# Sewage Treatment

## Unit-III

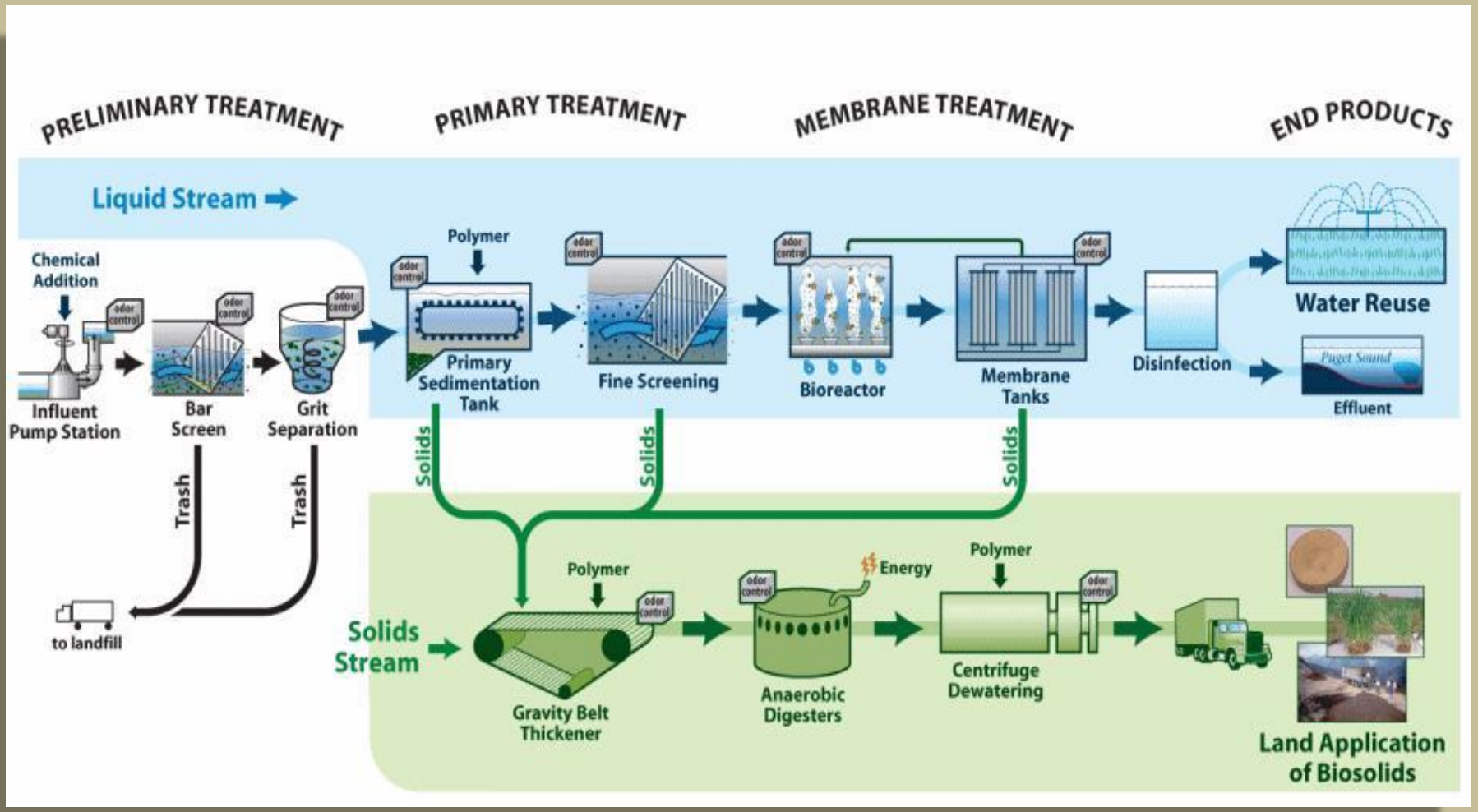
# Unit Operations

- **The Treatment of wastewater depends upon the impurities present**. The impurities present are **Physical, Chemical & Biological** and accordingly the treatment given are **physical, chemical & biological treatments.**

# Sewage Treatment

| Sr. No. | Type of Treatment | Type of Treatment Unit | Name of the Units | Function Type of Impurity Removed. |
|---|---|---|---|---|
| 1 | Physical Treatment | Physical | Screens | Large Suspended and Floating Matter |
| | | Physical | Grit Chamber | Grit |
| | | Physical | Clarifiers | Silt, Sand & Other heavier Matter |
| 2 | Chemical Treatment | Chemical | Chemical Reactors | Dissolved Chemicals |
| 3 | Biological Treatment | Biological | Trickling filter<br>Activated Sludge<br>Rotating Biological Contractors<br>Digesters | Dissolved Organic Chemicals |

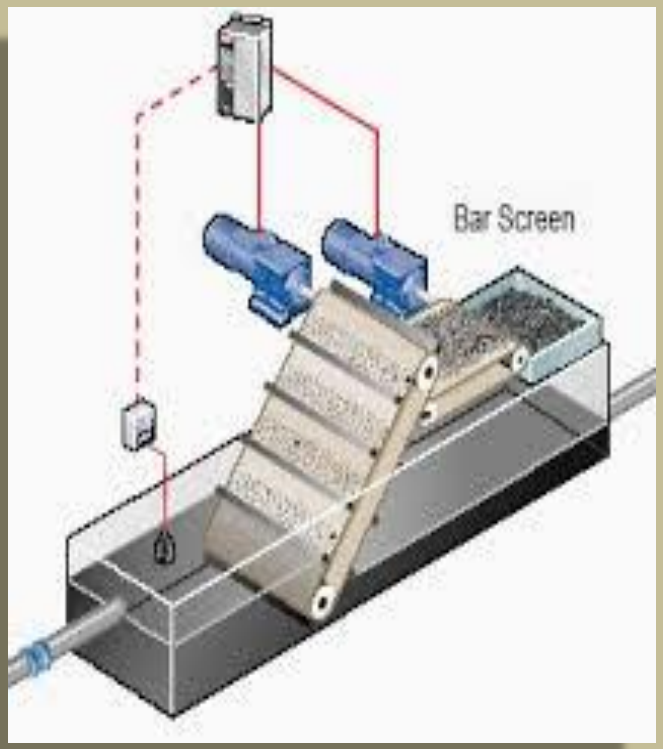
# Sewage Treatment Plant



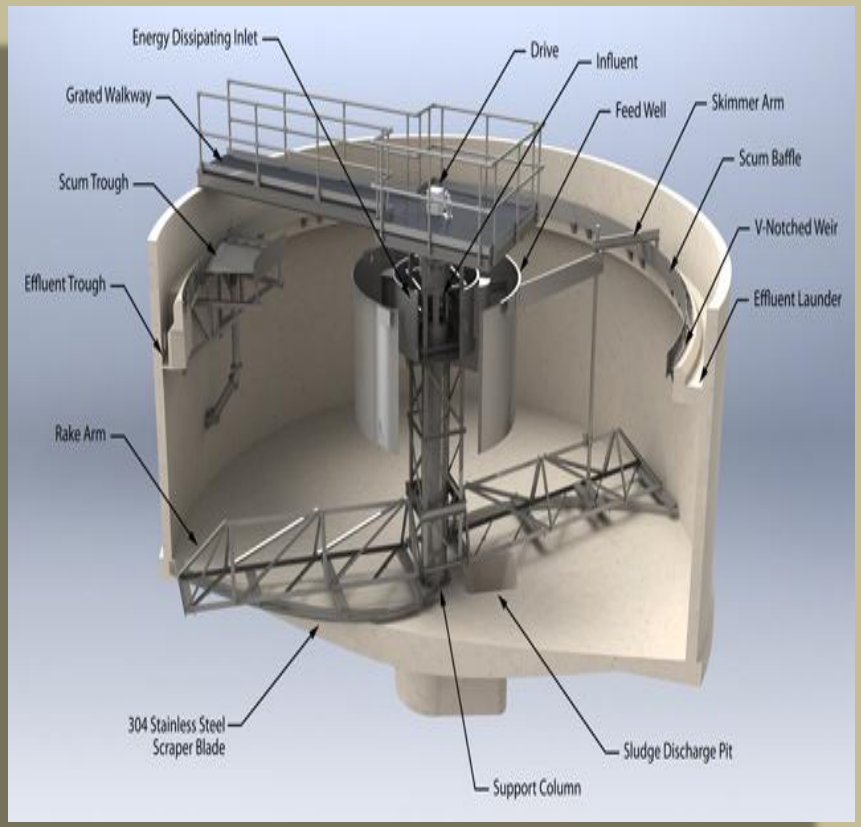
# Sewage Treatment

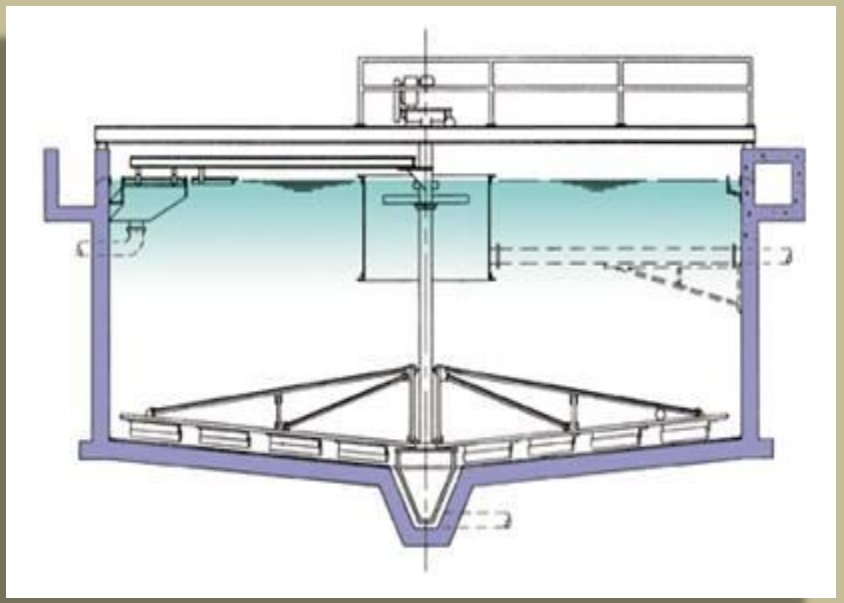
- In the above table the **Screen, Clarifiers, grit chamber are all physical treatment unit** because in all those units the removal of impurities is taking place due to physical processes like **Gravity Settling, Mechanical Straining, etc. Mechanical Straining takes place in screens and gravity Settling takes place in Clarifiers. Clarifiers are also known as Sedimentation Basin or Settling tanks.**

# Screens

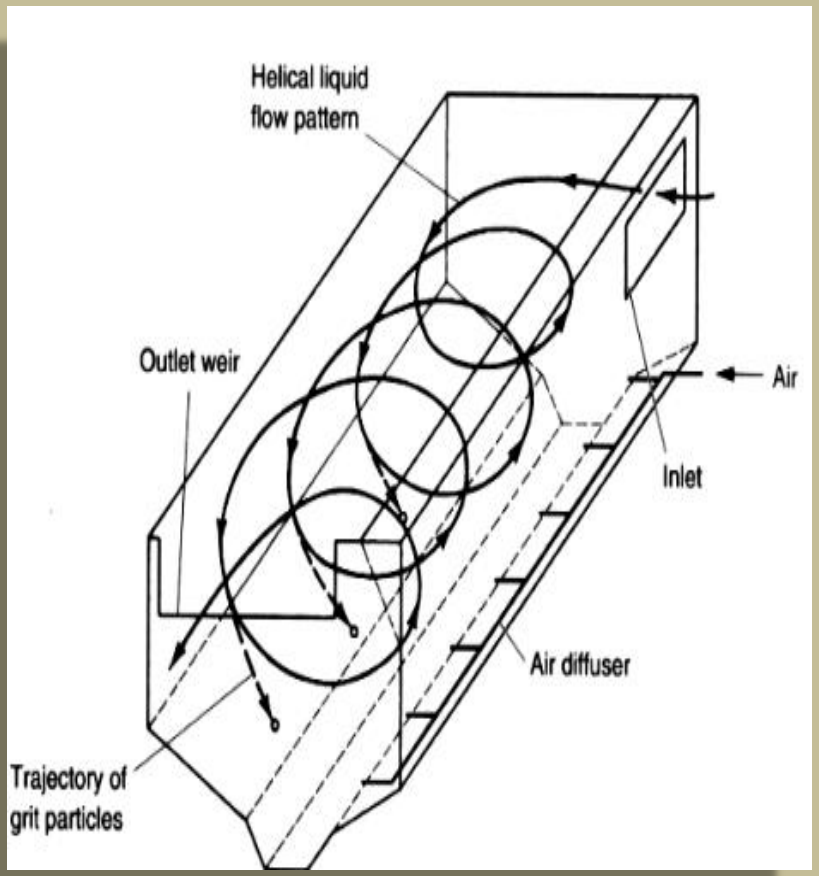


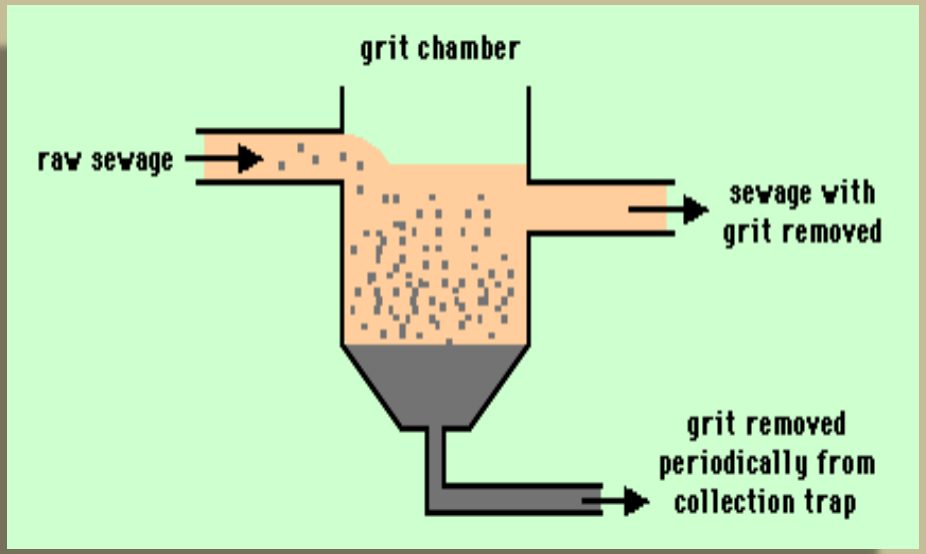

# Clarifiers


Energy Dissipating Inlet
Drive
Influent
Grated Walkway
Feed Well
Skimmer Arm
Scum Baffle
Scum Trough
V-Notched Weir
Effluent Trough
Effluent Launder
Rake Arm
304 Stainless Steel
Scraper Blade
Sludge Discharge Pit
Support Column



# Grit Chamber

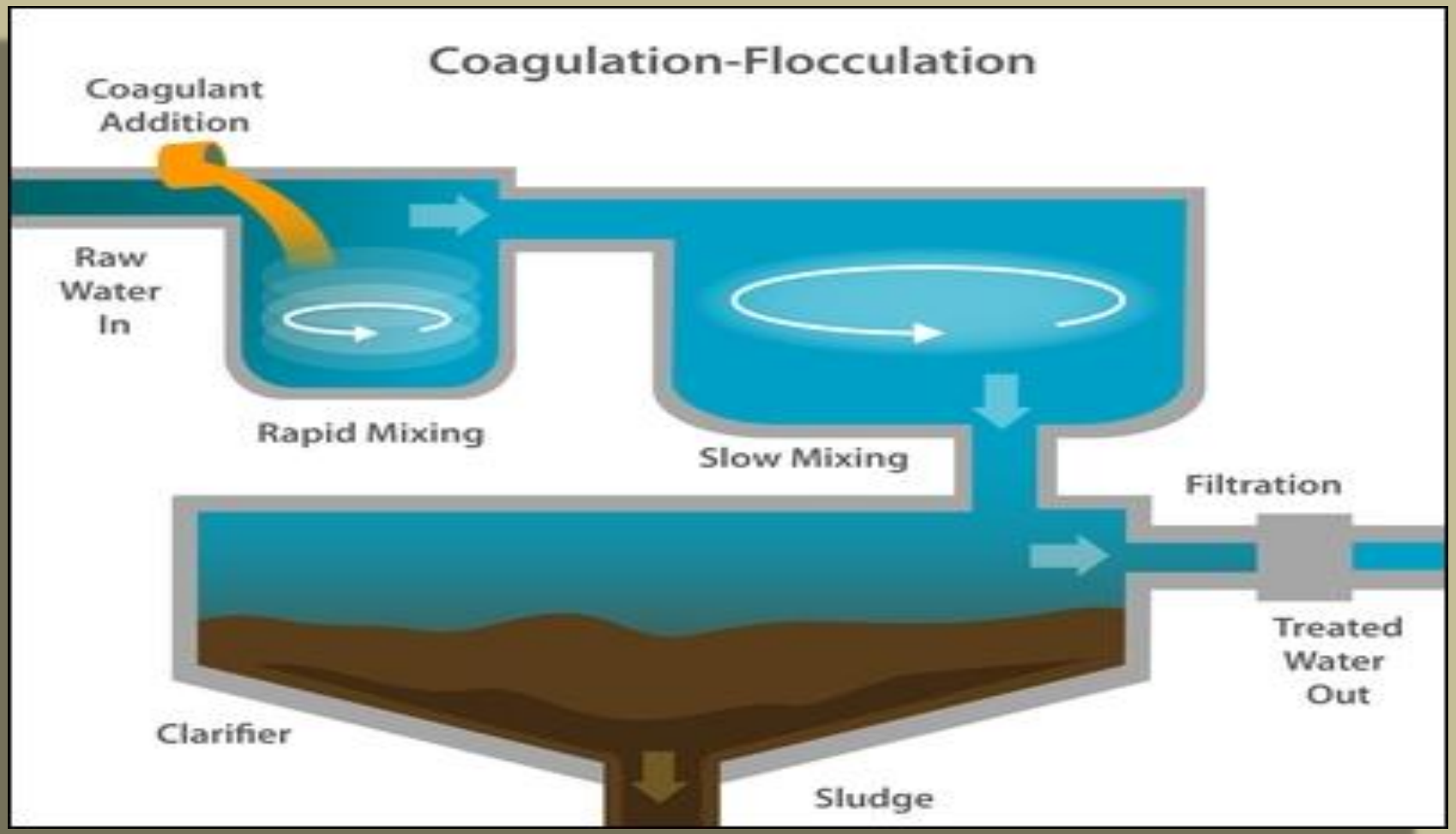


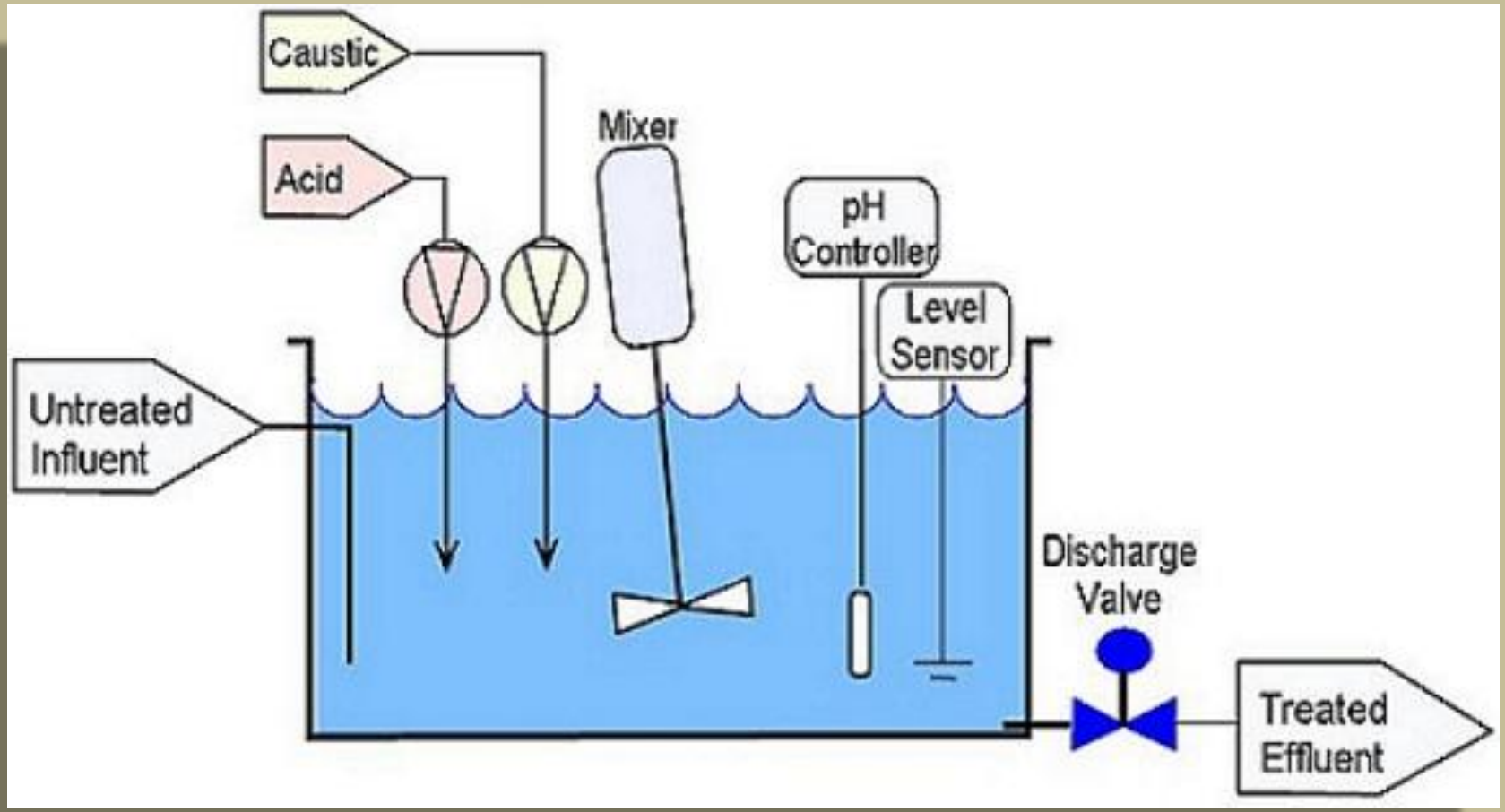
# Sewage Treatment

- **Chemical Treatment of Waste water is normally preferred when the wastewater discharge is very small like that produced by industries**, which contain Chemicals.
- **Chemical Treatment takes place in units which are called reactors**, Chemical treatment of the industrial wastewaters can be achieved from one of the following methods:
- ***Chemical Coagulation***
- ***Chemical Precipitation***
- ***Oxidation & Reduction***
- ***Neutralization***
- ***Ion Exchange***

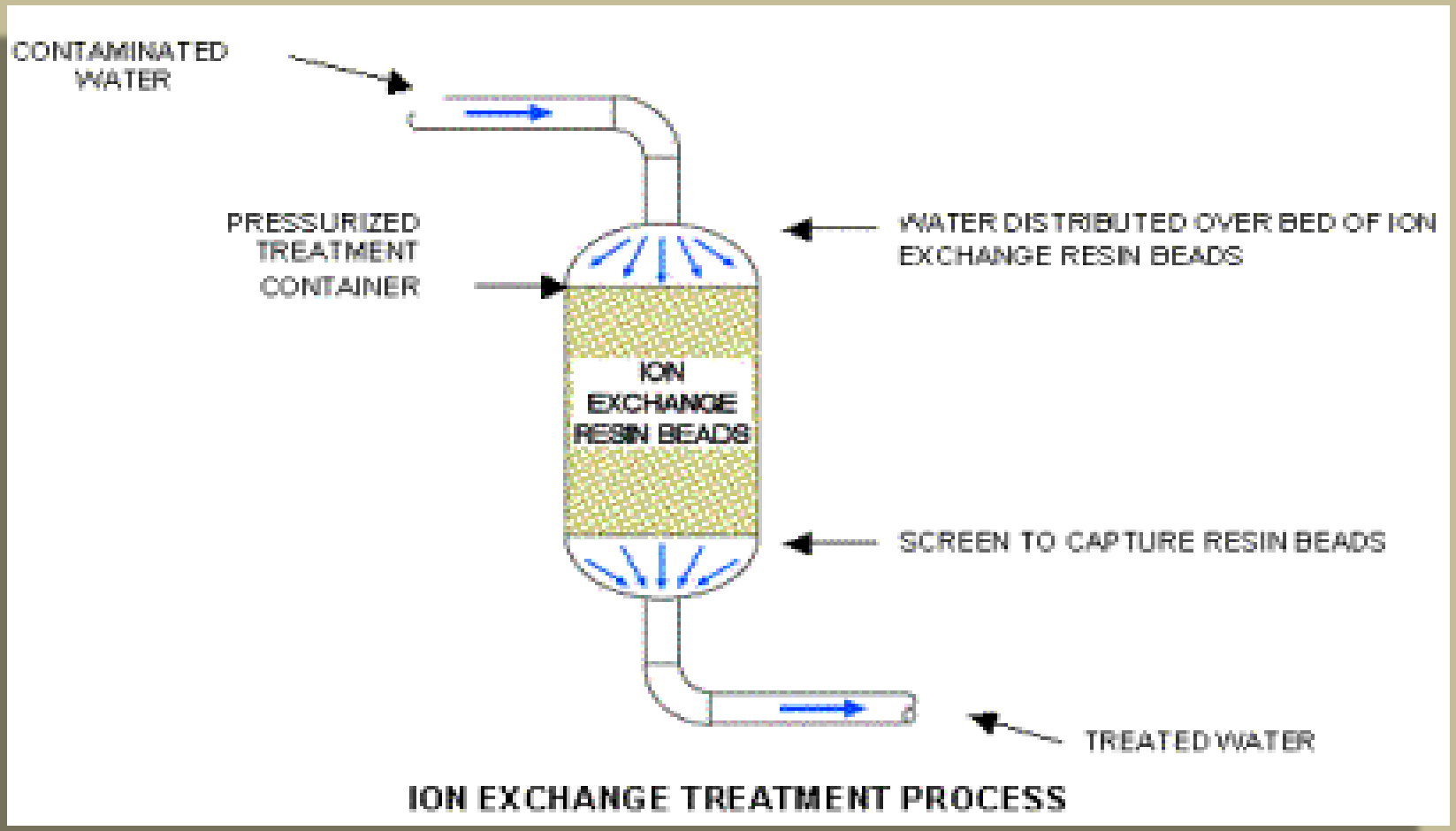
# *Chemical Coagulation*



# *Neutralization*



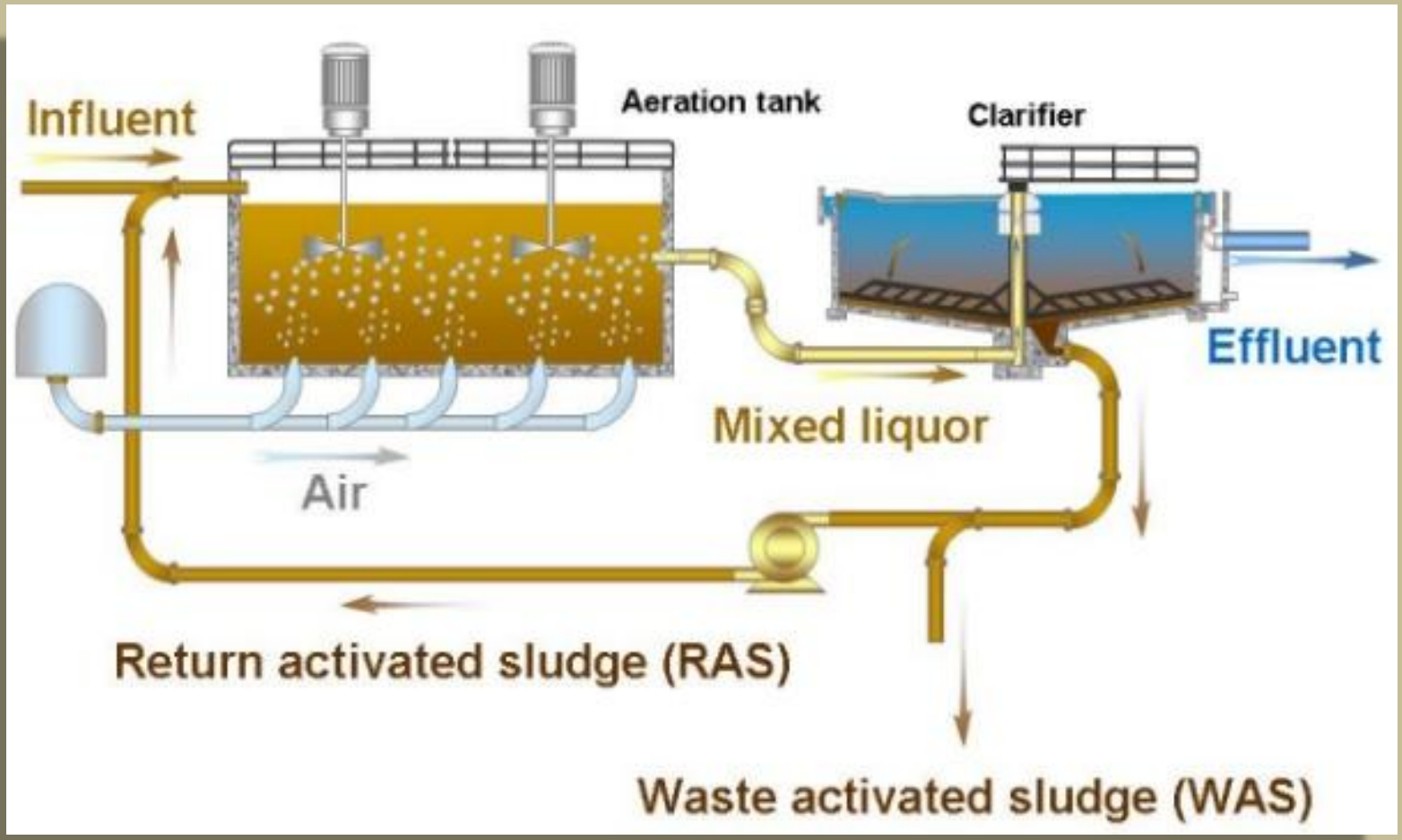
# *Ion Exchange*



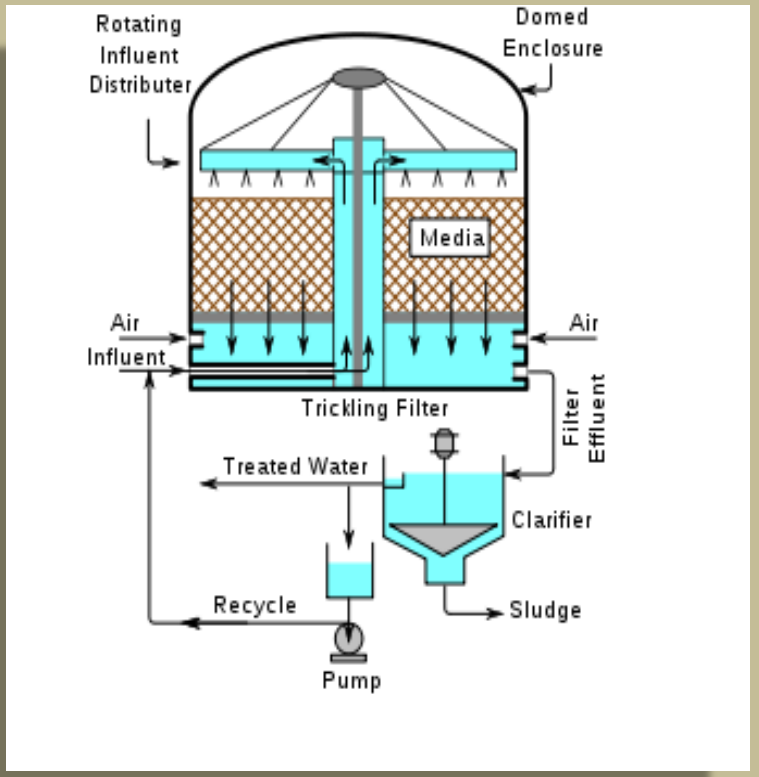
# Sewage Treatment

- **The Biological Treatment fully Utilizes the micro organisms for treatment of the wastewater**.
- **Depending upon the type of microbes** used, the biological treatment is classified as :
- **Aerobic Treatment Using aerobic Organisms**: The example of the treatment units are Activated Sludge Plant, Trickling Filter, Rotating Biological Contactors, Oxidation ponds, etc.
- **Anaerobic Treatment:** Anaerobic treatment uses the aerobic microbes. The example of anaerobic treatment units are sludge digesters etc.

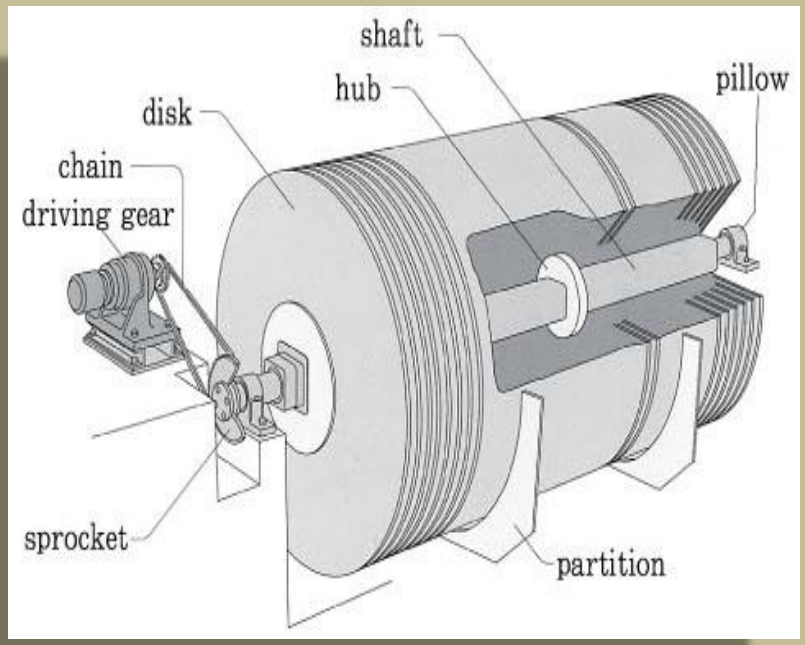
# Activated Sludge Plant



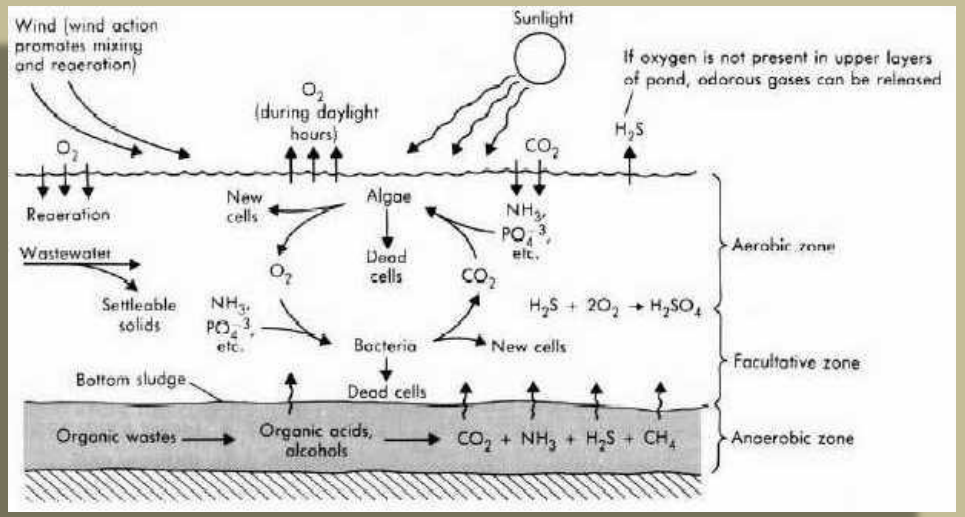
# Trickling Filters



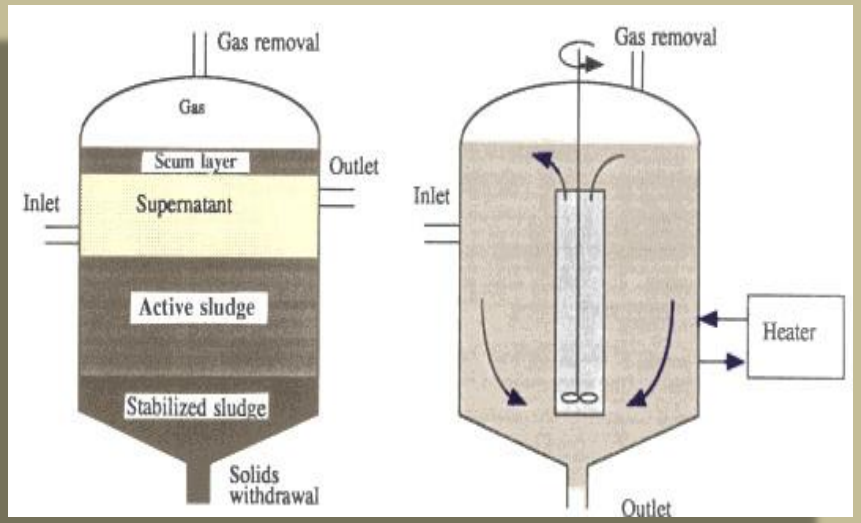
# Rotating Biological Contactors



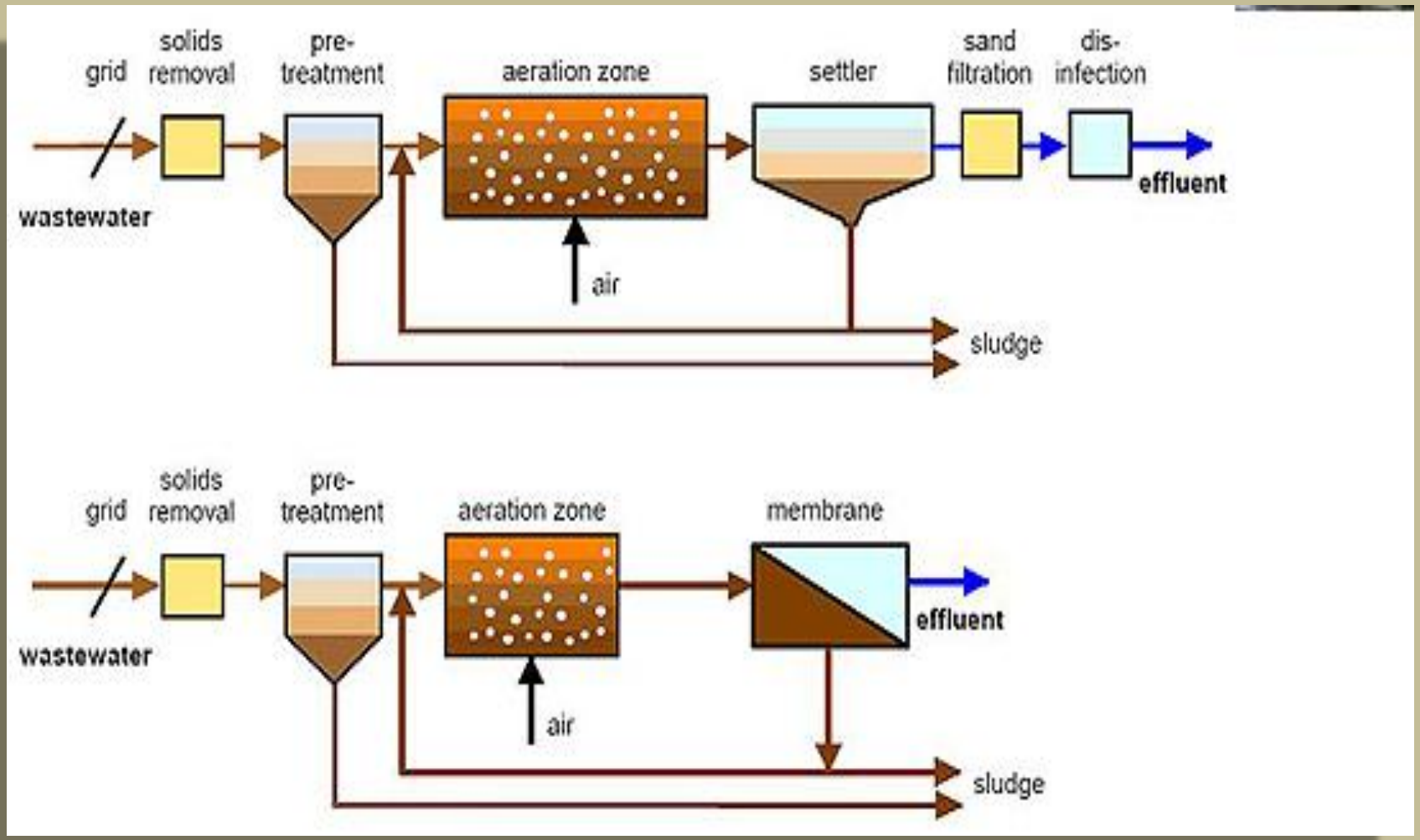
# Oxidation Ponds



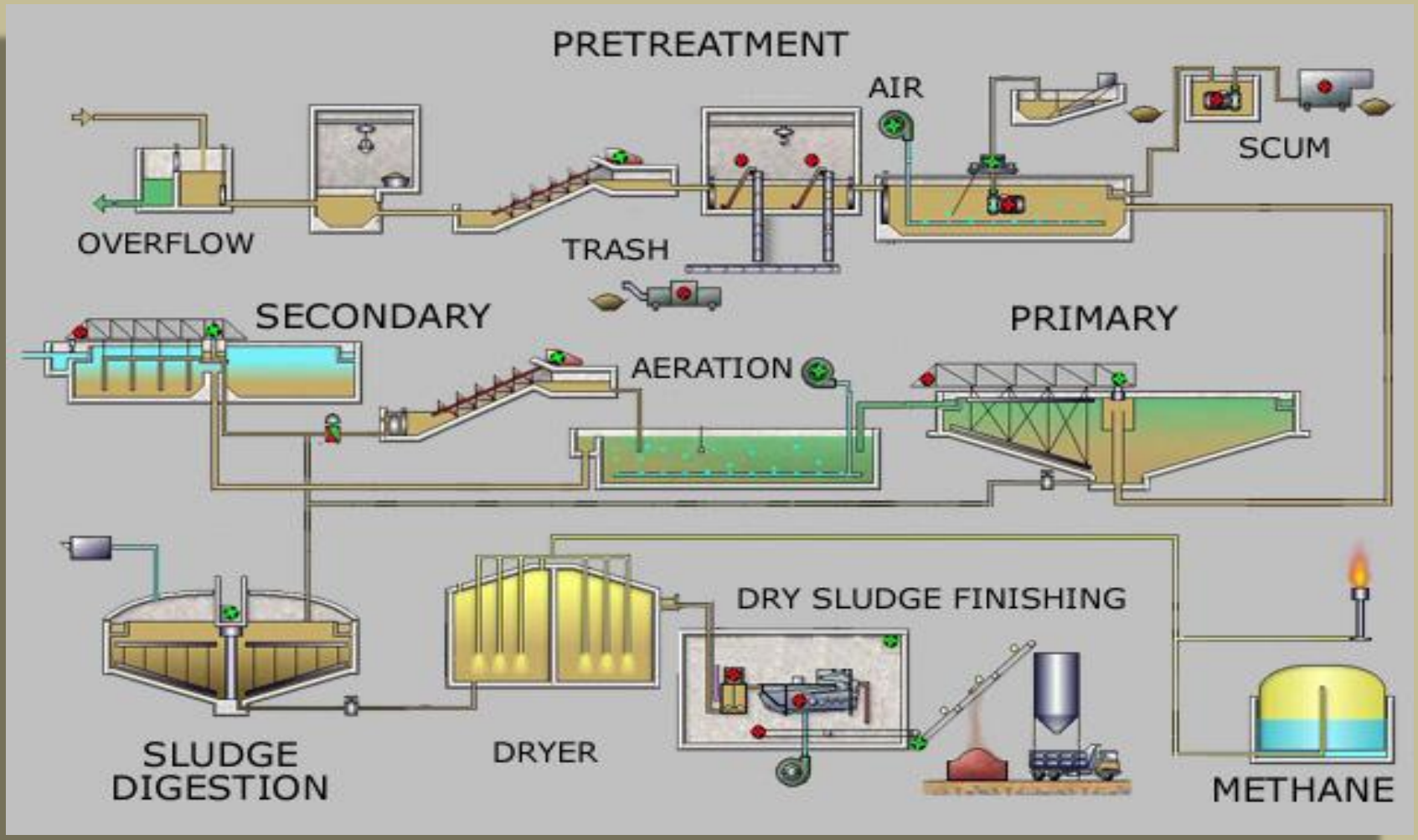
# Anaerobic Treatment (Sludge Digesters)



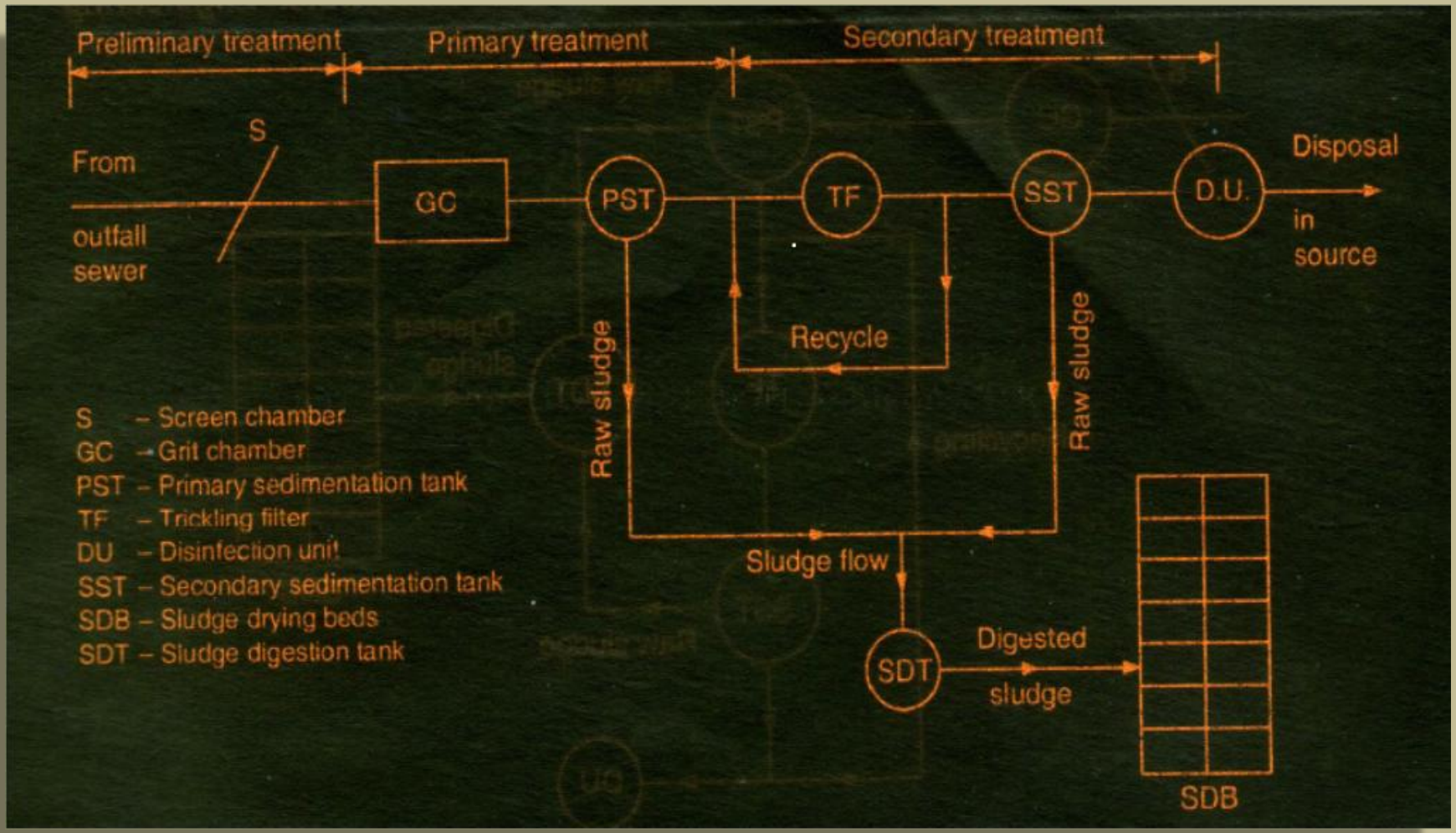

# Layout of Sewage Treatment Plant



# Layout of Sewage Treatment Plant



# Flow Sheet of Municipal Wastewater Treatment Plant



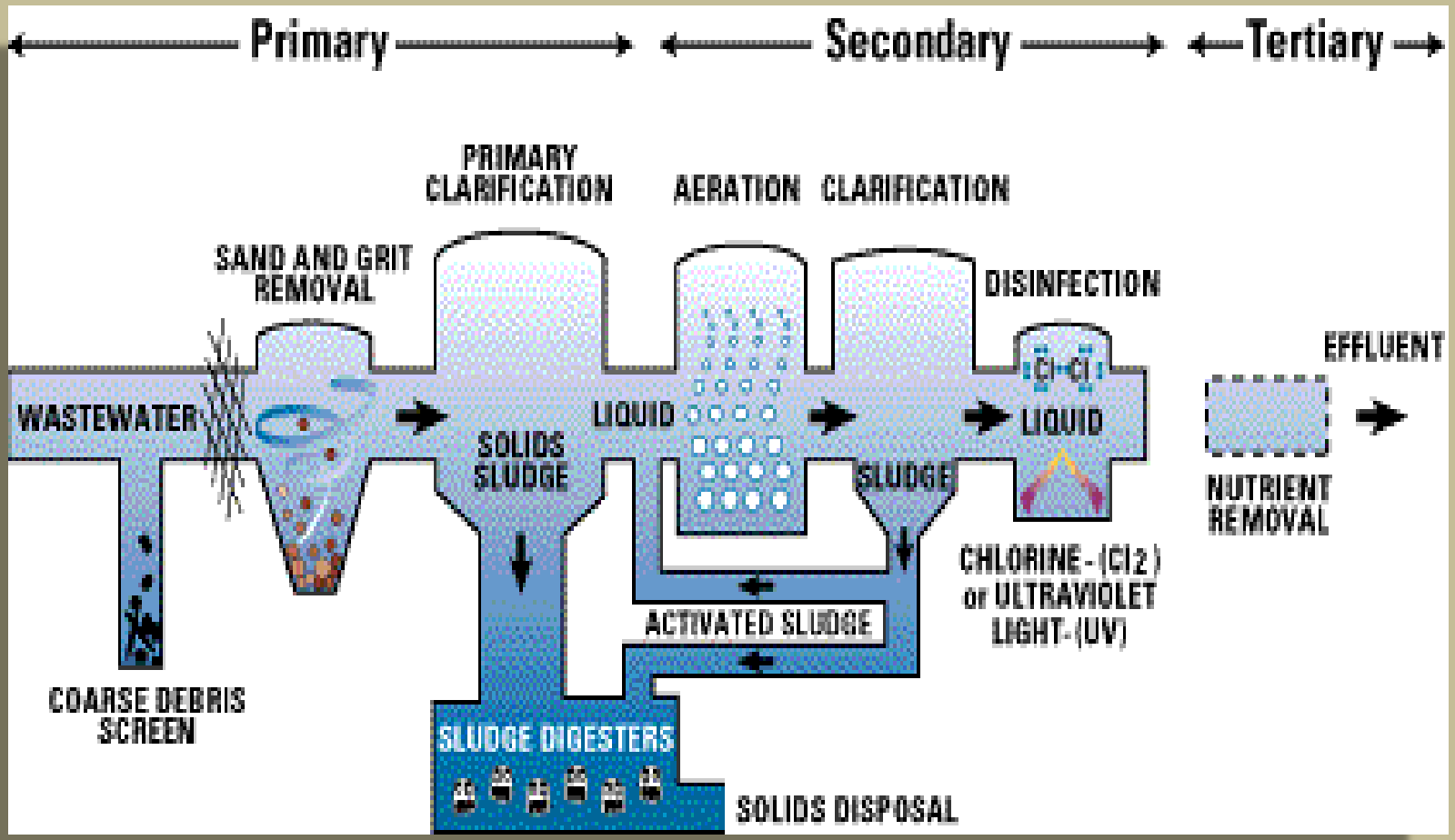
# Unit Operations in Wastewater Treatment.

- **The Wastewater through the outfall sewer reaches** the **wastewater treatment plant**.
- **There are various units in the wastewater treatment plant.** The typical municipal wastewater treatment flow sheet is shown in the fig.
- **S, GC, PST, TF** etc. are Various Unit are called as **Unit- Operations**
- So the **Unit Operation in screen chamber is screening.** In PST it is gravity Settling, in TF it is aerobic biological growth of microbes.

# Unit Operations in Wastewater Treatment

- In the above **treatment plant**, the treatment takes place in three Stages:
- **Preliminary Treatment** consisting of **screening and grit removal**
- **Primary Treatment-** Consisting **of Primary Sedimentation Tank**
- **Secondary Treatment-** Consisting of **Trickling filter and secondary sedimentation tank and disinfection Unit.**

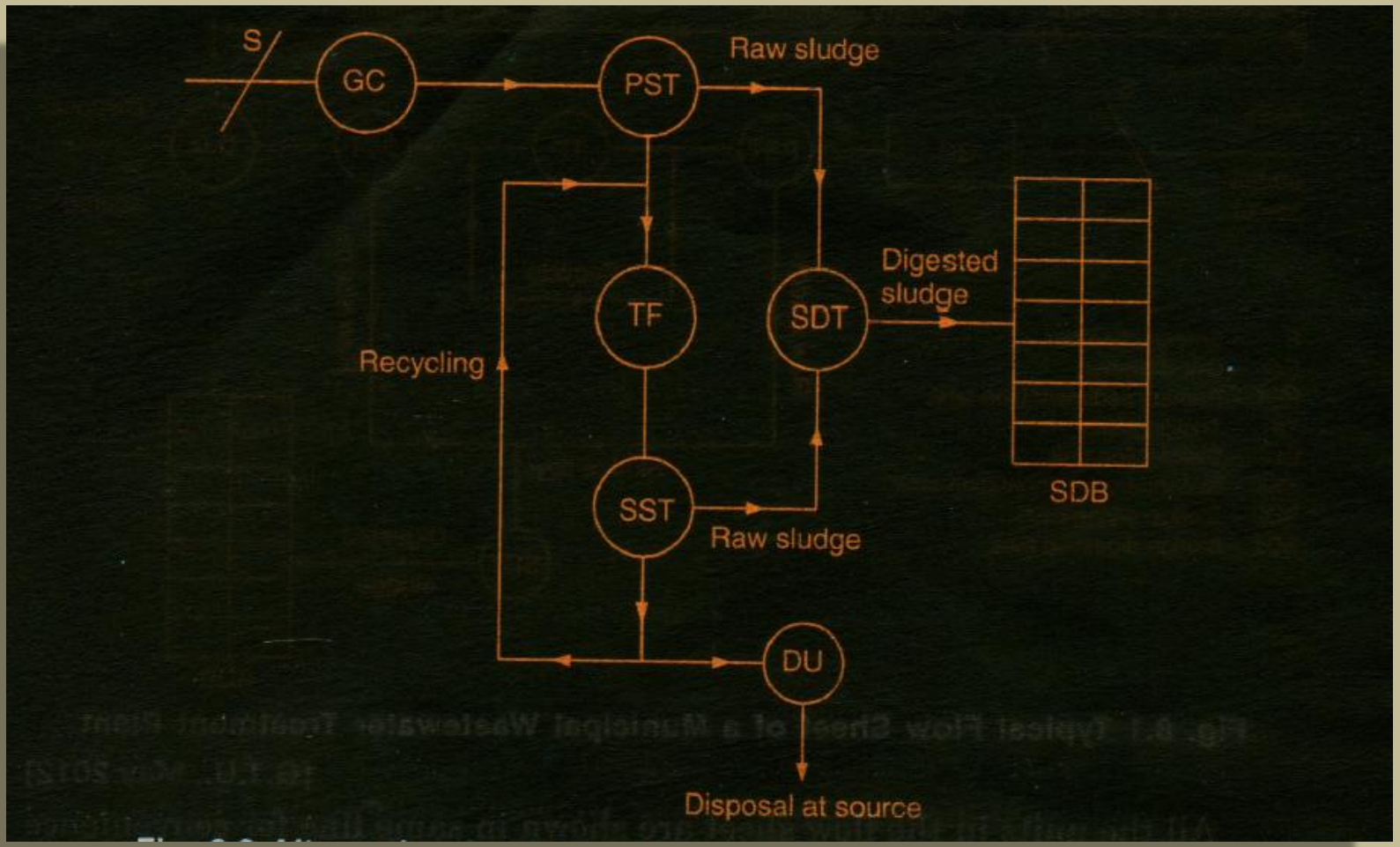
# Unit Operations in Wastewater Treatment



# Unit Operations in Wastewater Treatment

- **When the treated wastewater is intended for recycling or Reuse as Domestic Water Supply or for swimming Pool use**, the tertiary treatment is given to the wastewater. **The phosphorus & Nitrogen Content of Wastewater are reduced to Unobjectionable level in tertiary Treatment.** It should be remembered that tertiary treatment is given **after preliminary, primary and Secondary Treatment.**

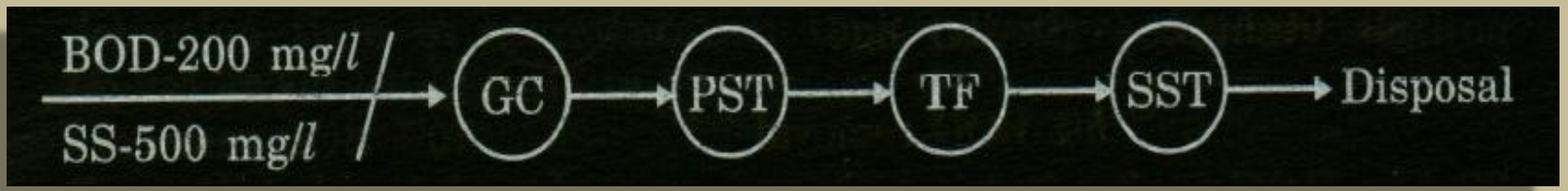
# Flow Sheet of Municipal Wastewater Treatment Plant



# Sewage Treatment Plant

- **The number & Units and type of Units selected depends upon the strength of the wastewater**. If the **Municipal wastewater is having high BOD & SS almost all units are required.** In some cases the wastewater is weak and then we can leave recycling system but all units are provided**. Recycling system is Used for increasing the BOD & SS removal in the biological Treatment.**

# Sewage Treatment Plant




- In order to select the **Units in Municipal Wastewater Treatment Plant.**
- By **Experience It has been found that each treatment has certain removal efficiency for BOD & SS**

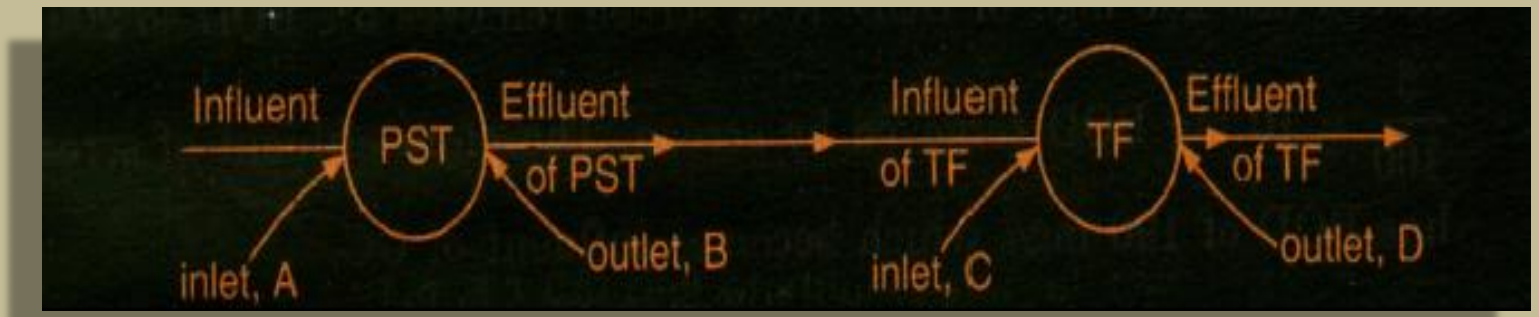
| Unit | BOD % | SS % |
|---|---|---|
| Screens | 5 | 10 |
| GC | 10 | 15 |
| PST | 25 | 35 |
| TF | 80 | 20 |
| SST | 25 | 40 |

# Sewage Treatment Plant

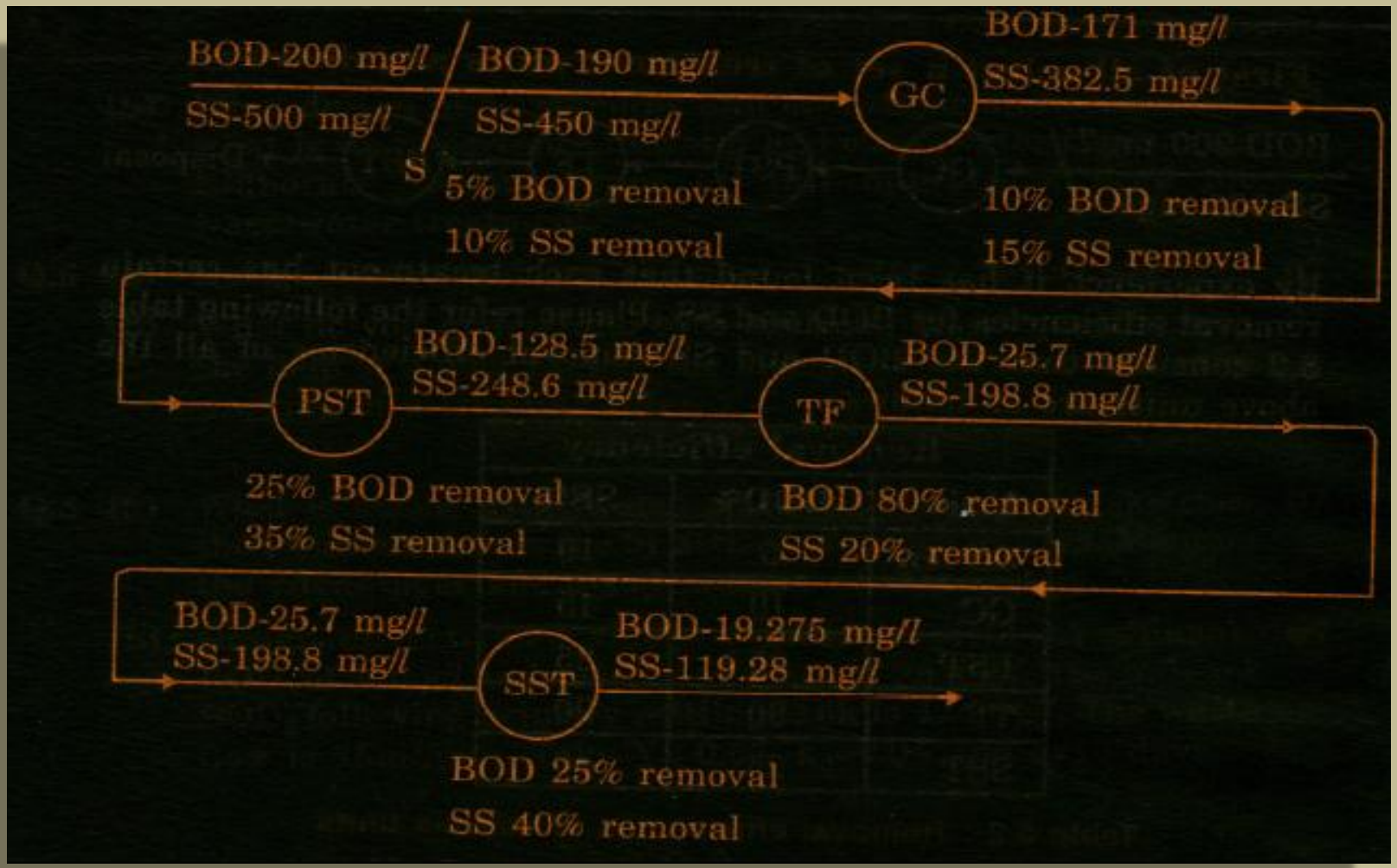
- **The Waste water entering the Wastewater unit is called Influent** and **Wastewater coming out from the treatment is called effluent.**

# Sewage Treatment Plant

- At **A influent** of PST enters in it. At **B effluent** of PST comes Out.
- Now the same effluent of **PST becomes influent of TF at C . At D effluent of TF comes Out.**
- Now we can find out the **BOD and SS of Influent and effluent of each unit** as below



# Flow Sheet of Municipal Wastewater Treatment Plant

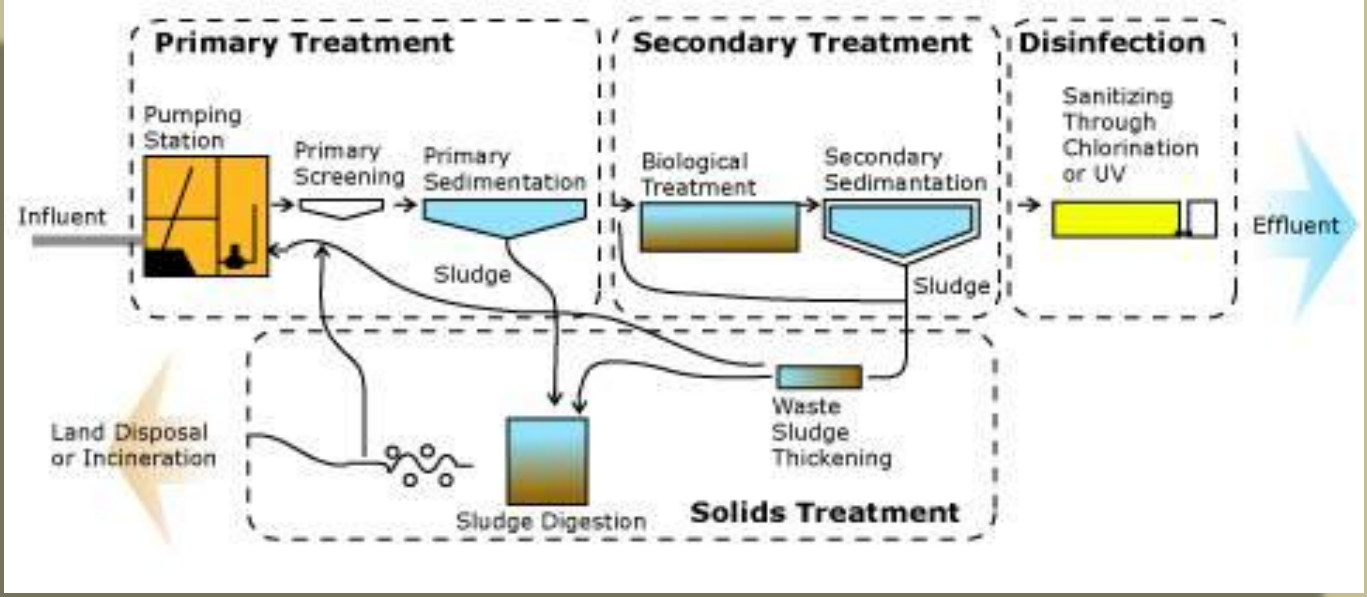


# Sewage Treatment Plant

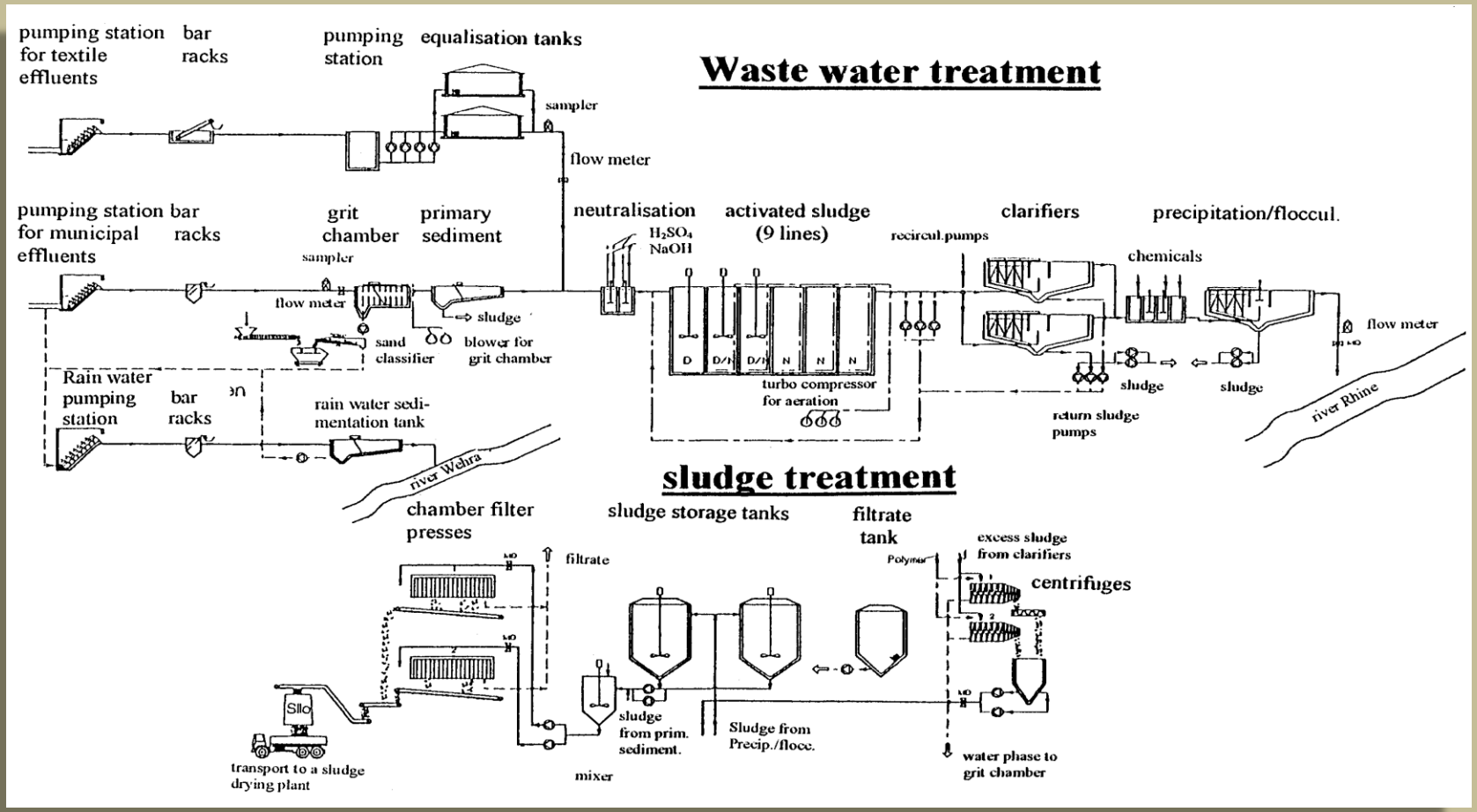
- **BOD** of incoming wastewater at Screens is **200 mg/l** i.e. **influent of screen has 200 mg/l of BOD**. Now **Screen removes 5 % of BOD** so **10 mg/l BOD is removed by Screens.** Therefore **effluent of screen has BOD of 190 mg/l** which becomes **influent of GC.**
- **Now GC removes 10 % of BOD** from its influent **therefore 19 mg/l BOD is removed** So **171 mg/l BOD remains in effluent of GC**. The calculations are made till the end unit of effluent is reached.

# Sewage Treatment Plant

- **The Selected units of Treatment Plant are called as Treatment Train**. From the above procedure we can find out the **final BOD and SS roughly and get idea weather our selected treatment train is effective or not.**



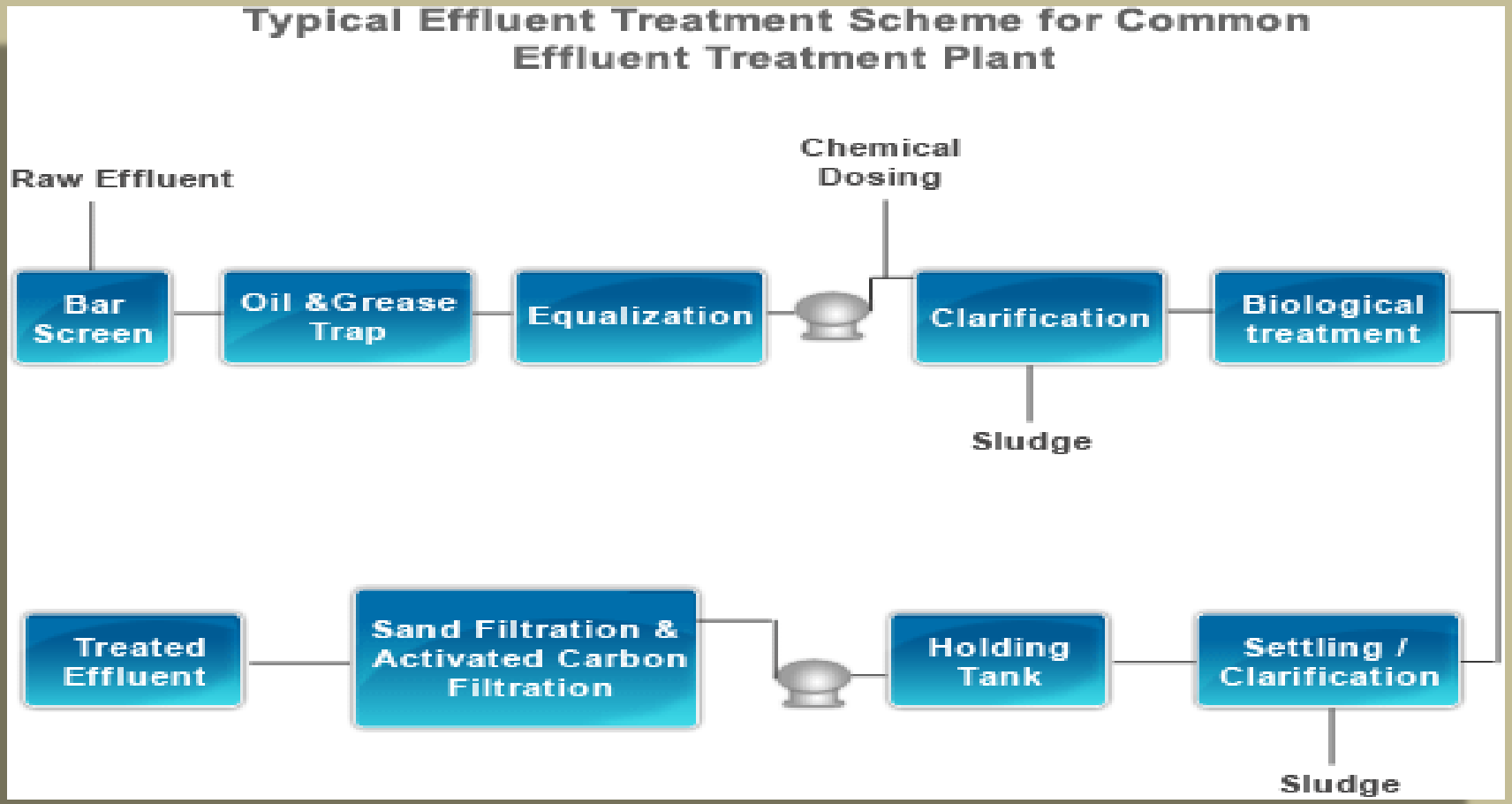
# Sewage Treatment Plant



# Treatment Units for Industrial Wastewater

- **The Treatment Units for Industrial Wastewater are also same as Stated for Municipal Wastewater treatment plant Layout**. Equalization basin is Included for treatment of the **Industrial Wastewater whose hourly variation of BOD & SS is very High.**
- The Typical flow sheet of Common Industrial effluent treatment Plant is shown below:

# Treatment Units for Industrial Wastewater



# Treatment Units for Industrial Wastewater