USN | | | | | | | | | |

CMR INSTITUTE OF TECHNOLOGY, BENGALURU.
ACCREDITED WITH A+ GRADE BY NAAC

Internal Assessment Test 2 – April 2018

Sub:	Industrial Wastewater Treatment			Sub Code:	10CV835	Branch:	Civil
Date:	19/04/18	Duration:	90 min's	Max Marks: 50	Sem/Sec:	VIII	OBE

<u>Answer any four questions from part A & any one question from part B</u>

		MARKS	CO	RBT
	<u>Part-A</u>			
1	How to remove **organic suspended solids and colloids** present in industrial waste water? Explain any one method.	[10]	CO2	L2
2	Explain any one biological treatment process for industrial wastewater stream: (i.) **Activated sludge process** (ii) **Trickling filters**	[10]	CO2	L2
3	Explain the functioning of preliminary treatment units provided for industrial effluent treatment plant.	[10]	CO2	L2
4	What is the difference between aerobic and anaerobic biological processes, narrate with examples.	[10]	CO3	L2
5	Briefly explain the following sludge disposal methods for industrial sludge: (i) **Disposal in water** (ii) **Disposal on land**	[5+5]	CO3	L2
6	Briefly explain the functioning of **return sludge tank** and **sludge thickening unit** provided for industrial sludge treatment.	[5+5]	CO3	L2
	<u>Part-B</u>			
7	Write down the advantages of combined treatment of industrial wastewater with domestic sewage.	[10]	CO3	L2
8	Draw a flow sheet diagram for **combined effluent treatment plant** for **textile industry**	[10]	CO3	L2

CCI CI

USN | | | | | | | | | |

CMR INSTITUTE OF TECHNOLOGY, BENGALURU.
ACCREDITED WITH A+ GRADE BY NAAC

Internal Assessment Test 2 – April 2018

Sub:	Industrial Wastewater Treatment			Sub Code:	10CV835	Branch:	Civil
Date:	19/04/18	Duration:	90 min's	Max Marks: 50	Sem/Sec:	VIII	OBE

Answer any four questions from part A & any one question from part B

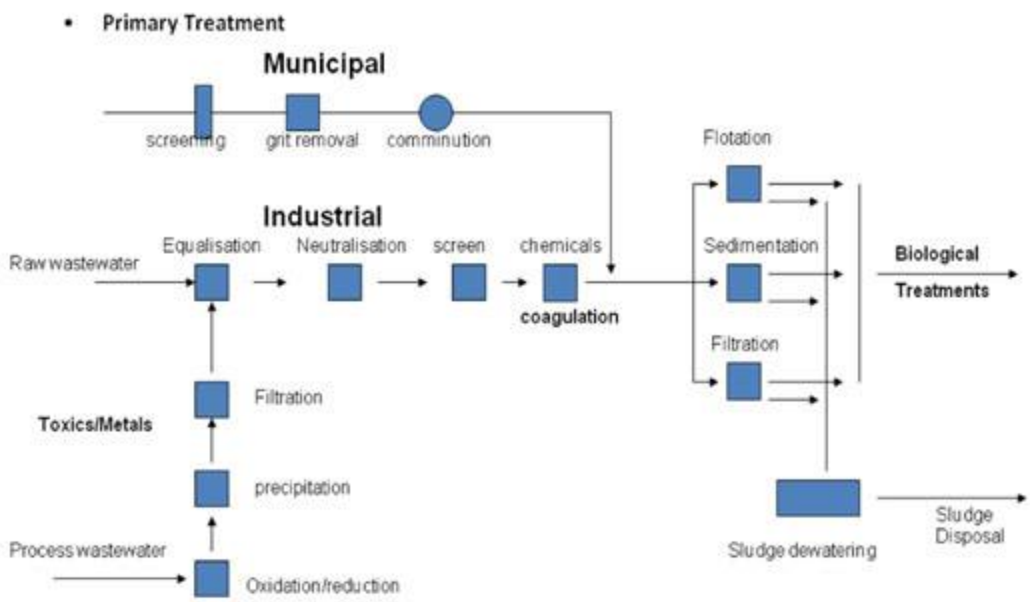
		MARKS	CO	RBT
	Part-A			
1	How to remove **organic suspended solids and colloids** present in industrial waste water? Explain any one method.	[10]	CO2	L2
2	Explain any one biological treatment process for industrial wastewater stream: (i.) **Activated sludge process** (ii) **Trickling filters**	[10]	CO2	L2
3	Explain the functioning of preliminary treatment units provided for industrial effluent treatment plant.	[10]	CO2	L2
4	What is the difference between aerobic and anaerobic biological processes, narrate with examples.	[10]	CO3	L2
5	Briefly explain the following sludge disposal methods for industrial sludge: (i) **Disposal in water** (ii) **Disposal on land**	[5+5]	CO3	L2
6	Briefly explain the functioning of **return sludge tank** and **sludge thickening unit** provided for industrial sludge treatment.	[5+5]	CO3	L2
	Part-B			
7	Write down the advantages of combined treatment of industrial wastewater with domestic sewage.	[10]	CO3	L2
8	Draw a flow sheet diagram for **combined effluent treatment plant** for **textile industry**	[10]	CO3	L2

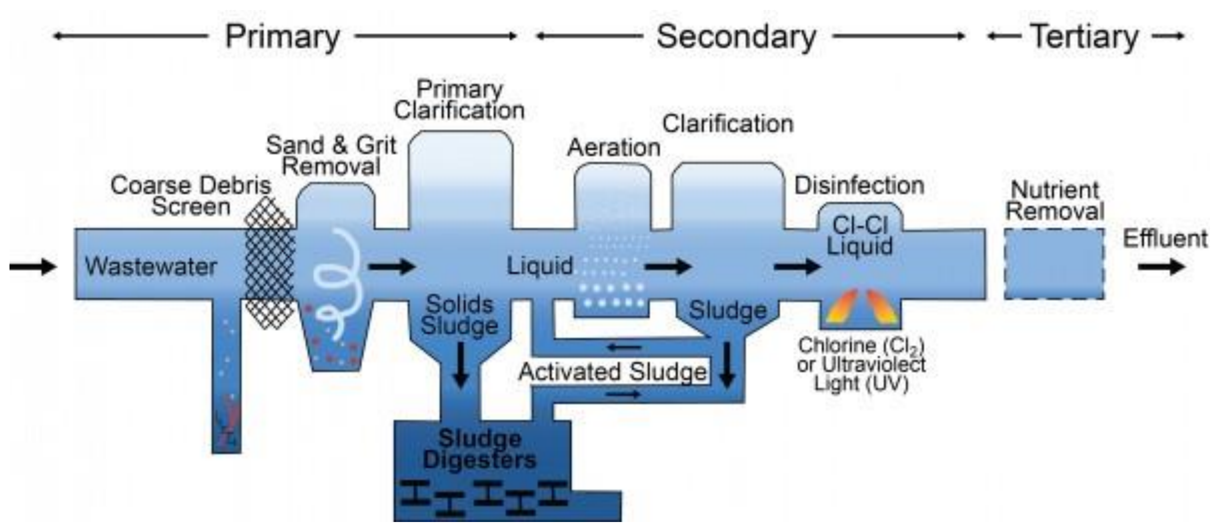
CCI CI

IAT 2 April, 2018 subject: Industrial wastewater treatment solution

Q.1

INORGANIC SUSPENDED SOLIDS REMOVAL TECHNIQUES IN IWW.





Any one process

Ion exchange

ACTIVATED CARBON, REVERSE OSMOSIS, ELECTROCOAGULATION, FILTRATION

Nitrogen removal Biological Nitrification and denitrification , Air stripping , Phosphorus removal

Physical:

a) filtration for particulate phosphorus

b) membrane technologies

B) **Chemical:**

a) precipitation b) other (mainly physical-chemical adsorption)

C) Biological

a) assimilation b) enhanced biological phosphorus removal (**EBPR)**

Membrane process

Membrane technology can be used to treat a variety of wastes, including sanitary landfill leachate containing both organic and inorganic chemical species, water-soluble oil wastes used in metal fabricating and manufacturing industries, solvent-water mixtures, and oil-water mixtures generated during washing operations at metal fabricating facilities. Depending upon the material used for membrane, nature of driving force and separation mechanism, the membrane processes can be classified into sub-processes such as electrodialysis (ED) or electrodialysis reversal (EDR), microfiltration (MF), ultrafiltration (UF), nanofiltration (NF), reverse osmosis (RO).

MF, UF, NF and RO use pressure to transport water across the membrane. MF removes particulate matter while RO removes many solutes as water permeate through the membrane. MF membranes have the largest pore size and typically reject large particles and various microorganisms. UF membranes have smaller pores than MF membranes and, therefore, in addition to large particles and microorganisms, they can reject bacteria and soluble macromolecules such as proteins. RO membranes are effectively non-porous and, therefore, exclude particles and even many low molar mass species such as salt ions, organics, etc. NF membranes are relatively new and are sometimes called loose RO membranes. They are porous

Membranes, but since the pores are of the order of ten angstroms or less, they exhibit performance between that of RO and UF membranes. Different membrane processes are being used in water treatment since 1960.

The driving forces for the use of membrane technology are increased regulatory pressure to provide better quality water, increased demand of water requiring exploitation of low quality water resources as source and development and commercialization of membrane processes. Application of membrane processes for wastewater treatment is increasing worldwide day by day with reduction in cost of process and increased water charges. Membrane processes are used for about 70 % of the total installed capacity of desalination worldwide and percentage is increasing (for drinking water). In Japan, more than 30 MLD wastewater is used as toilet flushing water in building. It has application in many industrial wastewater treatment plants to produce reusable quality water from the effluents.

The membrane is defined as the thin film separating two phases and acting as a selective barrier to the transport matter. Chemical potential difference exists between the two phases (Figure 23.3). Retentate contains non permeating species (Figure 23.4). Permeate forms the produced water from the membrane filtration.

Advantages:

Disadvantages:

Q.2 ANY ONE ADVANCED TERTIARY TREATMENT PROCESS:

A. REVERSSE OSMOSIS B. ION EXCHANGE

A. REVERSSE OSMOSIS

The reverse osmosis process

In the reverse osmosis process, cellophane-like membranes separate purified water from contaminated water. RO is when a pressure is applied to the concentrated side of the membrane forcing purified water into the dilute side, the rejected impurities from the concentrated side being washed away in the reject water.

RO can also act as an ultra-filter removing particles such as some micro-organisms that may be too large to pass through the pores of the membrane.

RO membranes

Reverse osmosis is a membrane technology used for separation also refferedas Hyperfiltration.

In a typical RO system the solution is first filtered through a rough filter like sand or active carbon, or dual filter etc.

If solution contains Ca++, Mg salts, iron, carbonates, then acid dosing system is introduced.

The pH is adjusted and the solution is then filter through micro cartridge filter (5-10 micron).

The pretreated water is then pumped in to the RO tank with a high pressure pump.

The membrane separates the pollutants in concentrated form in the reject stream and the pure water is collected as a permeate.

RO is more useful to separate salts and organic compounds from textile effluents. Some of the wastewater varieties from textile industry that can be treated by RO for recovery of reusable water such as:

1.Rayon industry process wastewater.

2.Textile dyes house effluent. Up to 80% of warm dye house wastewater can be recovered for recycle by RO membrane.

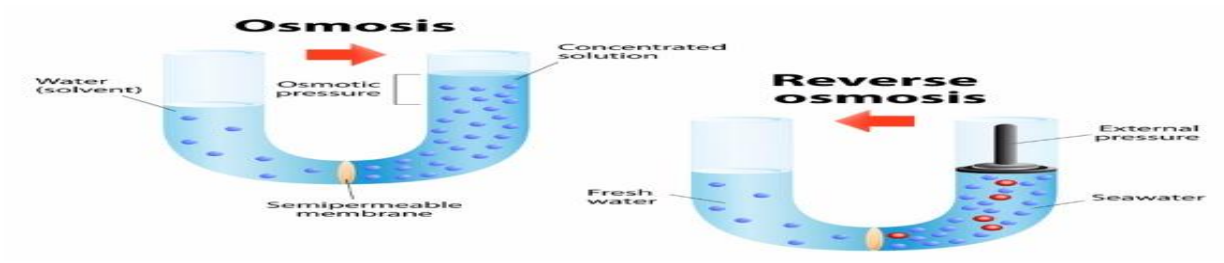
Design speciality

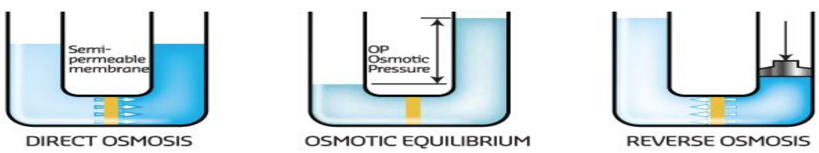
RO membrane modules are commonly fabricated in a spiral configuration. An important consideration of spiral elements is the design of the feed spacer, which promotes turbulence to reduce fouling

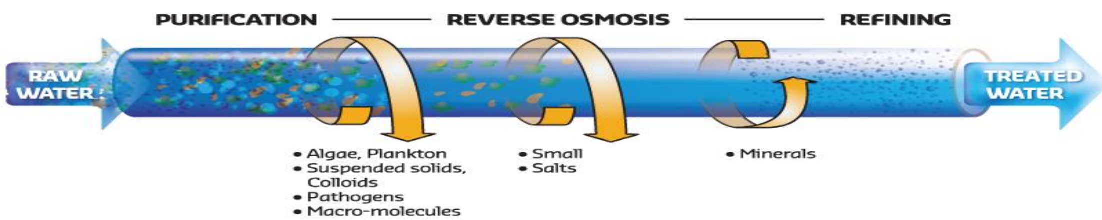
•The RO technique is a highly efficient process, in terms of high recovery, low operating cost

•RO membranes have a retention rate of 90% or more for most types of ionic compounds and they produce a high quality of permeate

•RO permeates the removal of all mineral salts, hydrolyzed reactive dyes and chemical auxiliaries, but the problem involved is that the higher the concentration of salts, the more important the osmotic pressure becomes and consequently, the greater the energy required.

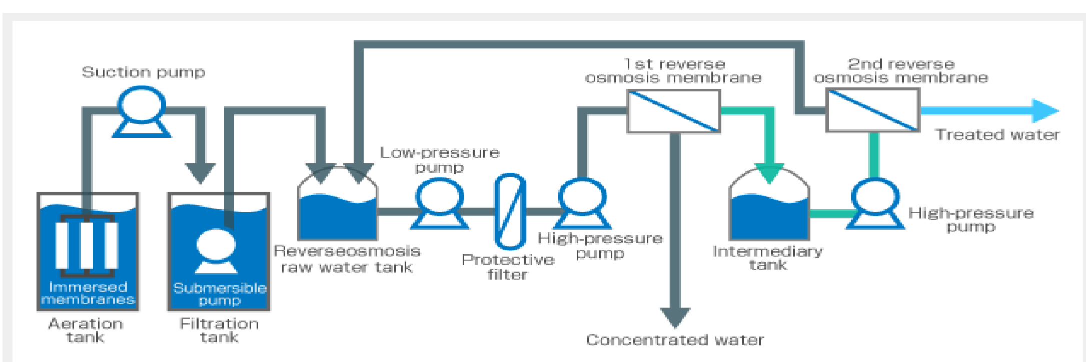






Common membrane materials include polyamide thin film composites (TFC), cellulose acetate (CA) and cellulose triacetate (CTA) with the membrane material being spiral wound around a tube, or hollow fibres bundled together.

Hollow fibre membranes have a greater surface area and hence capacity but are more easily blocked than spiral wound membranes.



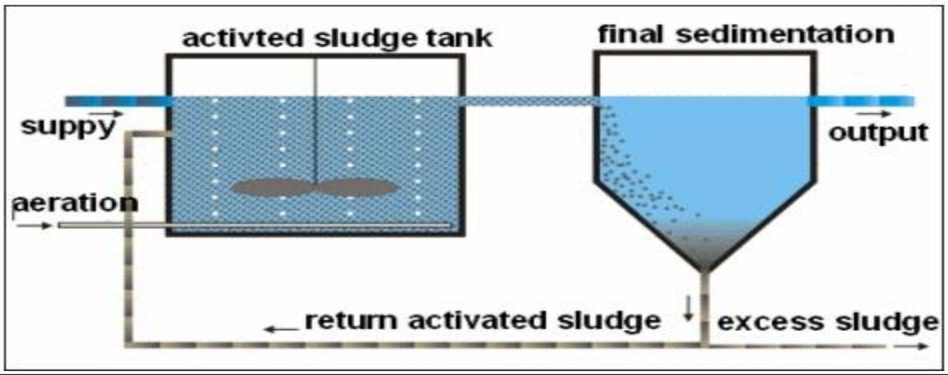
Advanced Sewage Treatment System Unit

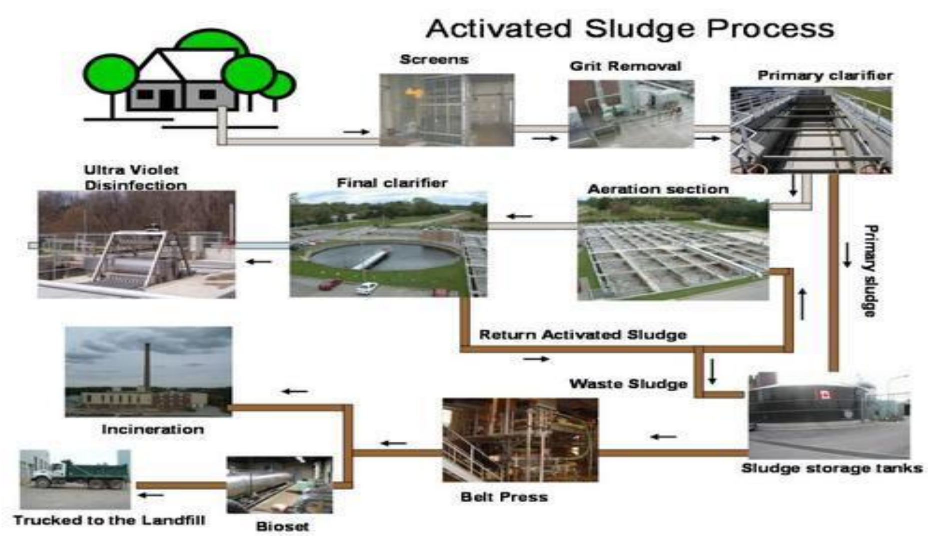
RO membranes are rated for their ability to reject compounds from contaminated water. A rejection rate (% rejection) is calculated for each specific ion or contaminant as well as for reduction of total dissolved solids (TDS).

TFC membranes have superior strength and durability as well as higher rejection rates than CA/CTA membranes. They also are more resistant to microbial attack, high pH and high TDS. CA/CTA's have a better ability to tolerate chlorine.

Sulphonated polysulphone membranes (SPS) are chlorine tolerant and can withstand higher pH's and are best used where the feed water is soft and high pH or where high nitrates are of concern.

Activated sludge process





The **activated sludge process** is a type of wastewater **treatment process** for treating sewage or industrial wastewaters using aeration and a biological floc composed of bacteria and protozoa.

the most common suspended growth process used for municipal wastewater treatment is the activated sludge process as shown in figure:

Activated sludge plant involves:

1. wastewater aeration in the presence of a microbial suspension,
2. solid-liquid separation following aeration,
3. discharge of clarified effluent,

4. wasting of excess biomass, and
5. return of remaining biomass to the aeration tank.

In activated sludge process wastewater containing organic matter is aerated in an aeration basin in which micro-organisms metabolize the suspended and soluble organic matter. Part of organic matter is synthesized into new cells and part is oxidized to CO_2 and water to derive energy. In activated sludge systems the new cells formed in the reaction are removed from the liquid stream in the form of a flocculent sludge in settling tanks. A part of this settled biomass, described as activated sludge is returned to the aeration tank and the remaining forms waste or excess sludge.

Activated Sludge Process Variables

The main variables of activated sludge process are the mixing regime, loading rate, and the flow scheme.

Mixing Regime

Generally two types of mixing regimes are of major interest in activated sludge process: ***plug flow*** and ***complete mixing***. In the first one, the regime is characterized by orderly flow of mixed liquor through the aeration tank with no element of mixed liquor overtaking or mixing with any other element. There may be lateral mixing of mixed liquor but there must be no mixing along the path of flow.

In complete mixing, the contents of aeration tank are well stirred and uniform throughout. Thus, at steady state, the effluent from the aeration tank has the same composition as the aeration tank contents.

The type of mixing regime is very important as it affects (1) oxygen transfer requirements in the aeration tank, (2) susceptibility of biomass to shock loads, (3) local environmental conditions in the aeration tank, and (4) the kinetics governing the treatment process.

Loading Rate

A loading parameter that has been developed over the years is the ***hydraulic retention time*** (HRT), q, d

$$q = \frac{V}{Q}$$

V= volume of aeration tank, m^3, and Q= sewage inflow, m^3/d

Another empirical loading parameter is ***volumetric organic loading*** which is defined as the BOD applied per unit volume of aeration tank, per day.

A rational loading parameter which has found wider acceptance and is preferred is ***specific substrate utilization rate***, q, per day.

A similar loading parameter is ***mean cell residence time*** or ***sludge retention time*** (SRT), q_c, d

$$q_c = \frac{V\,X}{Q_w X_r + (Q - Q_w X_e)}$$

where S_O and S_e are influent and effluent organic matter concentration respectively, measured as BOD_5 (g/m^3), X, X_e and X_r are MLSS concentration in aeration tank, effluent and return sludge respectively, and Q_w= waste activated sludge rate.

Trickling filter

TF is an attached growth process i.e. process in which microorganisms responsible for treatment are attached to an inert packing material. Packing material used in attached growth processes include rock, gravel, slag, sand, redwood, and a wide range of plastic and other synthetic materials.

Process Description

- The wastewater in trickling filter is distributed over the top area of a vessel containing non-submerged packing material.
- Air circulation in the void space, by either natural draft or blowers, provides oxygen for the microorganisms growing as an attached biofilm.
- During operation, the organic material present in the wastewater is metabolised by the biomass attached to the medium. The biological slime grows in thickness as the organic matter abstracted from the flowing wastewater is synthesized into new cellular material.
- The thickness of the aerobic layer is limited by the depth of penetration of oxygen into the microbial layer.
- The micro-organisms near the medium face enter the endogenous phase as the substrate is metabolised before it can reach the micro-organisms near the medium face as a result of increased thickness of the slime layer and loose their ability to cling to the media surface. The liquid then washes the slime off the medium and a new slime layer starts to grow. This phenomenon of losing the slime layer is called ***sloughing***.
- The sloughed off film and treated wastewater are collected by an underdrainage which also allows circulation of air through filter. The collected liquid is passed to a settling tank used for solid- liquid separation.

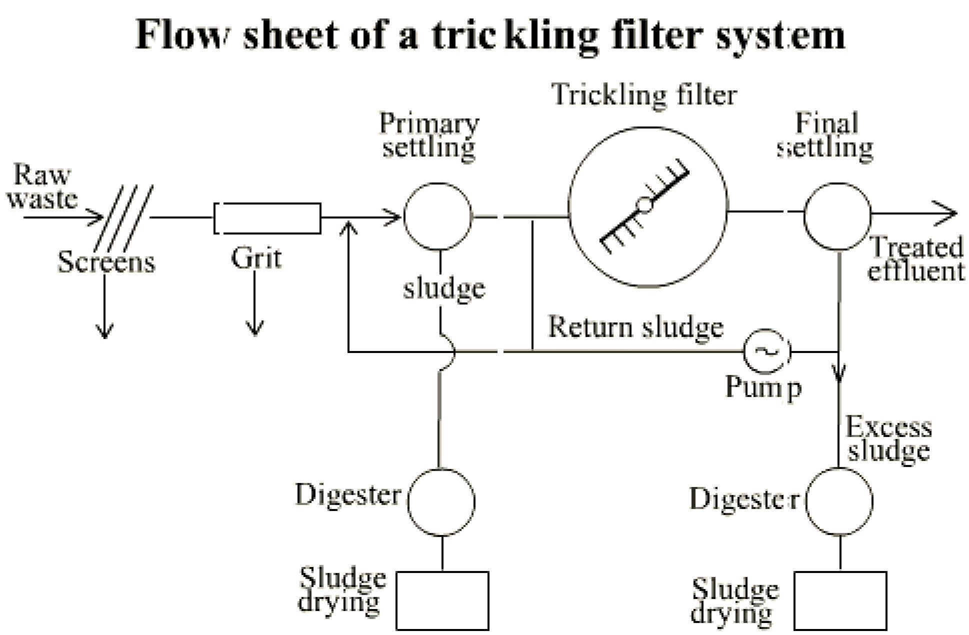
Types of Filters

Trickling filters are classified as high rate or low rate, based on the organic and hydraulic loading applied to the unit.

.No.	Design Feature	Low Rate Filter	High Rate Filter
1.	Hydraulic loading, $m^3/m^2.d$	1 - 4	10 - 40
2.	Organic loading,kg BOD / m^3.d	0.08 - 0.32	0.32 - 1.0
3.	Depth, m.	1.8 - 3.0	0.9 - 2.5
4.	Recirculation ratio	0	0.5 - 3.0 (domestic wastewater) upto 8 for strong industrial wastewater.

- The hydraulic loading rate is the total flow including recirculation appied on unit area of the filter in a day, while the organic loading rate is the 5 day 20°C BOD, excluding the BOD of the recirculant, applied per unit volume in a day.

- Recirculation is generally not adopted in low rate filters.
- A well operated low rate trickling filter in combination with secondary settling tank may remove 75 to 90% BOD and produce highly nitrified effluent. It is suitable for treatment of low to medium strength domestic wastewaters.
- The high rate trickling filter, single stage or two stage are recommended for medium to relatively high strength domestic and industrial wastewater. The BOD removal efficiency is around 75 to 90% but the effluent is only partially nitrified.
- Single stage unit consists of a primary settling tank, filter, secondary settling tank and facilities for recirculation of the effluent. Two stage filters consist of two filters in series with a primary settling tank, an intermediate settling tank which may be omitted in certain cases and a final settling tank.
- **Process Design**



Generally trickling filter design is based on empirical relationships to find the required filter volume for a designed degree of wastewater treatment. Types of equations:

1. NRC equations (National Research Council of USA)
2. Rankins equation
3. Eckenfilder equation
4. Galler and Gotaas equation

Q.3 **FUNCTIONING OF PRETREATMENT PROCESS FOR IWWT**

SCREENING

GRIT CHAMBER

NEUTRALIZATION

EQUALIZATION

PH CORRECTION

SKIMMING etc.

Q. 4 Aerobic and anaerobic biological processes

AEROBIC PROCESS:

Aerobic wastewater treatment is a process where bacteria utilize oxygen to degrade organic matter (generally quantified as biochemical oxygen demand or BOD) and other pollutants involved in various production systems. The two most common types of aerated wastewater systems are activated sludge systems and aerated stabilization basins (ASBs). ASBs are commonly found as treatment systems in the pulp and paper industry and are used in some municipalities, as well as other industries.

There are eight growth pressures that affect a treatment system but we will review two major ones: oxygen and organic loading (BOD). In a typical wastewater treatment system, the influent coming into the system has the most BOD because it hasn't yet been treated. As the influent reaches the ASB, it enters an aerated environment where the degradation will begin. Different types of aeration are used in ASBs but the most widely used are either surface aerators or diffused aeration systems. When using surface aeration, multiple units are needed to be properly spaced to treat the water. Diffused aeration is normally air that is supplied by compressors or blowers and piped under the surface where the air is released evenly throughout the ASB. Occasionally, pure oxygen is utilized in wastewater treatment, but this is relatively uncommon in ASBs.

The degradation of BOD is achieved through aerobic bacteria in a system. The bacteria utilize oxygen as an electron receptor in order to convert the organic material (BOD or oxygen demand) to carbon dioxide. Via this process they multiply, which in turn creates more bugs to break down more BOD. As the water flows through the system, many changes will occur. As the amount of BOD in the system reduces, the total number of bacteria will also decrease. The oxygen demand, as measured by oxygen uptake rate (OUR) will decrease and the environmental will become acceptable for more advanced life forms, such as protozoa or metazoan. A few of the common higher life forms are: flagellates, free swimming ciliates, stalked ciliates, and rotifers.

The higher life forms will feed on the dispersed bacteria and flocculated bacteria that have been formed after degradation has occurred. Higher life forms are an indication that most BOD has been removed from the system.

Activated sludge process, trickling filter, rotating batch reactor. Sequential batch reactor, activated bio-films, aerated lagoon etc.

<u>Final Treatment and Disposal</u>:

The final treatment processes prepare the water for return to the environment. These processes may include disinfection using chlorination or UV light, discharging the water to a soil absorption field, filtering through sand filters, drip irrigation, or evapotranspiration. Aerobic treatment units (ATUs) are more expensive to operate than typical septic systems.

Anaerobic process

Anaerobic bacteria (bacteria that live in environments that contain no oxygen) 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. No air input required and generates much less sludge (50-80% less) than aerobic treatment. The biogas produced can be used for a renewable energy source as a replacement for fossil fuels such as oil and natural gas. Uses less energy and fewer chemicals than aerobic treatment. Optimal operation of municipal anaerobic treatment systems is dependent upon warmer temperatures that exist around 35°C. Require lower costs to handle sludge than aerobic treatment systems.

The methane-rich biogas produced through anaerobic treatment must be collected, treated and used to avoid release into the atmosphere, as methane is a potent greenhouse gas and has a bad odor associated with it. The biogas can be used in cogeneration units to produce electricity and heat.

Q.5

SLUDGE DISPOSAL FOR INDUSTRIAL WASTE

a) **Disposal in water: b) disposal on land**
   a) **Disposal in water**

Methods of sludge treatment Before disposal, sludge is treated to change its chemical and/or physical properties to make it fit for environmentally safe disposal options. The wastewater composition, chemicals used, and treatment units mainly determine the amount and properties of chemical sludge. Stabilization treatments will decrease the volume, the amount of pathogenic organisms, concentrates contaminants and also diminishes odour. Hence, stabilization makes the transport of sludge safer and cheaper. The sludge can then be treated by conditioning and thickening to improve the effects of dewatering. It also has a disinfection and odour reduction effect on the sludge. Chemical or thermal conditionings are the most common conditioning techniques and there are four common thickening techniques: gravity thickeners, gravity belt thickeners, dissolved air floatation and drum thickeners. Chemical conditioning can also have a stabilising effect as well as deodorising but there is a cost component of chemicals. Thermal conditioning is suitable for all types of sludge. It requires energy and there are also chances of foul odour. These methods are used to reduce water content and increase dry solids content. They also improve the density and strength of sludge for further dewatering treatment.

Industrial wastewater treatment is an unusual engineering challenge. Where else in industry are the designers asked to provide a process that will produce a very high level of efficiency and reliability while being given an unpredictable, inconsistent and highly variable raw material with which to work? This conundrum is further compounded if, as is often the case, the waste is highly concentrated, high in salts or hot.

High concentrations of organics (>5,000 mg/L BOD) pose two challenges. The mere concentration issue means even very efficient treatment can leave a significant effluent concentration (98% efficient treatment of a stream with 10,000 mg/L BOD still leaves 200 mg/L in the effluent.) Further, a stream with a high concentration of BOD will release a lot of heat from bio-oxidation of organics, which can cause mixed liquor temperature to exceed the mesophilic range; this typically results in deflocculation, foaming and high effluent TSS.

High salt concentration (>1,000 mg/L) contributes to high effluent TSS as dispersed solids increase with ionic strength of the solution.

Providing sludge tank and return sludge technologies and treating in the following units before discharge:

Sludge thickening units

Sludge drier- dewatering sludge

Return sludge tank

Thickening is a step to reduce the water content in sludge and it can be done by a gravitation thickener, gravity belt thickener, centrifuge or dissolved-air flotation, etc. These methods basically separate the sludge into two phases; i.e. a clear water phase and the condensed sludge. Thickening increases the content of dry matter and decreases the volume of the sludge. Gravity thickening low in energy consumption requires lesser investment as compared to the other methods. However it is not as effective on secondary sludge. Gravity belt thickening and drum thickening often require a polymer to be incorporated for optimal functioning. These methods however are compact and don't require high amounts of energy. If the solid particles have a low rate of settlement the air flotation technique can be applied. Nonetheless, it incurs high energy costs.

Sludge, originating from the waste water treatment process, is residue either moist or mixed with a liquid component, generated during the primary, the secondary and the tertiary treatment.

ROUTES FOR SLUDGE DISPOSAL:

LANDFILLING

INCINERATION

USING OF SLUDGE IN AGRICULTURE (LANDSPREADING

Factors that influence sludge management:

Cost

Ease of disposal

Accessibility of sites

Human and animal health concerns

Environmental concerns

Social concerns

<u>Methods Purpose</u>

Stabilization 1. Anaerobic digestion 2. Composting 3. Pasteurisation 4. Lime stabilization 5. Bed of reed

It reduces pathogenic micro organisms It concentrates contaminants Reduction of odour

Conditioning 1. Chemical 2. Thermal

Preparatory step for dewatering, thickening and drying. It improves the effect of the subsequent water reducing treatments

Thickening

1. Gravity thickening 2. Gravity belt thickening 3. Dissolved air floatation 4. Drum thickener

It reduces the water content in sludge It also increases the content of dry matter (DS)

It decrease the volume of the sludge Dewatering 1. Centrifuges 2. Belt filter press 3. Recessed-plate filter press 4.

Drying bed It reduces the water content in sludge It also increases the content of dry matter (DS) It decrease the volume of the sludge Drying 1. Direct 2. Indirect It reduces the water content in sludge It also increases the content of dry matter (DS) It decrease the volume of the sludge.

Biological sludge treatment

The biological sludge treatment is essential to condense and to ameliorate sludge which is produced by wastewater/ effluent treatment. Some of the treatment methods are:

Anaerobic digestion: It is the decomposition of sludge in an anaerobic environment. Mass reduction, methane production, and improved dewatering properties of the fermented sludge are important features of anaerobic digestion. However, it requires investment for a digestion chamber, etc. and it also has a slow degeneration rate. To improve the biodegradability of sludge pre-treatments such as thermal pre-treatment (Stuckey & McCarty, 1984; Li & Noike, 1992), addition of enzymes (Knapp & Howell, 1978), ozonation (Yasui & Shibata, 1994), chemical solubilisation by acidification (Gaudy et al., 1971; Woodard & Wukasch, 1994) or alkaline hydrolysis (Mukherjee & Levine, 1992), and mechanical sludge disintegration (Müller, 1996) and ultrasound pre-treatment (A. Tiehm, K. Nickel and U. Neis, 2001) can be done. The degeneration process can also be inhibited by the high concentration of inhibitors such as heavy metals, temperature, etc.

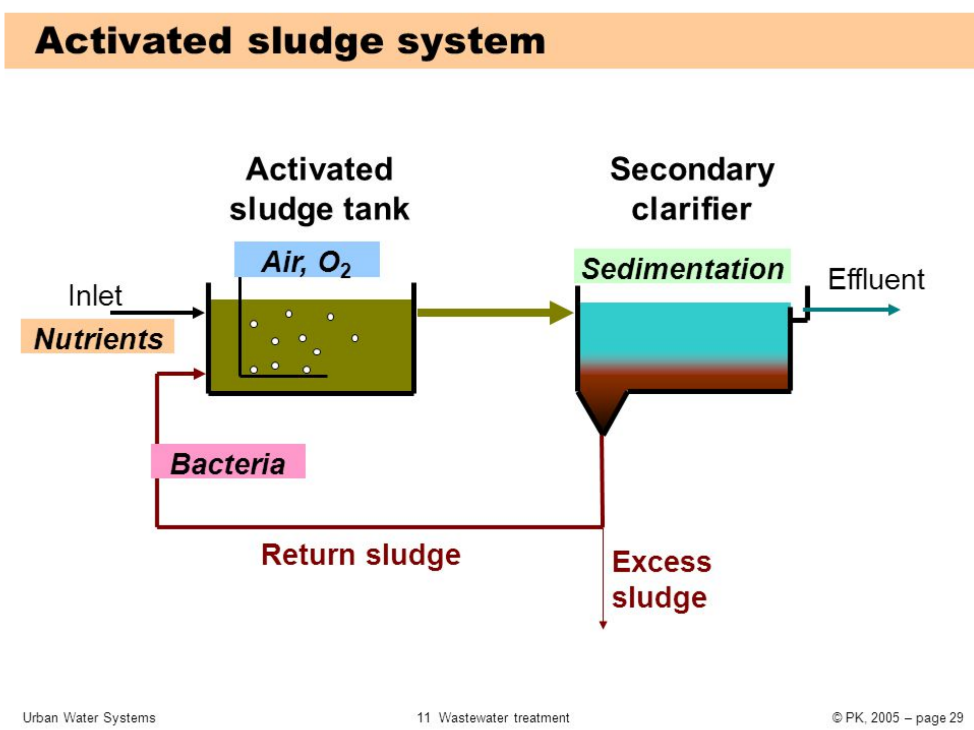
Aerobic digestion: This is the process of oxidizing and decomposing the organic matter in the sludge by micro-organisms in an aerobic environment. Aerobic sludge digestion is one process that may be used to reduce both the organic content and the volume of the sludge. Though this process is sensitive to temperature, heavy metals etc. and incur higher energy costs and there is no useful by-product such as methane. Enzyme treatment: This method is usually used as a pre-treatment of sludge to improve the hydrolysis of organic matter in sludge which limits the rate of anaerobic digestion resulting in an improvement in both biogas production and also improves the dewatering properties of the digested sludge.

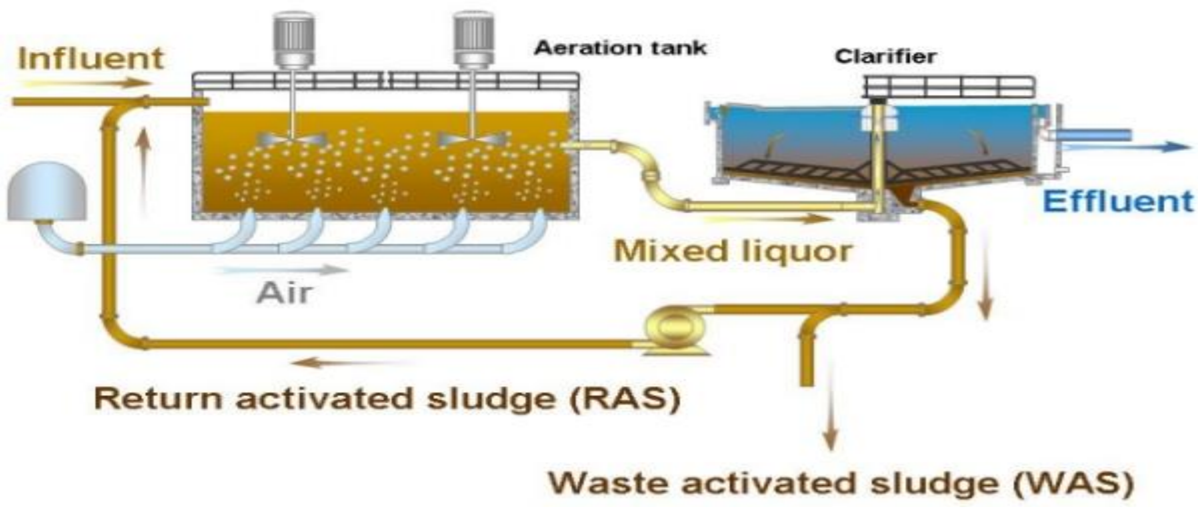
Thermal Hydrolysis: Thermal treatment is incorporated in the sludge treatment process to reduce sludge production, enhance biogas production in anaerobic digesters and inactivate pathogens, improve dewatering of sludge. This process hydrolyses organic solids and makes them soluble, thereby making sludge more readily biodegradable. It also reduces the hydraulic retention time in the anaerobic digester. Chemical stabilization: In this process sludge is treated with chemicals in different ways to stabilize the sludge solids. The common methods of chemical stabilization are lime stabilization and chlorine stabilization. These methods stabilise all kinds of sludge, eliminates odour and destroys pathogenic micro-organisms (Andreadakis, 1999). Use of Polyelectrolytes as a conditioner for sludge dewatering operations is also gaining popularity due to their success of improving process yields. Microbial consortium: Consortium of beneficial microbes that can degrade sludge. It can compose of aerobic and/ or anaerobic microorganisms. The application of microbial consortium modifies the microbial ecology of the sludge. This helps in achieving maximum biological growth and as a result, maximum organic matter will be consumed. Microbial consortium like EM (Effective Microorganism) reduces BOD, COD, TSS, Total and Faecal Coli form in all sewage and effluent generated in an industry; it also controls the pH value, so that the effluent, after being treated, carries a neutral pH of around 6.5 to 7.5. This consortium EM suppresses the putrefaction of sludge leading to odour reduction, the microbes also secretes some enzymes which digests their own cell and thereby reducing the biomass/ sludge. The need for use of extra chemical is also eliminated.

Uses in composting natural fertilizers and soil conditioning etc.

Q.6 Return sludge tank and sludge thickening unit in IWWT

RETURN SLUDGE TANK Part of the settled material, the **sludge**, is **returned** to the head of the aeration system to re-seed the new **wastewater** entering the **tank**. This fraction of the floc is called **return** activated **sludge** (**R.A.S.**). To send back the industrial excess sludge into the process again we use RST.



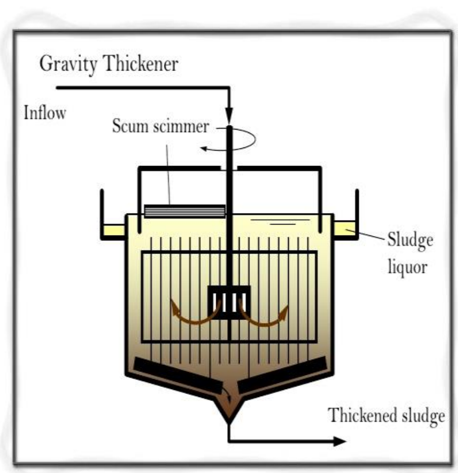


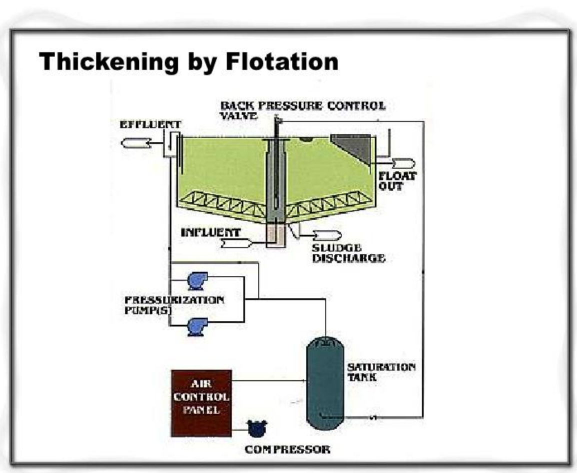
The activated sludge process is usually employed following primary sedimentation. The wastewater contains some suspended and colloidal solids and when agitated in the presence of air, the suspended solids form nuclei on which biological life develops and gradually build up to larger solids which are known as activated sludge. The activated sludge must be kept in suspension during its period of contact with the wastewater being treated by some method of agitation.

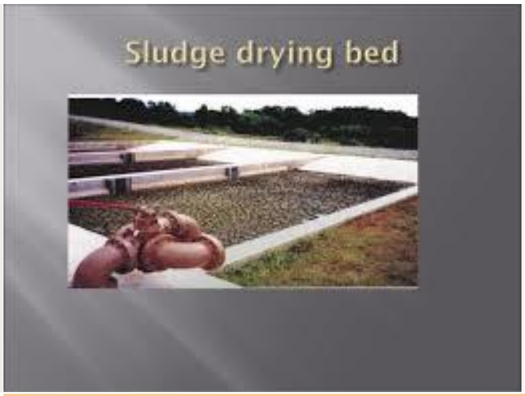
The activated sludge process, therefore, consists of the following steps:

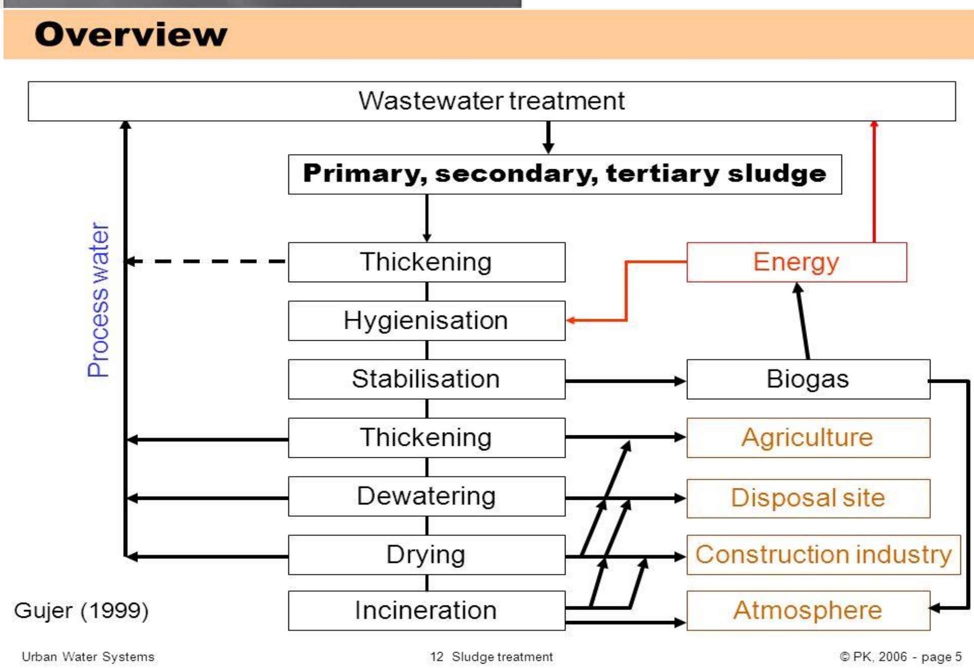
- Mixing the activated sludge with the wastewater to be treated (mixed liquor).
- Aeration and agitation of this mixed liquor for the required length of time.
- Separation of the activated sludge from the mixed liquor, in the final clarification process.
- Return the proper amount of activated sludge for mixture with the wastewater.
- Disposal of the excess activated sludge.

Sludge thickening tanks are provided to dry the sludge and make more thicker for the composting application etc.



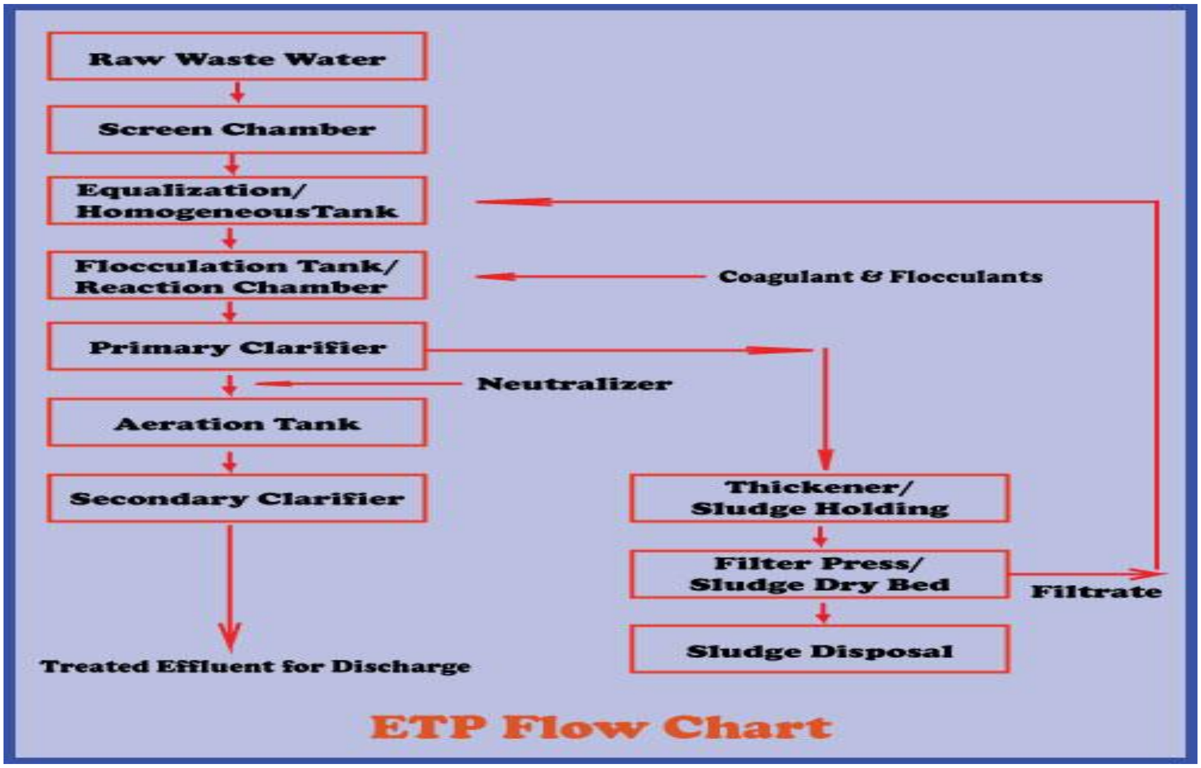




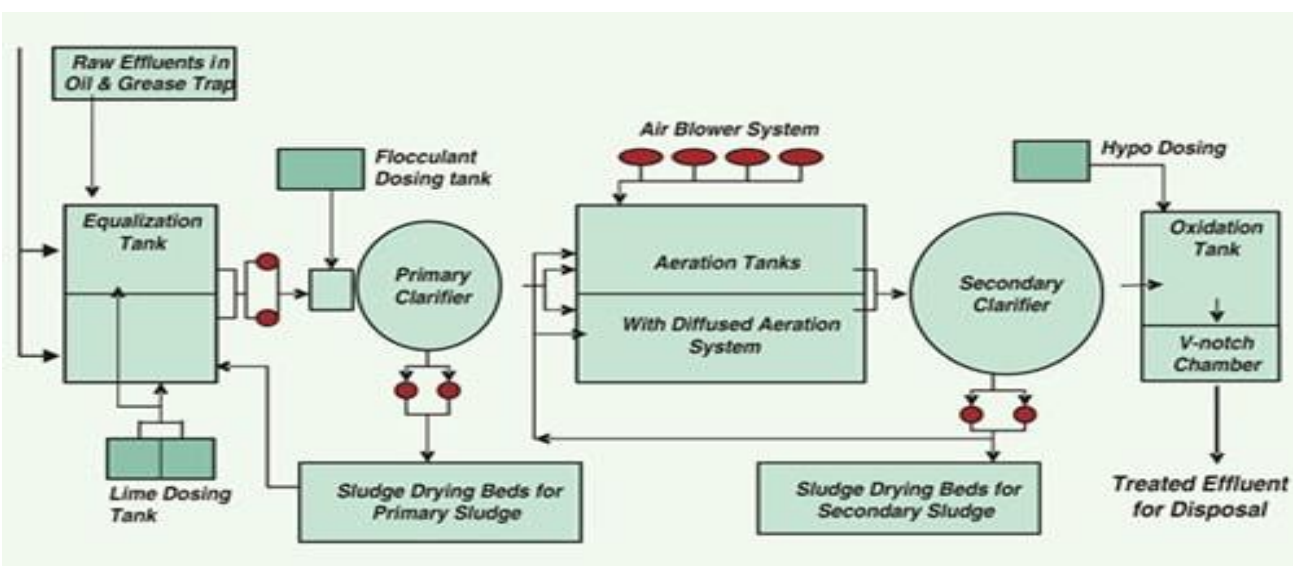


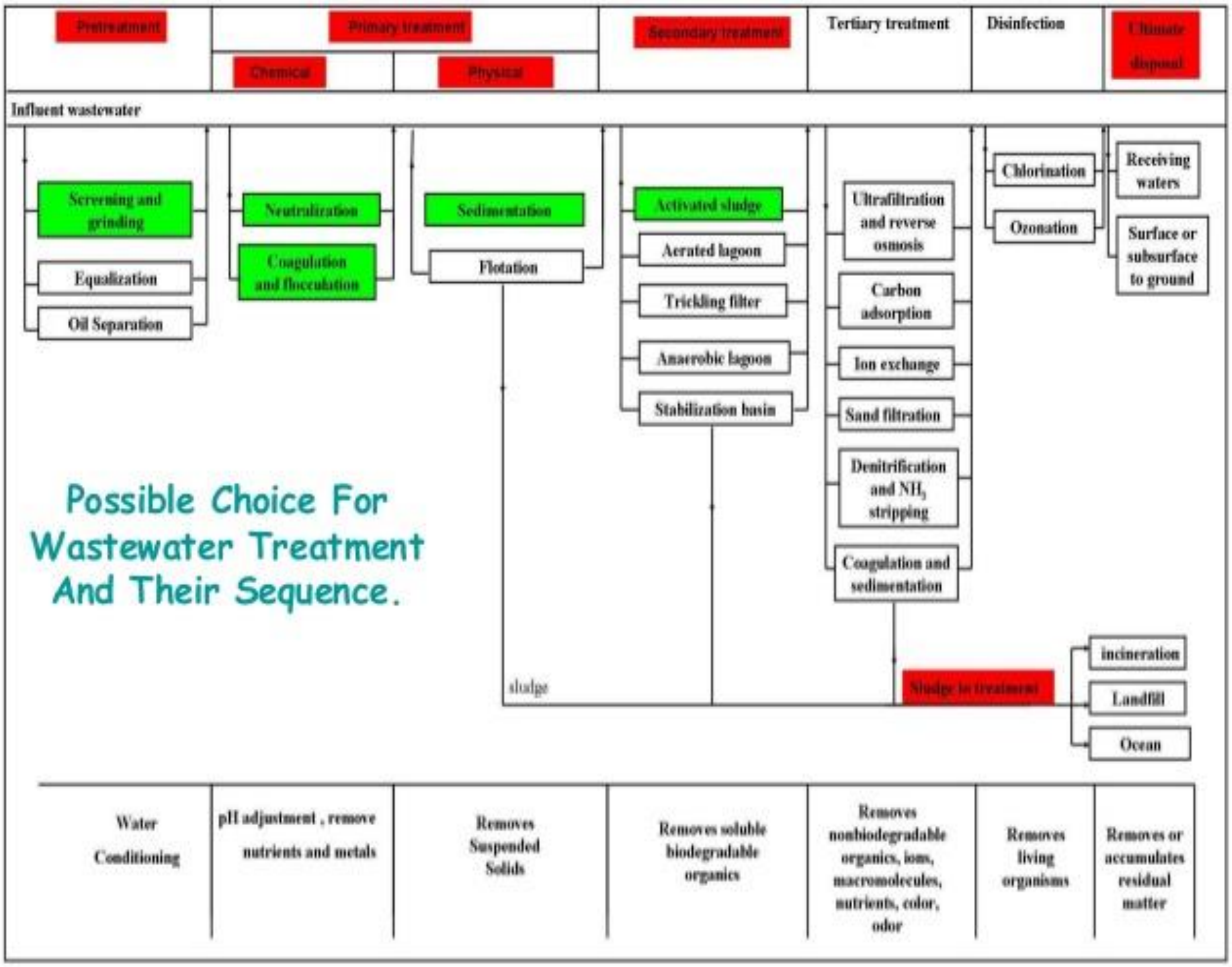
Methods of sludge disposal: thickening drying and dewatering etc.

Q.8 COMMON EFFLUENT TREATMENT PLANT FOR TEXTILE INDUSTRY WASTE TREATMENT



CETP FLOW SHEET FOR TEXTILE





SUGGESTIVE TREATMENT UNITS FOR TEXTILE MILL

Q.7 Combined treatment benefits domestic sewage with industrial wastewater treatment

FEASIBILITY OF COMBINED TREATMENT OF INDUSTRIAL WASTES WITH DOMESTIC WASTES

It is often possible & advisable for an industry to discharge its waste water directly into a municipal sewage treatment plant, where a certain portion of the pollution can be removed. A municipal sewage plant, if designed & operated properly can be handle almost any type & quantity of industrial waste. Hence one possibility that should be seriously considered is the co operation of industry & municipality in the joint construction and operation of a municipal waste water treatment plant.

There are many advantages to be gained from such a joint venture:-

1. Here the responsibility is placed with one owner, while at the same time, the cooperative spirit between industry & municipality increases, particularly if the division of costs is mutually satisfactory.

2. Only one chief operator is required, whose sole obligation is the management of the treatment plant i.e. he is not burden by the miscellaneous duties often given to the industrial employee in charge of waste disposal & the chances of mismanagement and neglect which may result if industrial production men operate waste treatment plants, are eliminated.

3. Since the operator of such a large treatment plant usually receives higher pay than separate domestic plant operators, better trained people are available.

4. Even if identical equipment is required construction costs are less for a single plant than for 2 or more. Furthermore, municipalities can apply for state & or federal aid for plant construction, which private industry is not eligible to receive.

5. The land required for plant construction & for disposal of waste products is obtained more easily by the municipality.

6. Operating costs are lower, since more waste is treated at a lower rate per unit of volume.

7. Possible cost advantages resulting from lower municipal financing cost & federal grants.

8. Some wastes may add valuable nutrient for biological activity to counter act other industrial wastes that are nutrient deficient. Thus bacteria in the sewage are added to organic industrial wastes as seeding material. These microorganisms are vital to biological treatment. Also, acids from 1 industry may help to neutralization alkaline wastes from another industry.

9. The treatment of all waste water generated in the community in a municipal plant, enables the municipality to assure a uniform level of treatment to all the users of the river & even to increase the degree of treatment given to all waste water to the maximum level obtainable with technological advance.