filters	Large Area is required for working

BIOLOGICAL TREATMENT

	Aerobic	Anaerobic
Applicability	low strength:	low, medium and high strength:
(BOD, mg/l)	(100 - 2000 mg/l)	(250 - > 100.000 mg/l)
BOD-removal:	93-99%	90%
NH_3-conversion:	95%	low
NO_3-removal:	90%*	high

Tertiary Treatment (Optional)

- Tertiary and/or advanced wastewater treatment is employed when specific wastewater constituents which cannot be removed by secondary treatment must be removed.
- Individual treatment processes are necessary to remove nitrogen, phosphorus, additional suspended solids, refractory organics, heavy metals and dissolved solids.
- Tertiary Treatment Process are-

- De-chlorination and disinfection
- Reverse Osmosis
- Ion Exchange

TERTIARY

Type	Method	Effect of treatment
Chemical precipitation/ suspended solids	The use of a chemical agent and coagulants causes dissolved and suspended substances to precipitate out of solution.	Removal of BOD, fats and solids, salts, lime, ferric chloride, sulfides.
Membrane	A membrane allows specific types of substances to pass through while retaining others. Membranes are categorised according to size:	Removal of:
	Microfiltration	solids and oils from liquids and slurries
	Ultrafiltration	solutes from solids, colloids, emulsions and macromolecules; fats and solids
	Nanofiltration	water from water solute mixture
	Reverse osmosis (smallest pore size)	water from water solute mixture.
Centrifugation	Centrifugal force causes components to flow outwards.	Separation of oil and water and large particles.
Evaporation	Uses heat, sometimes with a reduction in pressure to vaporise components from a liquid.	Removal of inorganic salts.
Distillation	Uses differences in volatility between the components of a liquid.	Separation of solvent mixtures and volatile organic compounds.
Filtration	Water moves through filter beds and screens, which remove substances.	Reduction of suspended solids or oils and grease.
Ultraviolet disinfection	UV contains energy that is absorbed in the DNA of micro-organisms, disrupting reproduction at the cellular level.	Removal of micro-organisms, such as coliform bacteria, viruses, protozoa.
Chlorination	Chlorine is used for disinfection.	Removal of pathogenic organisms such as bacteria, viruses and protozoa.
Carbon absorption	Carbon removes refractory organic compounds.	Removal of tannins, lignins and ethers.
Ion exchange	Water is demineralised.	Removal of ammonia, phosphate, nitrates, calcium.

THANK YOU