WASTEWATER TREATMENT

- It is a process used to convert wastewater into an effluent that can be returned to the water cycle with minimal environmental issues
- Instead of disposing of treated wastewater it is reused for various purposes, which is knows as water reclamation
- During the treatment process, pollutants are removed or broken down
- The infrastructure used for wastewater treatment is called a wastewater treatment plant or a sewage treatment plant in the case of municipal wastewater

AEROBIC WASTEWATER TREATMENT

- Aerobic processes use bacteria that require oxygen, so air is circulated throughout the treatment tank
- These aerobic bacteria then break down the waste within the wastewater
- Some systems utilize a pretreatment stage prior to the main treatment to reduce the chance of clogging the system
- Electricity is required for system operation

ADVANTAGES

- Minimum odor
- Large BOD removal providing a good quality effluent
- High rate treatment with less land requirement
- Final discharge may contain DO which reduces the immediate OD on receiving water

DISADVANTAGES

- Energy cost of aeration at an adequate rate to maintain the DO levels needed
- Some organics cant be efficiently decomposed aerobically
- These biologically non-reactive components mainly composed of insoluble materials can account for up to 70% COD
- Reduction in storage capacity of lagoons and/ or ponds

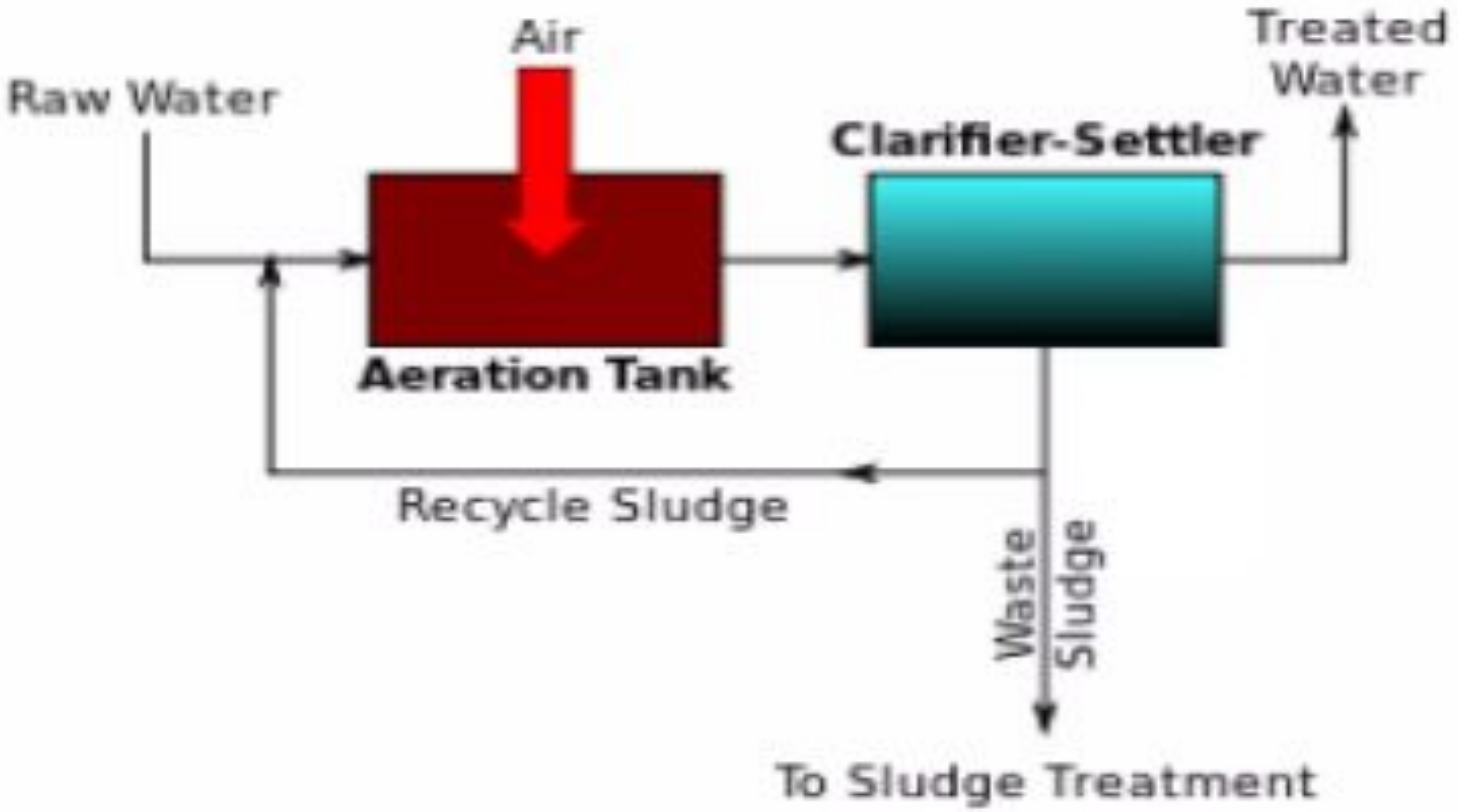
ACTIVATED SLUDGE PROCESS

- Process for treating sewage or industrial wastewaters using aeration and a biological floc composed of bacteria and protozoa
- is a biological process that can be used for oxidizing carbonaceous biological matter, oxidizing nitrogenous matter (NH_3 and N_2), removing nutrients (N and P).
- Aeration methods - diffused aeration, surface aerators (cones) and pure oxygen aeration

ACTIVATED SLUDGE PROCESS

- The sludge blanket is measured from the bottom of the clarifier
- The Sludge Volume Index is the volume of settled sludge in mm occupied by 1 gram of dry sludge solids after 30 mins of settling in a 1000 ml graduated cylinder.
- The Mean Cell Residence Time is the total mass(kg) of mixed liquor suspended solids in the aerator and clarifier divided by the mass flow rate (kg/day) of MLSS effluent
- The F/M is amount of BOD fed to the aerator (kg/day) divided by the amount of MLVSS (kg) under aeration
- Some use Mixed Liquor Suspended Solids for expedience, but Mixed Liquor Volatile Suspended Solids is considered more accurate for the measure of microorganisms

ACTIVATED SLUDGE PROCESS

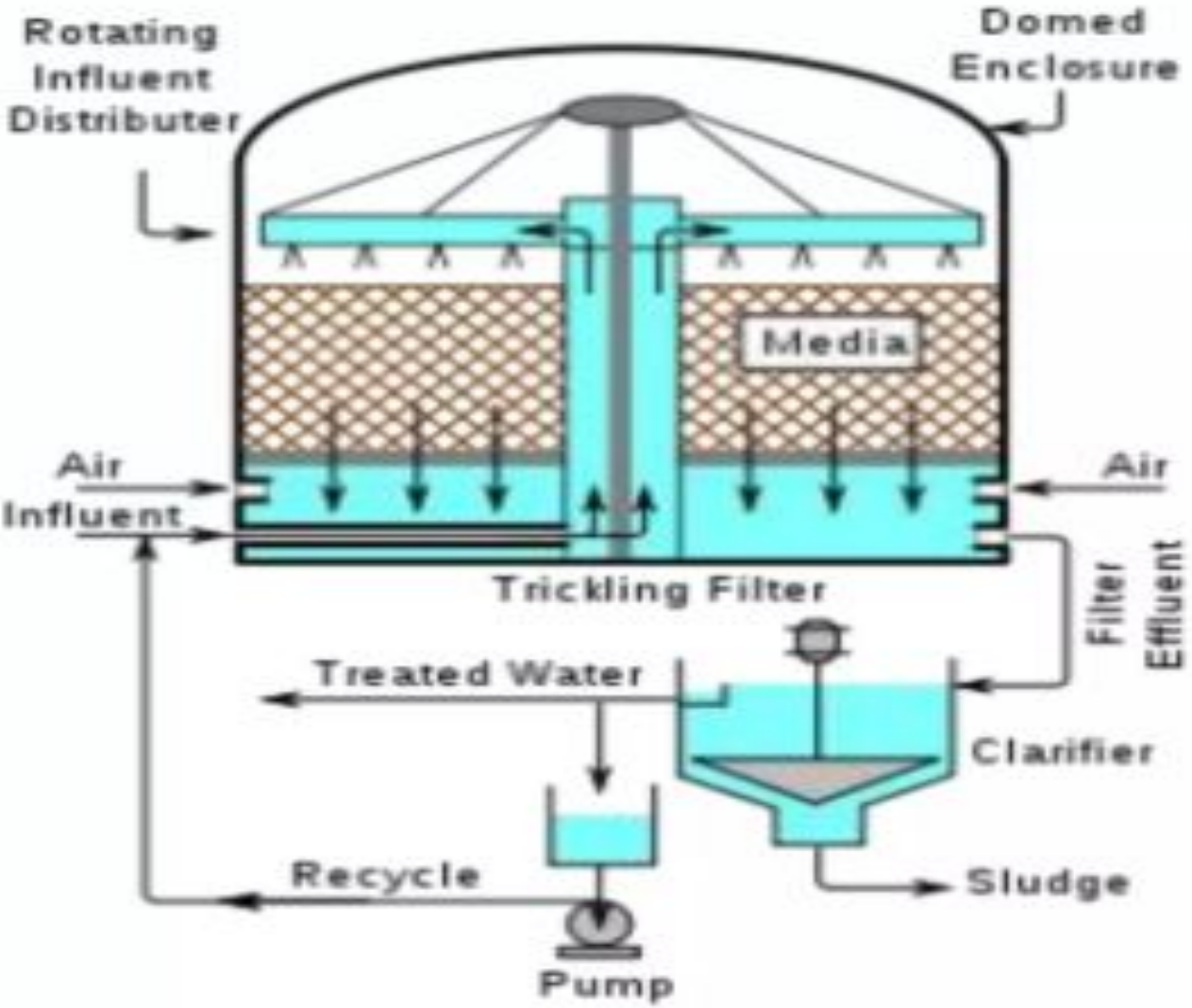


PROCESS

- Pre-treatment stage to remove large solids and other undesirable substances
- Aeration stage, where aerobic bacteria digest biological wastes
- Settling stage allows undigested solids to settle, forms a sludge that must be periodically removed from the system
- Disinfecting stage, where chlorine or similar disinfectant is mixed with water, to produce an antiseptic output

TRICKLING FILTER

- First used by Dibden and Clowes
- It consists of rocks, lava, coke, gravel, slag, polyurethane foam, sphagnum peat moss, ceramic, or plastic media over which sewage flows downward and causes a layer of microbial slime (biofilm) to grow, covering the bed of media
- Aerobic conditions are maintained by splashing, diffusion, and either by forced-air flowing through the bed or natural convection of air if the filter medium is porous


Rotating
Influent
Distributer
Domed
Enclosure
Media
Air
Influent
Air
Trickling Filter
Filter
Effluent
Treated Water
Clarifier
Recycle
Sludge
Pump

PROCESS

- Sewage flow enters at a high level and flows through the primary settlement tank
- The supernatant from the tank flows into a dosing device, often a tipping bucket which delivers flow to the arms of the filter
- The flush of water flows through the arms and exits through a series of holes pointing at an angle downwards
- This propels the arms around distributing the liquid evenly over the surface of the filter media
- Both absorption and adsorption of organic compounds and some inorganic species by the layer of microbial bio film

PROCESS

- The filter media is typically chosen to provide a very high surface area to volume
- Passage of the waste water over the media provides DO which the bio-film layer requires for the biochemical oxidation of the organic compounds and releases CO_2 gas, water and other oxidized end products
- As the bio film layer thickens, it eventually sloughs off into the liquid flow and subsequently forms part of the secondary sludge
- Other filters utilizing higher-density media do not produce a sludge that must be removed, but require forced air blowers and backwashing

ROTATING BIOLOGICAL CONTACTOR

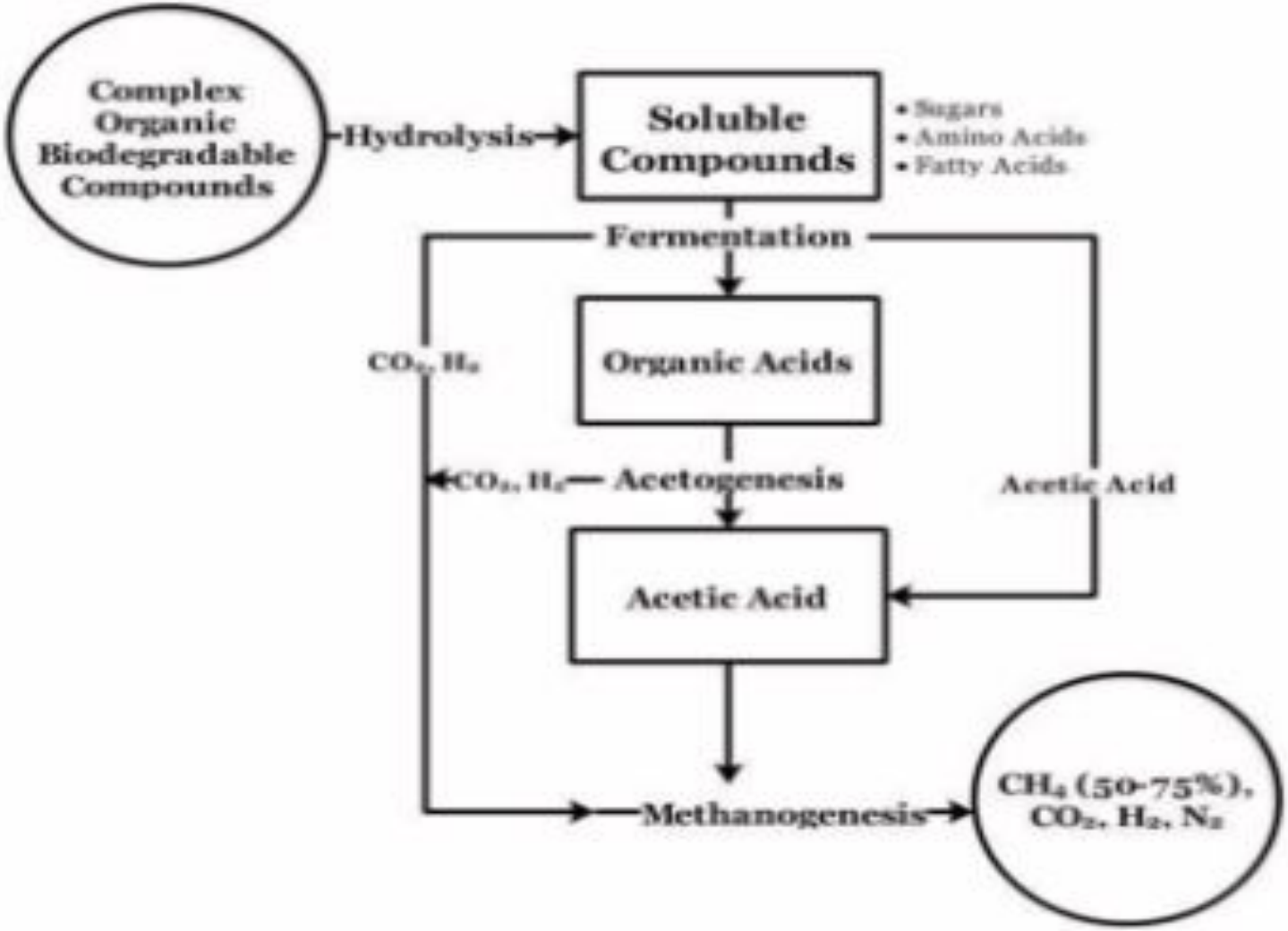
- RBC is a type of secondary treatment process
- The primary treatment process means removal of grit and sand through a screening process, followed by settling
- This process involves allowing the wastewater to come in contact with a biological medium in order to remove pollutants
- It consists of a series of closely spaced, parallel discs mounted on a rotating shaft which is supported just above the surface of the waste water.
- Microorganisms grow on the surface of the discs where biological degradation of the wastewater pollutants takes place

AEROBIC STABILIZATION PONDS

- It reduce the organic content (measured as BOD) and kill pathogens in the wastewater
- Ponds are depressions holding water confined by earthen structures
- After treatment, the effluent may be returned to surface water or reused as irrigation water if the effluent quality is high enough
- Waste stabilization ponds use no aerators
- High-performance lagoon technology with aerators has much more in common with that of activated sludge

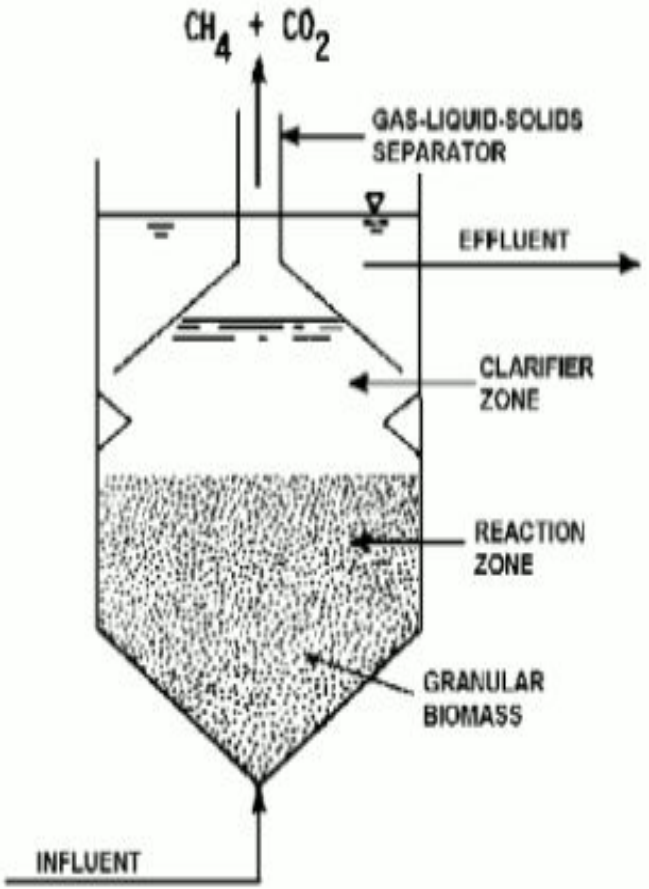
ANAEROBIC WASTEWATER TREATMENT

- Anaerobic bacteria transform organic matter in the wastewater into biogas that contains large amounts of methane gas and carbon dioxide
- Energy-efficient process
- Often used to treat industrial wastewater that contains high levels of organic matter in warm temperatures
- It can be used as a pretreatment prior to aerobic municipal wastewater treatment


Complex Organic Biodegradable Compounds
Hydrolysis
Soluble Compounds
• Sugars
• Amino Acids
• Fatty Acids
Fermentation
CO_2, H_2
Organic Acids
CO_2, H_2
Acetogenesis
Acetic Acid
Acetic Acid
Methanogenesis
CH_4 (50-75%), CO_2, H_2, N_2

UPFLOW ANAEROBIC SLUDGE BLANKET

- It is a suspended-growth high-rate digester, with i
  biomass clumped into granules that
  will settle relatively easily and with typical loading
  rates in the range 5-10 kg COD/m^3/d
- It is a methanogenic (methane-producing) digeste
  that evolved from the anaerobic clarigester



UPFLOW ANAEROBIC SLUDGE BLANKET REACTOR

PROCESS

- Forming a blanket of granular sludge which suspends in the tank
- Wastewater flows upwards through the blanket and is processed (degraded) by the anaerobic microorganisms
- The upward flow combined with the settling action of gravity suspends the blanket with the aid of flocculants
- The blanket begins to reach maturity at around three months
- Eventually the aggregates form into dense compact biofilms referred to as "granules"
- Biogas with a high concentration of methane is produced as a by-product, and this may be captured and used as an energy source, to generate electricity
- The heat produced as a by-product of electricity generation can be reused to heat the digestion tanks
- UASB reactors are typically suited to dilute waste water streams (3% TSS with particle size >0.75mm)

ANAEROBIC FILTER

- The digestion tank contains a filter medium where anaerobic microbial populations can establish themselves
- They produce a less solid residue than other types of filter

The most preferred treatment method for dairy wastewater is a biological method including processes such as activated sludge, tricking filters, aerated lagoons, sequential batch reactor (SBR), upflow anaerobic sludge blanket (UASB), anaerobic filters,