

Introduction to Wastewater Treatment



Agenda

1. Wastewater treatment

2. Treatment method

3. Zero liquid discharge

4. Conclusion

1. Wastewater Treatment

Wastewater from dairy industries is one that has complex characteristics and is considered a challenge for environmental engineers in terms of treatment as well as utilization.



A significantly large volume of waste is generated from dairy industries and contains a high amount of pollution load, particularly in terms of suspended solids, organic matter etc. Dairy industry wastewater are produced mainly by cleaning process.

EFFLUENT CHARACTERISTIC OF DAIRY PLANT

The effluent characteristics from a typical Dairy plant are presented in Table:

Parameter (Mg/ltr)	Milk Processing	Integrated Dairy	Chilling Plant
BOD	657-1,016	1,634-4,953	55-5,034
COD	1,341-2,195	3,800-8,631	121-6,877
Suspended solids	538-657	89-4,953	36-899
Nitrogen	50.25	96.32	49.25-72.5
Fat	-	100-6,070	-
Phosphorus	2.6-4.8	0.3-0.8	0.14-0.2
Chloride	-	104	-
pH	6.6-6.9	5.6-6.8	2.9-10.7
Oil & Grease	-	280-2,207	5-176

2. Treatment Method



Treatment of dairy industry wastewater requires a process that combines mechanical, chemical, and biological treatment measures.



Screening, Grit removal, flow equalization, sedimentation or dissolved air flotation are used to reduced suspended solid load from dairy effluent.



Biological treatment methods are applied for Reduction of soluble organic matter and disinfection.

2.1 Wastewater treatment in dairy factory

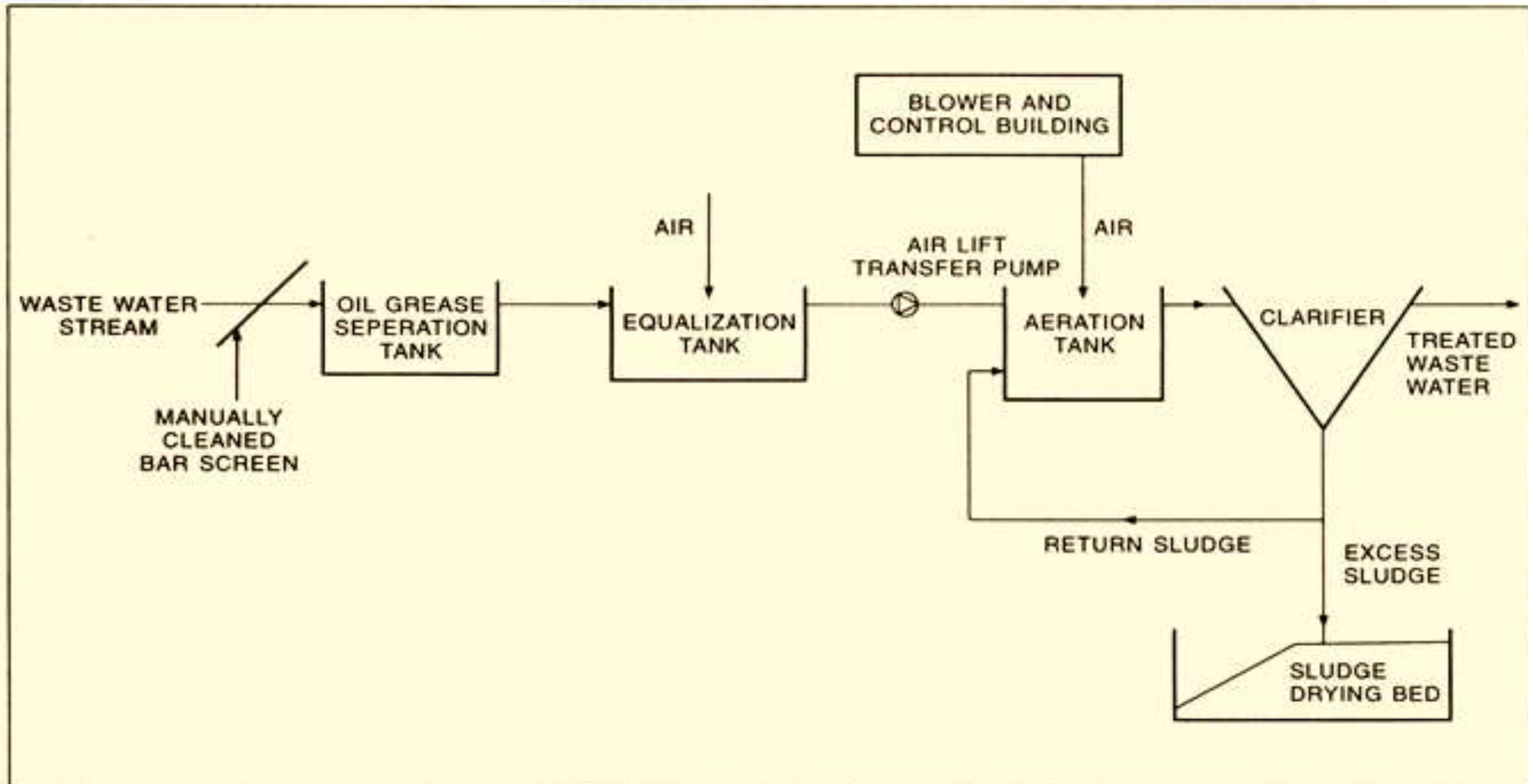
The pollution load from Dairy can also be reduced with better water by using the following biological treatment (anaerobic and aerobic).

The conventional system of treating wastewater is by Activated Sludge Process (ASP) from various units of a dairy plant. The various units include Bar Screen, Skimming Tank, Equalization Basin, Aeration Unit, Clarifier, and Sludge Drying Beds.

Treatment method :

1. Anaerobic Lagoon Technique.
2. Anaerobic Digestion.
3. SBR
4. MBBR
5. Up-flow Anaerobic Sludge Blanket (UASB).
6. Up flow Blanket Filter (UBF).
7. Aerobic Bioconversion.

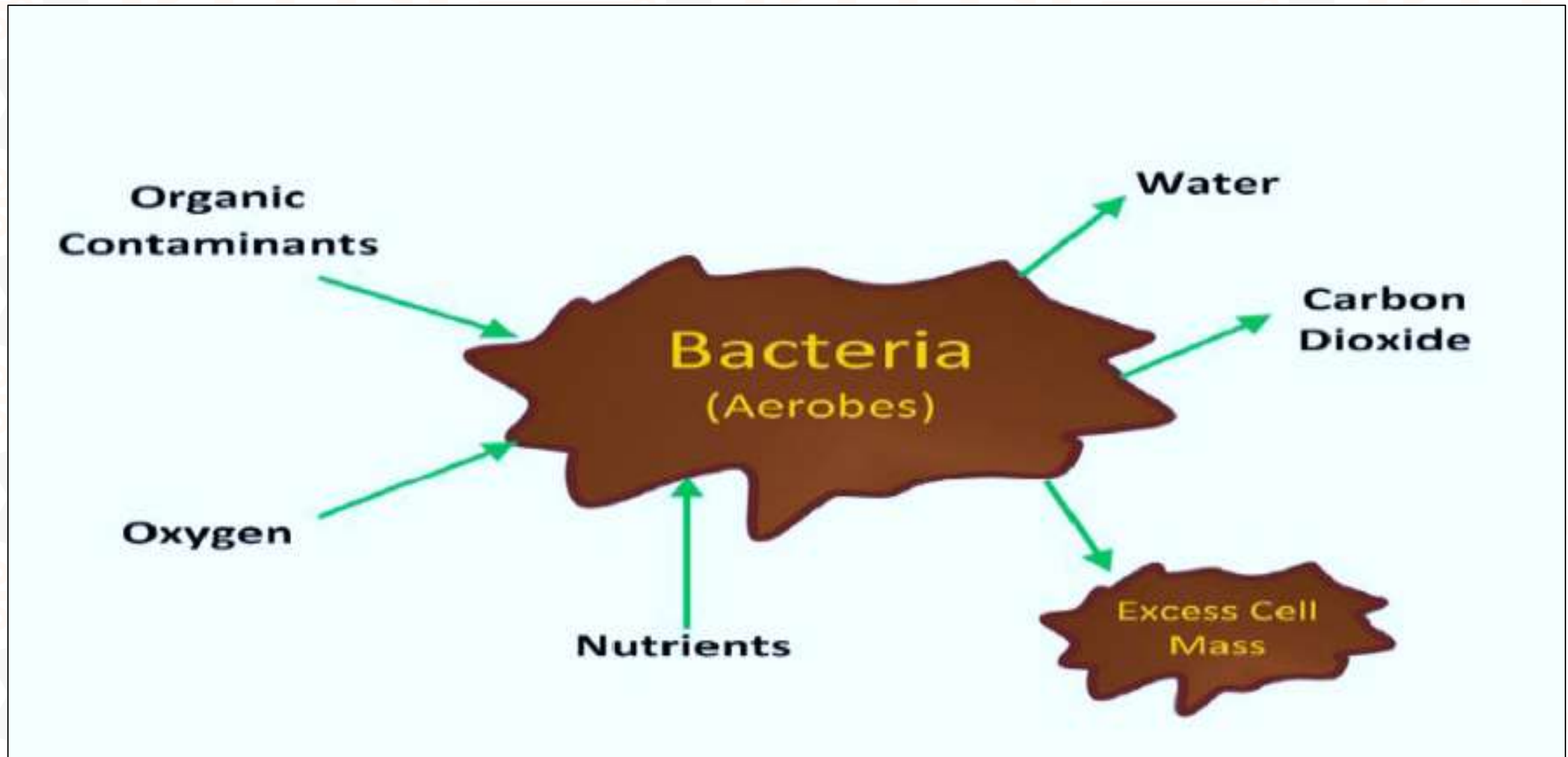
Activated sludge process



2.2 Aerobic Process

- It generally involves the degradation of organic in the presence of oxygen. Conventional treatment indulges activated sludge, **trickling filter**, and aerated lagoons





Aerobes present in Biological treatment

2.3 Anaerobic process

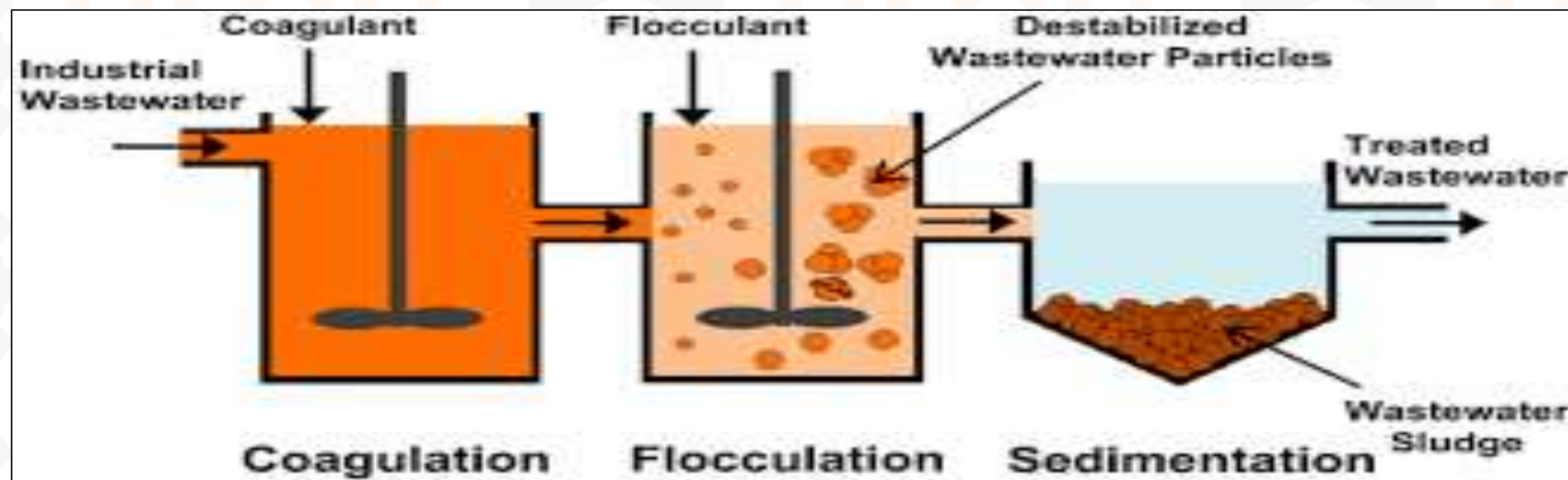
Anaerobic treatment is also widely used in sugar manufacturing industry for wastewater treatment.

It has so many disadvantage over aerobic process which include the lesser energy required , lesser sludge production which indirectly reduces sludge disposal cost.

3. Physico-chemical method

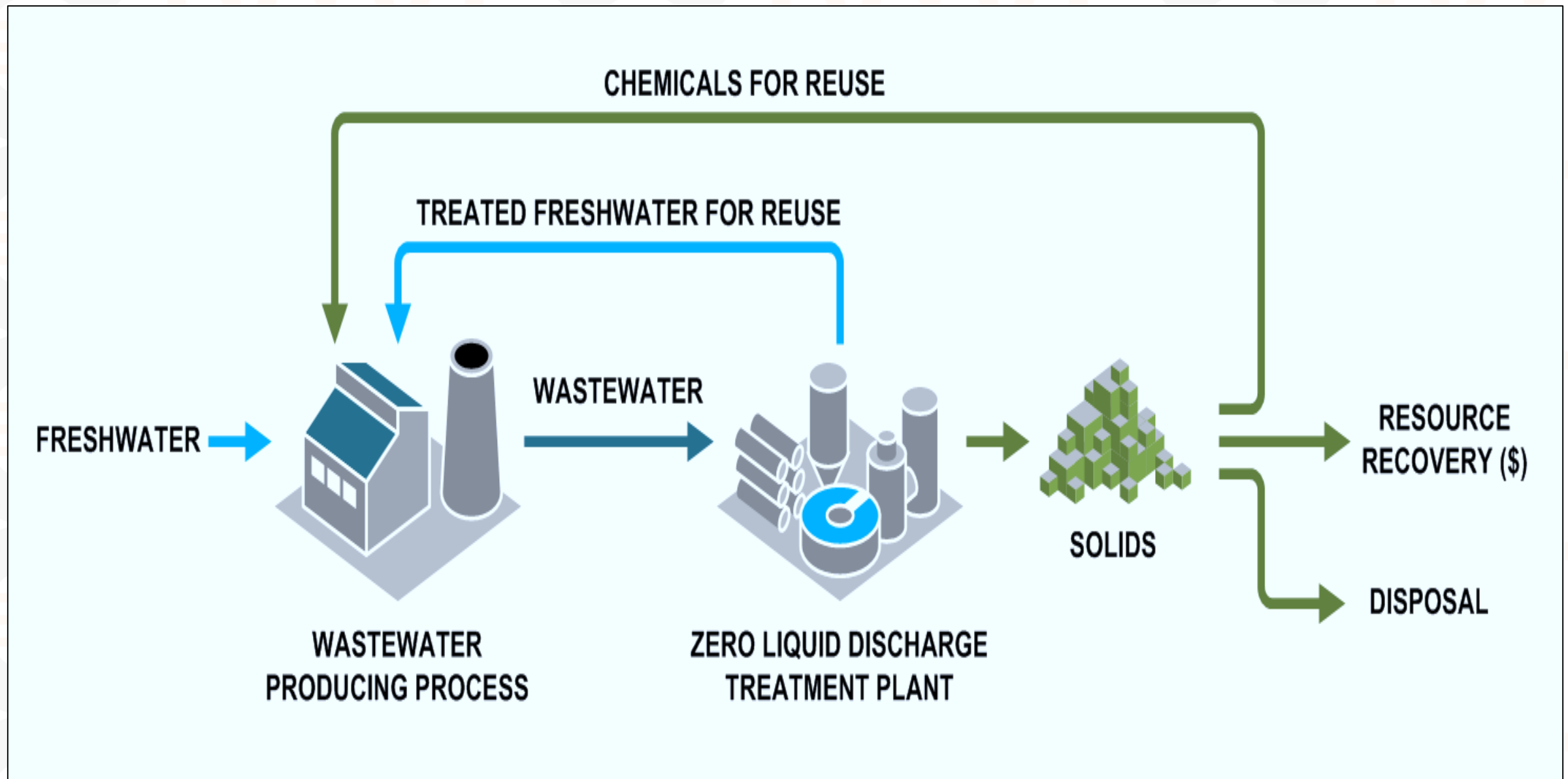
- Physico chemical treatment involves using chemicals which can modify the physical state of colloidal particles which helps in making them more stable and coagulable for further treatment or filtration purposes.
- Physico-chemical treatment involves a set of processes which may be consecutively performed in a single unit or in separate units. These processes are coagulation, flocculation and sedimentation.
- **Coagulation** process is integral to neutralizing the charges (usually negative) on the colloid surfaces by the addition of coagulant while rapidly mixing of wastewater. Ferric chloride, aluminium polychloride, are some of the commonly used coagulants.

- **Flocculation** involves the grouping of previously formed flocs or clumps during slow mixing process. This helps in flocs gaining larger volumes and density which will eventually prepare them for sedimentation.
- Total suspended solids, **biological oxygen demand (BOD)**, **chemical oxygen demand (COD)**, nutrients such as nitrogen and phosphorus, heavy metals, can be successfully removed from wastewater in varying percentages using Physico-chemical treatment.



4. Zero Liquid Discharge (ZLD)

- **Zero Liquid Discharge (ZLD)** is a treatment process designed to remove all liquid waste from a system. The focus of ZLD is to reduce wastewater economically and produce clean water that is suitable for reuse (irrigation), thereby saving money and being beneficial to the environment.
- Zero discharge system is meant to treat effluent water in such a manner that water has no TDS (total dissolved solids) and is free from any impurities. But practically this is not correct since some TDS (total dissolved solid) will be always available in wastewater after the effluent treatment process.
- *Therefore, the main aim is to recover usable materials such as water and salt from effluent, and; minimize the generation of waste so that it can be safely stored on-site without the need for discharge into the environment it can be reused also.*



Zero liquid discharge

5. Conclusion

1. The dairy industry is among the most polluting industries as it produces large volume of wastewater that may adversely affect the environment if discharged untreated.
2. Dairy wastewater is characterized by high COD, BOD and nutrient levels.
3. Wastewater can be treated by some Physico-chemical method and biological oxidation methods such as trickling filters, rotating biological contactor (RBC), and activated sludge.
4. Compact solutions Such as zero liquid discharge treats wastewater from industrial processes and recover valuable products during recycling operations. Materials are efficiently removed from the water, or wet material, and reduced to solid waste that can be sold, reused, or more efficiently disposed of.

Reference

1. https://www.researchgate.net/publication/332183222_Wastewater_Treatment_Methodologies_Review_Article
2. <https://www.britannica.com/technology/wastewater-treatment>
3. <https://neoakruthi.com/blog/waste-water-treatment-methods.html>
4. https://web.iitd.ac.in/~arunku/files/CVL100_Y16/LecSep1220.pdf

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