SEEWAGE TREATMENT

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Abstract: - sewage treatment is a process of removing contaminants from wastewater and household sewage both runoff (effluents), domastic,commercial and industrial. The sewage treatment contains three three stages of treatment called, primary, secondary and tertiary treatment. Primary treatment consists of temporarily holding the sewage in a quiescent basin where heavy solids can settle to the bottom while oil, grease and lighter solids float to the surface. The settled and floating materials are removed and the remaining liquid may be discharged or subjected to secondary treatment. Secondary removes dissolved and suspended biological matter. Secondary treatment is typically performed by indigenous water-borne micro-organisms in a managed habitat. Secondary treatment may require a separation process to remove the micro-organisms from the treated water prior to discharge or tertiary treatment.tertiry treatment order to allow rejection into a highly sensitive or fragile ecosystem, Treated water is sometimes disinfected chemically or physically. In the process of pretreatment processes like screening, grit removal, flow equalization were carried out. in secondary treatment includes trickling filter, rotating biological filters, activated sludge are used. While tertiary contain filtration, lagooning, nutrient removal, disinfection, and order control were carried out.

1 Introduction: - a lack of proper treatment of sewage poses a threat to public health. And the network of tunnels and channels that currently exist as the main sewage disposal system. Sewage contaminates the canals' water with bacteria and other contaminates hazardous to humans. The principal objective of wastewater treatment is generally to allow human & industrial effluent to be disposed of without danger to human health or unacceptable disposal and utilization and indeed is an effective from waste water desposal. In case of irrigation , the required quantity of effluent will depend o crops to be irrigated , the soil condition & system of effulent , distribution adopted. Through crop restriction & selection of irrigation system which minimize helth risk . adopting as low a level of treatment as possible is espacily desirable in developing countries.not only from the point of view of cost but also in acknowledgment of the difficulty of operating complex system, its main aims to need to reduce organic & suspended solid loads to limit pollution to the environment. It is also very usefull to removal of toxic substances from water . conventional waste water treatment consist of a combination of physical, chemical, and biological process & operations of removal solids, organic matter and sometimes nutrients from water , in order to increase treatment level are preliminary, primery , secondry & tertiory and advance treatment. The main purpose of study the about sewage treatment plant is that to make a healthy environment for the society to leave in a healthy way, to use the sewage water for proper sanitation, and in irrigation , and many other usefull works, the contribution of this perticuler paper is to tell the importance of good sewage treatment , and give a brief discussion about the various elements and their work process of the sewage plant in the process of making water usefull in all different aspects.

2 Classification of sewage treatment plant:- sewage treatment processes are often classified as:-

i) Preliminary treatment
ii) Primary treatment
iii) Secondary (or biological treatment)
iv) Complete final treatment

2.1 Preliminary treatment: - preliminary treatment consist solely in separating the floating materials (like tree branch, dead animal etc.)And also the heavy settle able inorganic solids .the treatment reduces the BOD of wastewater by about 15 to 30%.

2.1.1 screening :- screening consist of passing the sewage through different types of screens, so as to trap and remove the floating matter, such as pieces of cloth, paper,wood,etc.these floating material, if not removed, will chock the pipes, screen should preferably be placed before grit.

2.1.2 Grit removal: - Pretreatment may include a sand or grit channel or chamber, where the velocity of the incoming sewage is adjusted to allow the settlement of sand, grit, stones, and broken glass. These particles are removed because they may damage pumps and other equipment. Grit chambers come in 3 types: horizontal grit chambers, aerated grit chambers and vortex grit chambers.

2.1.3 Flow equalization: - Clarifiers and mechanized secondary treatment are more efficient under uniform flow conditions. Equalization basins may be used for temporary storage of diurnal or wet-weather flow peaks. Basins provide a place to temporarily hold incoming sewage during plant maintenance and a means of diluting and distributing batch discharges of toxic or high-strength waste which might otherwise inhibit biological secondary treatment (including portable toilet waste, vehicle holding tanks, and septic tank pumpers). Flow equalization basins require variable discharge control, typically include provisions for bypass and cleaning, and may also include aerators. Cleaning may be easier if the basin is downstream of screening and grit removal.

2.1.4 Fat and gas removal: - fat and grease are removed by passing the sewage through a small tank where skimmers collect the fat floating on the surface. Air blowers in the base of the tank may also be used to help recover the fat as froth. Many plants, however, use primary clarifiers with mechanical surface skimmers for fat and grease removal.

2.2 Primary treatment:- In the primary sedimentation stage, sewage flows through large tanks, commonly called "pre-settling basins", "primary sedimentation tanks" or "primary clarifiers". The tanks are used to settle sludge while grease and oils rise to the surface and are skimmed off. Primary settling tanks are usually equipped with mechanically driven scrapers that continually drive the collected sludge towards a hopper in the base of the tank where it is pumped to sludge treatment facilities. Grease and oil from the floating material can sometimes be recovered for saponification.

2.3 secondary treatments :- secondry treatment involves further treatment of the effluent ,coming from the primery sedimentation tank, this is generally accomplish through biological decomposition of organic matter , which can be carried out by either aerobic or anaerobic conditions. In this biological units,bacteria will decompose the fine organic matter , to produce clearer effluent , the effluent from the secondary biological treatment will usually contain a little BOD (5 to 10% original), and may contains several milligrams per liter of DO .the organic solid\ sludge ,separated out in primary as well as secondary settling tank, will be disposed of by stablishing them under anaerobic process in a sludge digestion tank.

2.3.1 Activated sludge :- activated sludge plants encompass a variety of mechanisms and processes that use dissolved oxygen to promote the growth of biological floc that substantially removes organic material. The process traps particulate material and can, under ideal conditions, convert ammonia to nitrite and nitrate ultimately to nitrogen gas.

2.3.2 Aerobic granular sludge :- Activated sludge systems can be transformed into aerobic granular sludge systems (aerobic granulation) which enhance the benefits of activated sludge, like increased biomass retention due to high sludge satiability

2.3.3 Surface aerated basins (lagoons):- Activated sludge systems can be transformed into aerobic granular sludge systems (aerobic granulation) which enhance the benefits of activated sludge, like increased biomass retention due to high sludge satiability. Activated sludge systems can be transformed into aerobic granular sludge systems (aerobic granulation) which enhance the benefits of activated sludge, like increased biomass retention due to high sludge satiability. the floating surface aerators are rated to deliver the amount of air equivalent to 1.8 to 2.7 kg O_2/kW. Biological oxidation processes are sensitive to temperature and, between 0 °C and 40 °C, the rate of biological reactions increase with temperature. Most surface aerated vessels operate at between 4 °C and 32 °C.

2.3.4 Filter beds: - trickling filter beds are used where the settled sewage liquor is spread onto the surface of a bed made up of coke (carbonized coal), limestone chips or specially fabricated plastic media.
The liquor is typically distributed through perforated spray arms. the distributed liquor trickles through the bed and is collected in drains at the base. These drains also provide a source of air which percolates up through the bed, keeping it aerobic. Biological films of bacteria, protozoa and fungi form on the media's surfaces and eat or otherwise reduce the organic content. This biofilm is often grazed by insect larvae, snails, and worms which help maintain an optimal thickness. Overloading of beds increases the thickness of the film leading to clogging of the filter media and pounding on the surface. Recent advances in media and process micro-biology design overcome many issues with trickling filter designs.

2.3.5 Biological aerated filter: - Biological Aerated (or Anoxic) Filter (BAF) or Biofilters combine filtration with biological carbon reduction, nitrification or denitrification. BAF usually includes a reactor filled with a filter media. The media is either in suspension or supported by a gravel layer at the foot of the filter. The dual purpose of this media is to support highly active biomass that is attached to it and to filter suspended solids. Carbon reduction and ammonia conversion occurs in aerobic mode and sometime achieved in a single reactor while nitrate conversion occurs in anoxic mode. BAF is operated either in up flow or down flow configuration depending on design specified by manufacturer.

2.3.6 Rotating biological contractors:-A rotating biological contractor (RBC) is a cylindrical media of closely mounted thin flat circular plastic sheet or discs of 3to 3.5m in diameter, 10 mm thick and placed at 30 to 40 mm spacing mounted on column shaft b/w two flat discs and welding them together as a unit. it usually made up in upto 8m length & may be placed in series or parallel in a specially constructed tanks. The RBC are kept immersed in wastewater by about 40%of their diameter rotated around their central horizontal shaft at a speed of 1-2 rpm by means of power supplied. Approximately 95% of the surface area is thus alternatively immersed in wastewater and then exposed to the atmosphere above the liquid. Sludge produced in this process may contain about 0.4 kg per kg of BOD5 applied the theoretical model is similar to that of trickling filters.

2.3.7 Membrane bioreactors:- Membrane bioreactors(MBR) combine activated sludge treatment with a membrane liquid-solid separation process. The membrane component uses low pressure microfiltration or ultra filtration membranes and eliminates the need for clarification and tertiary filtration. The membranes are typically immersed in the aeration tank; however, some applications utilize a separate membrane tank. One of the key benefits of an MBR system is that it effectively overcomes the limitations associated with poor settling of sludge in conventional activated sludge (CAS) processes. The technology permits bioreactor operation with considerably higher mixed liquor suspended solids (MLSS) concentration than CAS systems, which are limited by sludge settling. The process is typically operated at MLSS in the range of 8,000–12,000 mg/L, while CAS are operated in the range of 2,000–3,000 mg/L. The elevated biomass concentration in the MBR process allows for very effective removal of both soluble and particulate biodegradable materials at higher loading rates. Thus increased sludge retention times, usually exceeding 15 days, ensure complete nitrification even in extremely cold weather.

2.3.8 Secondary sedimentation:- The final step in the secondary treatment stage is to settle out the biological floc or filter material through a secondary clarifier and to produce sewage water containing low levels of organic material and suspended matter.

2.4 tertiary treatments:-it consist of removing the organic load left aftr the secondry treatment , paeticulerly to kill the pathogenic bacteria, this is generally carried out by chlorination. The purpose of tertiary treatment is to provide a final treatment stage to further improve the effluent quality before it is discharged to the receiving environment (sea, river, lake, wet lands,ground, etc.).

2.4.1 Filtration: - Sand filtration removes much of the residual suspended matter. Filtration over activated carbon, also called carbon adsorption, removes residual toxins.

2.4.2 Lagooning: - Lagooning provides settlement and further biological improvement through storage in large man-made ponds or lagoons. These lagoons are highly aerobic and colonization by native macrophysics, especially reeds, is often encouraged. Small filter feeding invertebrates such as Daphnia and species of Rotifer greatly assist in treatment by removing fine particulates.

2.4.3 Nutrient removal:- Wastewater may contain high levels of the nutrients nitrogen and phosphorus. Excessive release to the environment can lead to a build up of nutrients, called eutrophication, which can in turn encourage the overgrowth of weeds, algae, and cyanobacteria. This may cause an algal bloom, a rapid growth in the population of algae. The algae numbers are unsustainable and eventually most of them die. The decomposition of the algae by bacteria uses up so much of the oxygen in the water that most or all of the animals die, which creates more organic matter for the bacteria to decompose. In addition to causing deoxygenation, some algal species produce toxins that contaminate drinking water supplies. Different treatment processes are required to remove nitrogen and phosphorus.

2.4.3.1 Nitrogen removal:- The removal of nitrogen is effected through the biological oxidation of nitrogen from ammonia to nitrate (nitrification), followed by denitrification, the reduction of nitrate to nitrogen gas. Nitrogen gas is released to the atmosphere and thus removed from the water.Nitrification itself is a two-step aerobic process, each step facilitated by a different type of bacteria. The oxidation of ammonia (NH_3) to nitrite (NO_2^-) is most often facilitated by *Nitrosomonas* spp. ("nitroso" referring to the formation of a nitro so functional group). Nitrite oxidation to nitrate (NO_3^-), though traditionally believed to be facilitated by *Nitrobacter* spp. (nitro referring the formation of a nitro functional group), is now known to be facilitated in the environment almost exclusively by *Nitrospira* spp.Denitrification requires anoxic conditions to encourage the appropriate biological communities to form. It is facilitated by a wide diversity of bacteria. Sand filters, lagooning and reed beds can all be used to reduce nitrogen, but the activated sludge process (if designed well) can do the job the most easily. Since denitrification is the reduction of nitrate to dinitrogen gas, an electron donor is needed. This can be, depending on the wastewater, organic matter (from faeces), sulfide, or an added donor like methanol. The sludge in the anoxic tanks (denitrification tanks) must be mixed well (mixture of recirculated mixed liquor, return activated sludge [RAS], and raw influent) e.g. by using submersible mixers in order to achieve the desired denitrification.Sometimes the conversion of toxic ammonia to nitrate alone is referred to as tertiary treatment.Many sewage treatment plants use centrifugal pumps to transfer the nitrified mixed liquor from the aeration zone to the anoxic zone for gentrification

2.4.3.2 Phosphorus removal:- Phosphorus can be removed biologically in a process called enhanced biological phosphorus removal. In this process, specific bacteria, called polyphosphate accumulating organisms (PAOs), are selectively enriched and accumulate large quantities of phosphorus within their cells (up to 20 percent of their mass). When the biomass enriched in these bacteria is separated from the treated water, these biosolids have a high fertilizer value.

3 Disinfection:- Disinfection of potable water is the specialized treatment for destruction for destruction or removal of organism capable of causing disease ; it should not be confused with sterilization,which is the destruction of removal of all life.pathogens(disease producing organism) are present in both groundwater and surface water supplies. These organisms, under certain conditions,are capable of surviving in water supplies for week at temperatures near 21C, and for months at colder temperatures. Destruction or removal of these organisms is essential in providing a safe potable water supply. While the exact effect of disinfection agents on microorganisms is not clerly understood, type and concentration of microorganism , type of concentrationof disinfectant,conact time provided,chemical cherecter & temperature of water being treated are the factors which determines the efficiency of disinfection.

4 Sludge treatment and disposal:- The sludge's accumulated in a wastewater treatment process must be treated and disposed of in a safe and effective manner. The purpose of digestion is to reduce the amount of organic matter and the number of disease-causing microorganisms present in the solids. The most common treatment options include anaerobic digestion, aerobic digestion, and composting Sludge treatment depends on the amount of solids generated and other site-specific conditions. Composting is most often applied to small-scale plants with aerobic digestion for mid sized operations, and anaerobic digestion for the larger-scale operations.The sludge is sometimes passed through a so-called pre-thickener which de-waters the sludge.

4.1 Anaerobic digestions: - Anaerobic digestion is a bacterial process that is carried out in the absence of oxygen. The process can either be thermophilic digestion, in which sludge is fermented in tanks at a temperature of 55 °C, or mesophilic, at a temperature of around 36 °C. Though allowing shorter retention time (and thus smaller tanks), thermophilic digestion is more expensive in terms of energy consumption for heating the sludge. It reduces the BOD by about 35 to 40%.This reduction can be increased with a combination of anaerobic and aerobic treatment by installing Aerobic *Treatment* Units (ATUs) in the septic tank. One major feature of anaerobic digestion is the production of biogas (with the most useful component being methane), which can be used in generators for electricity production and/or in boilers for heating purposes. Many larger sites utilize the biogas for combined heat and power, using the cooling water from the generators to maintain the temperature of the digestion plant at the required 35 ± 3 °C.

4.2 Aerobic digestion:-Aerobic digestion is a bacterial process occurring in the presence of oxygen. Under aerobic conditions, bacteria rapidly consume organic matter and convert it into carbon dioxide. The operating costs used to be characteristically much greater for aerobic digestion because of the energy used by the blowers, pumps and motors needed to add oxygen to the process. However, recent technological advances include non-electric aerated filter systems that use natural air currents for the aeration instead of electrically operated machinery. Aerobic digestion can also be achieved by using diffuser systems or jet aerators to oxidize the sludge. Fine bubble diffusers are typically the more cost-efficient diffusion method; however, plugging is typically a problem due to sediment settling into the smaller air holes. Coarse bubble diffusers are more commonly used in activated sludge tanks (generally a side process in waste water management) or in the flocculation stages. A key component for selecting diffuser type is to ensure it will produce the required oxygen transfer rate.

4.3 Composting: - Composting is also an aerobic process that involves mixing the sludge with sources of carbon such as sawdust, straw or wood chips. In the presence of oxygen, bacteria digest both the wastewater solids and the added carbon source and, in doing so, produce a large amount of heat.

4.4 Incineration: - Incineration of sludge is less common because of air emissions concerns and the supplemental fuel (typically natural gases or fuel oil) required burning the low calorific value sludge and vaporizing residual water. Stepped multiple hearth incinerators with high residence time and fluidized bed incinerators are the most common systems used to combust wastewater sludge. Co-firing in municipal waste-to-energy plants is occasionally done, this option being less expensive assuming the facilities already exist for solid waste and there is no need for auxiliary fuel.

4.5 Sludge disposal:-the digested sludge from the digestion tank contains lots of water and is therefore, first of all dewatered or dried up before further disposal either by burning or dumping ,in India the the water of sludge is removed by drying the sludge on drying beds; in western countries dewatering is generally done by vacuum filters or by using high speed speed centrifuges.

5 Conclusions:-the paper includes the overall description about sewage water treatment its different aspects the main advantage of study of this paper is to study about saving extra water, recycling of water ,ground and surface water source from pollution due to treatment of wastewater ,pretreated water used for vegetation and also limiting the air pollutation in treatment plant. Although this paper also have some limitation such as handling of dry sludge cake& food chain is missed for various organism, life cycle river animal, various chemicals were used to treat the wastewater & also natural capacity to treat water remains un-utilized.the main application of this paper is water desalination and industrial water treatment to public wastewater filtration , water reuse & ultrapure water production. The application and integrated salutation make the treatment and transport of water & wastewater possible of customer all over the world.

6 References:-