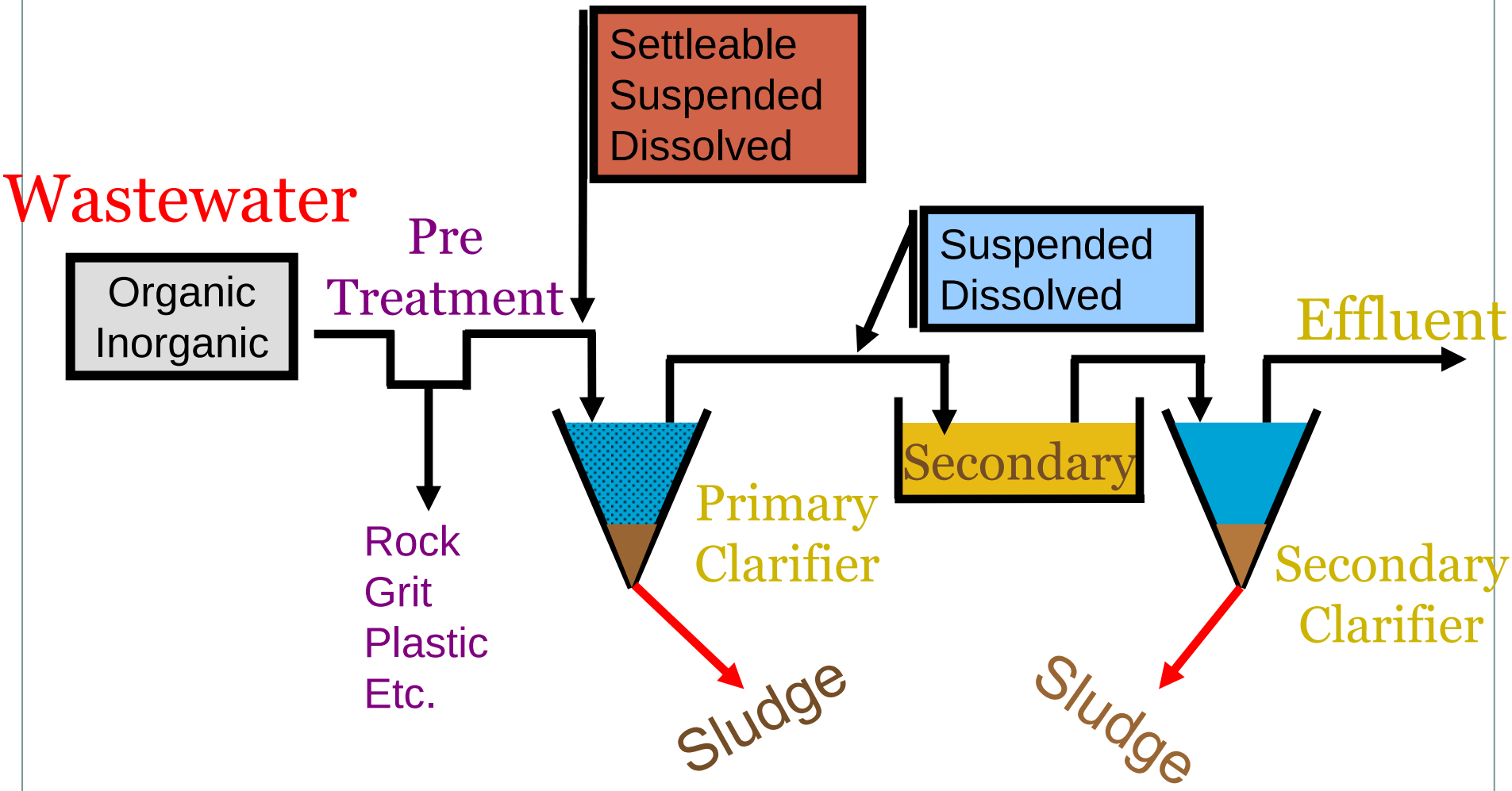
SLUDGE

- Sludge is the concentrated impurities of waste water into solid form

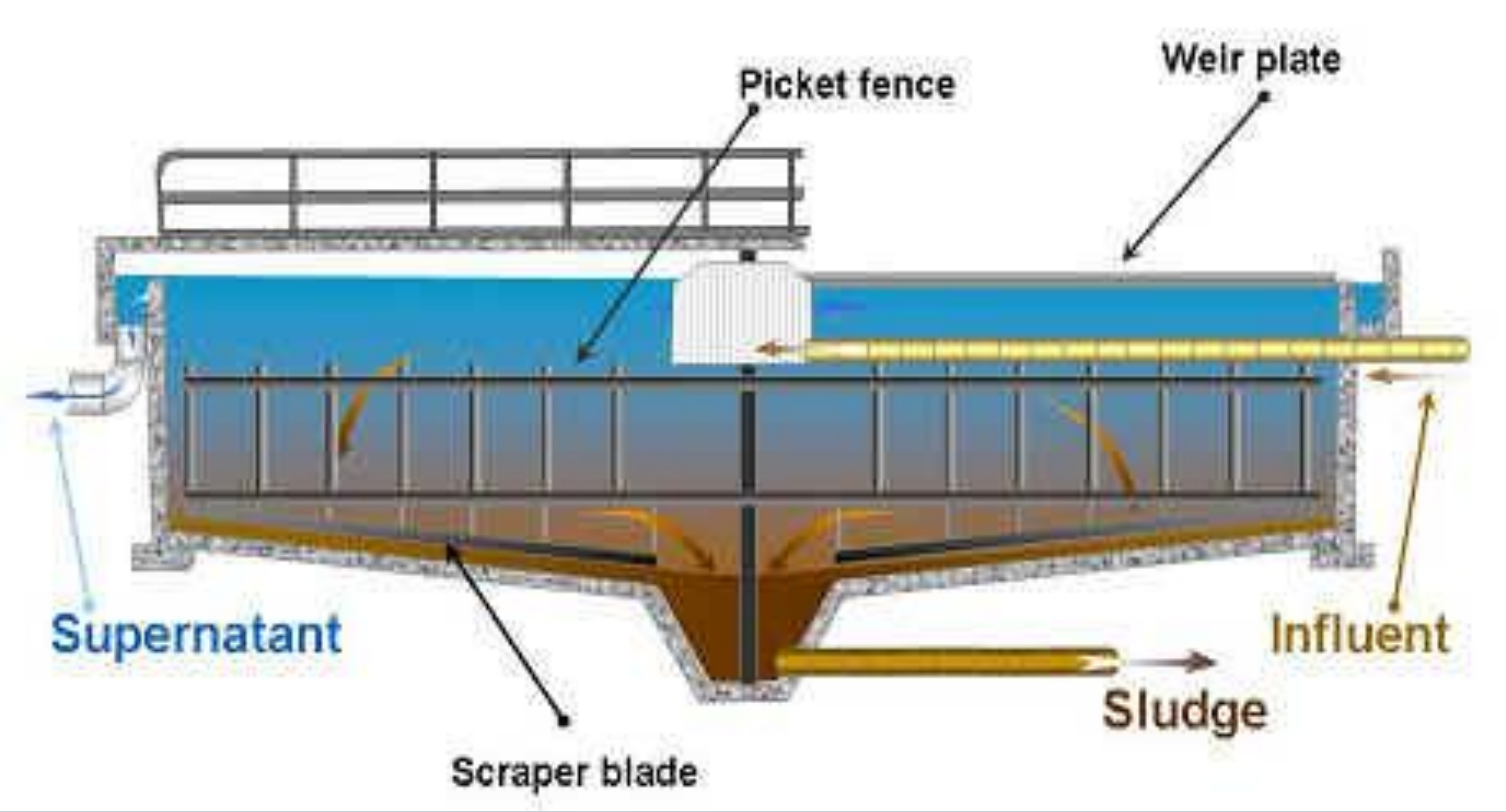

Settleable
Suspended
Dissolved
Wastewater
Pre
Treatment
Organic
Inorganic
Suspended
Dissolved
Effluent
Secondary
Primary
Clarifier
Rock
Grit
Plastic
Etc.
Secondary
Clarifier
Sludge
Sludge

SLUDGE THICKENING

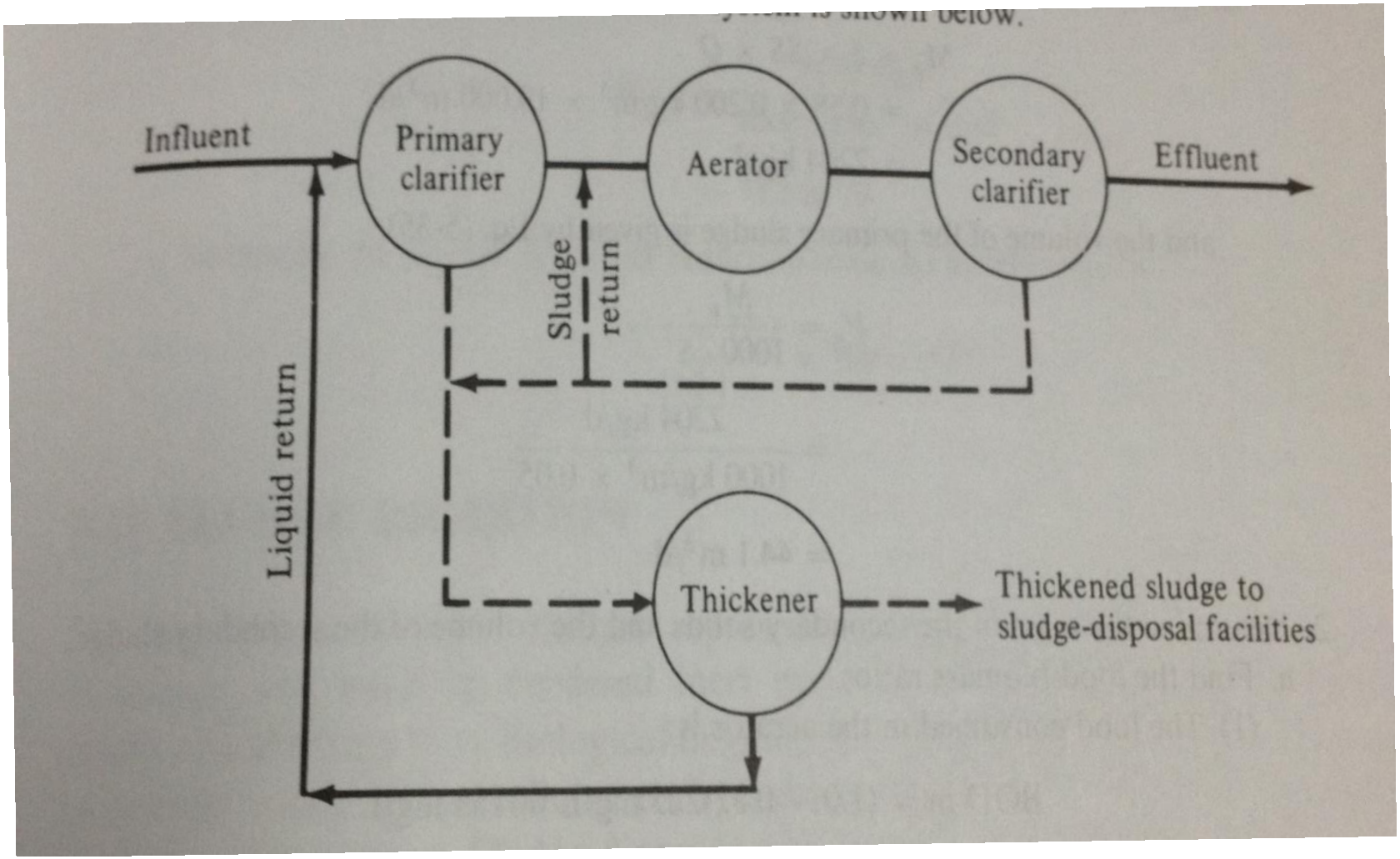
- Thickening is a procedure used to increase the solid content of sludge by removing a portion of the liquid fraction
- Thickening is generally acomplished by physical means including gravity settling , flotation , centrifugation etc
- Location of the thickener in a wastewater treatment plant is important.

- A thickener operates like a settling tank
- The feed enters from the middle , are distributed radially
- The settled sludge is collected from the underflow
- The effluent exits over the weirs
- The thickening process takes place in settling tank with long enough solids retention time

GRAVITY THICKENER



- Gravity thickeners contain pickets on the scraper cause a horizontal agitation .
- It helps to release water trapped in the flocculent structure of the sludge
- These are commonly used when suspended culture system sludges are to be thickened
- These thickeners have ability to double the solid content of the sludge


Influent
Primary clarifier
Aerator
Secondary clarifier
Effluent
Sludge return
Liquid return
Thickener
Thickened sludge to sludge-disposal facilities

SLUDGE DIGESTION

- Sludge digestion serves both to reduce the volume of the thickened sludge still further and to render the remaining solids and relatively reduce pathogen

- These goals can be achieved by :-

  Anaerobic digestion

  Aerobic digestion

ANAEROBIC DIGESTION

- Anaerobic digestion is the most common method for dealing with the waste water containing primary sludge
- The principle function is to convert as much of the sludge as possible to end products such as liquid and gases
- Very less residual biomass as possible is produced

- The anaerobic sludge digestion often divides the organisms into broad groups :-
- Acid formers
- Methane formers

ACID FORMERS

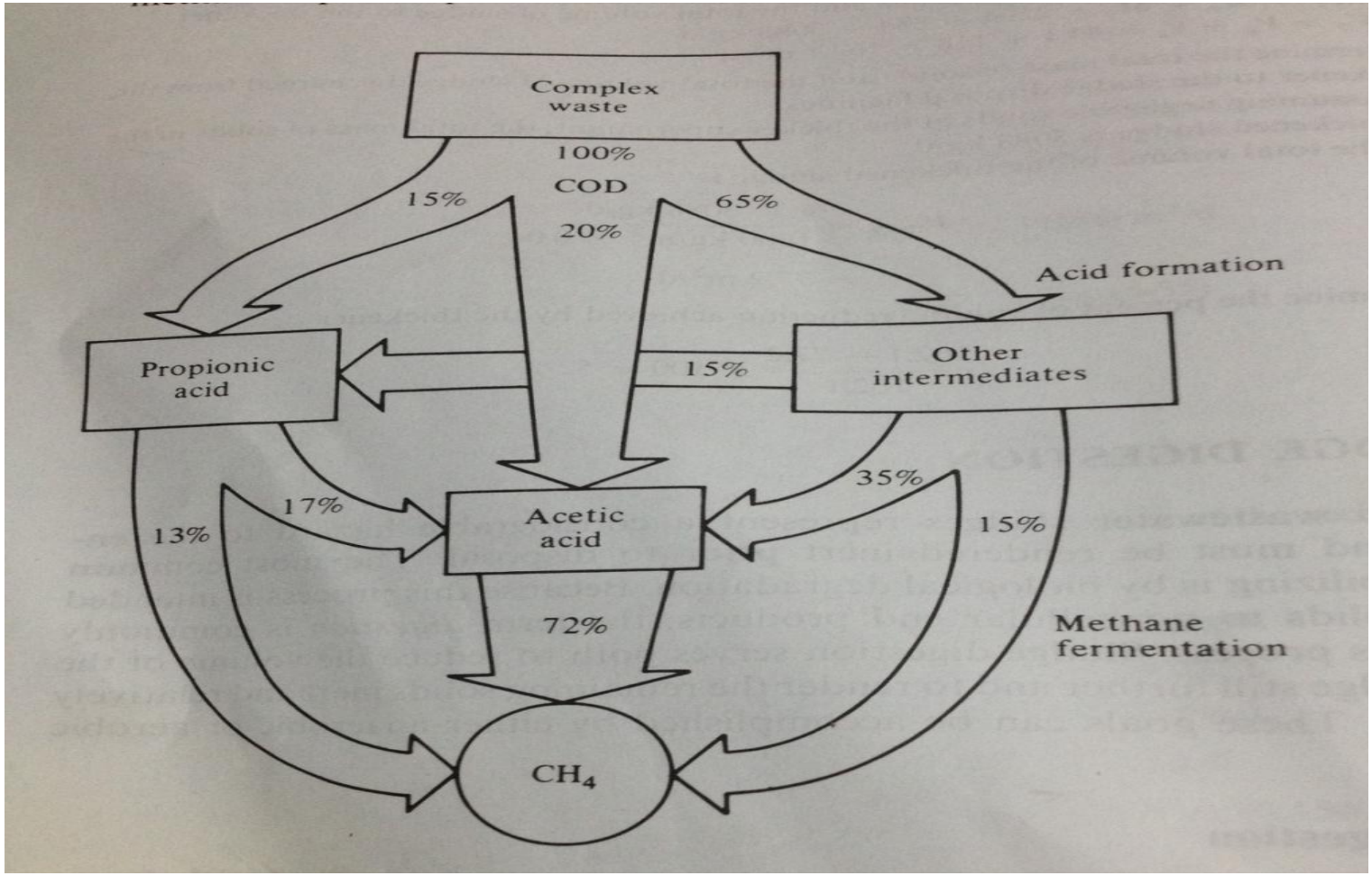
- The acid formers consist of facultative and anaerobic bacteria and include organisms that solubilize the organic solids through hydrolysis

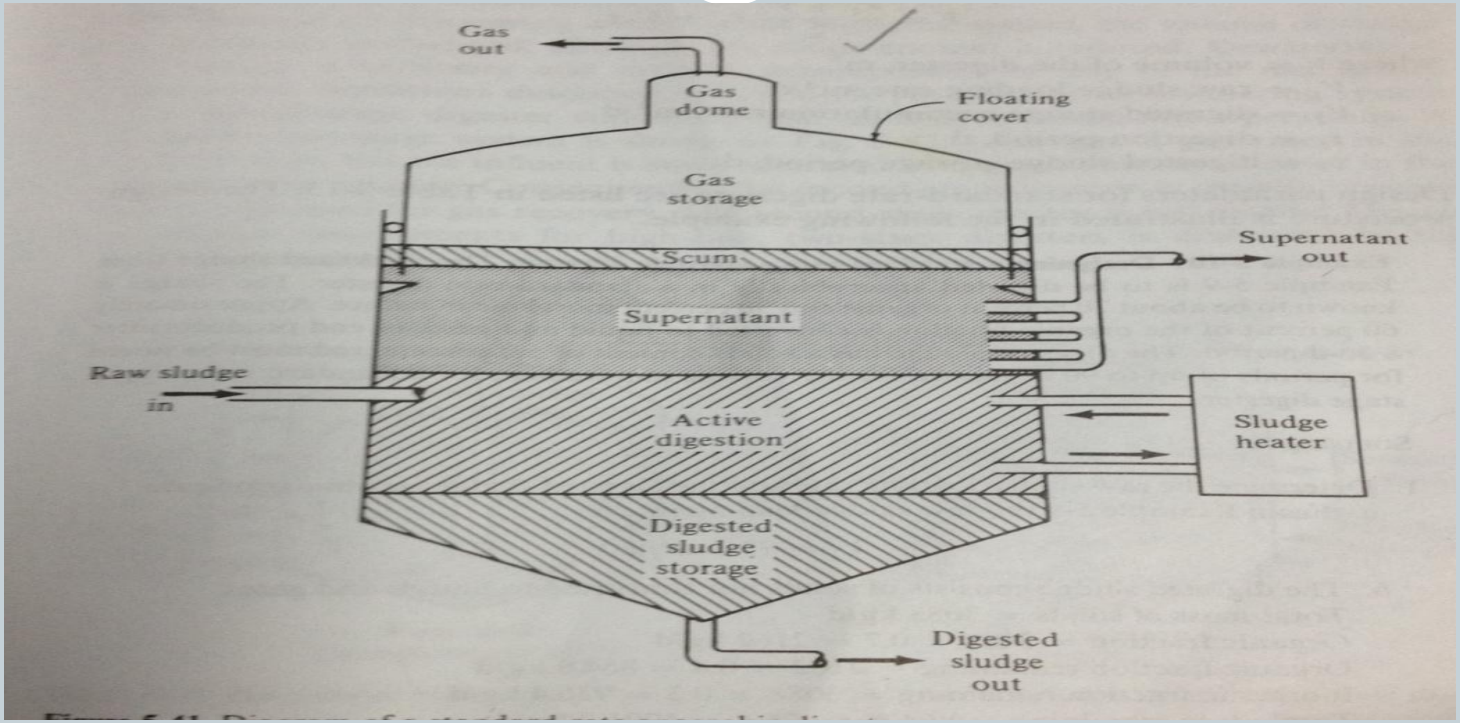
- The soluble products are then fermented to acids and alcohols of low molecular weight

METHANE FORMERS

- Methane formers consist of strict anaerobic bacteria
- Acids and alcohols along with hydrogen and carbon dioxide are converted to methane

Pathway and products of anaerobic digestion





- Sludge is fed into the digestor on an intermittent basis and supernatant is withdrawn and returned to secondary treatment unit

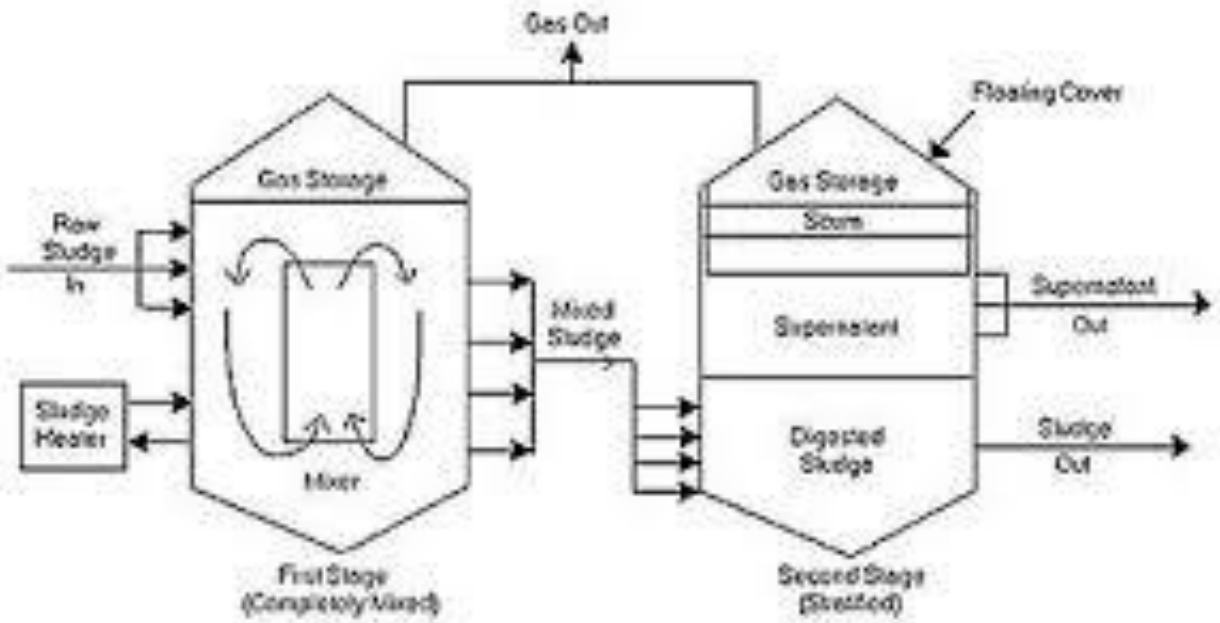
- A typical standard rate anaerobic digester consisting of a single – stage operation
- The conical bottom facilitates sludge withdrawal
- Floating cover accommodate volume change due to sludge addition or withdrawl
- Sludge separates in the reactor
- Although some mixing occur in the zone of active digestion and in the supernatant

HIGH RATE DIGESTERS

- These are more efficient
- Require less volume
- The contents are mechanicaly mixed to ensure better contact between the organics and the microorganisms
- Unit is heated to increase the metabolic rate of the microorganisms
- Optimum tempurature is around 35° C

- Little gas is generated in the second stage
- But the second stage is covered and is equipped for gas recovery
- The second stage reactor is not heated

Two Stage, High Rate Anaerobic Digester



ADVANTAGES

- Waste stabilisation
- Odour reduction
- Scalable technology
- Low capital cost
- Fuel based renewable/pack generation

DISADVANTAGES

- No useful byproduct
- Required expertise
- Affected by changes in loading and conditions

AEROBIC DIGESTION

- This process is essentially a continuation of the aeration process , with the volume being reduced by thickening in the secondary clarifier and sludge thickener
- It is an endogenous respiration process

ADVANTAGES

- The process is easy to control
- It usually has lower ammonia concentration
- Explosive gases are not produced

DISADVANTAGES

- Aerobic digestion is energy consumptive
- Temperature dependent
- Aerobic digestion does not produce energy