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ASSIGMENT;- ENVIROMENTAL SCIENCES

QUESTION;-

Wastewater treatment is a process used to remove contaminants from wastewater or sewage and convert it into an effluent that can be returned to the water cycle with minimum impact on the environment, or directly reused. The latter is called water reclamation because treated wastewater can be used for other purposes. The treatment process takes place in a wastewater treatment plant (WWTP), often referred to as a Water Resource Recovery Facility (WRRF) or a Sewage Treatment Plant (STP). Pollutants in municipal wastewater (households and small industries) are removed or broken down.

Waste water treatment

1. Waste water Treatment When effluent discharged into a river body such as lake, river or sea anumber of process occur like physical, chemical and biologicalcharacteristics of water change which cause loss of organism.The extent of damage depend upon type pf pollutant present in effluent.Non bio-degradable pollutant like mercury are most deadly as theyaccumulate in aquatic organism which lead to Biomagnifications.Large quantity of biodegradable waste can affect living organism in thewater bodies in which waste are discharged.areIt is necessary to treat effluent or waste water before discharging inwater body. The treatment procedure are generally divided into threegroups-1. Primary Treatment or Mechanical Treatment2. Secondary Treatment or Biological Treatment3. Tertiary Treatment or Advance Biological or Chemical Treatment

2. Primary Treatment- In primary treatment suspended solid and floating material isremoved. Effluent is passes through a screen which is used toremove certain material like wood pieces, plastic , paper,floating debris. Then effluent is passed through chamber whichis known as grit chamber.-Fatty and oily substance can be removed by flotation method.In order to trap fatty and oily substance a instrument calledCentrifugal Separator is used in this process fatty substanceare reached to outside and clean water remain in the center ofcyclone.- The water is passed in Settling Tank in which water remainfor a long time in which suspended particles are settled downthis process is known as Sedimentation.

3. -Sedimentation can be accelerated by adding chemicalsubstance known as Coagulant like Alum.- Some small particles may be separated by FloatationMethod . In this method bubble of air pass through the bottomof tank and small particles come in the contact with bubblecome out on the surface of water.- Colloidal particles can be removed by Flocculation andPrecipitation.

4. Primary Tratment- Physical Treatment- Chemical TreatmentPhysical chemical waste water treatment techniques aretechniques to remove the coarse fraction.Oil, fatty acids and suspended solids could be removedby the use of the following techniques:1. Physical Treatment a) Screening b) Grit Chamberc) Floatation or skimming tank

5. Chemical Treatment- Sedimentation- Coagulation- Flocculation- FilterationPhysical chemical treatment is normally used toprepare the waste water for the next treatmenttechnique, in many cases biological treatment.

6. Screen Chamber:Screen chamber remove dead animals, branches of tree, logsof wood, rags and other coarse floating material.The effluent is passed through the bar screens for ragremoval. In this section, two automatic bar screen cleanersremove large solids (rags, plastics, etc.) from the raw sewage.The collected material is placed in dumpsters to be taken laterto the landfill

7. Grit Tanks:Grit include sand, ash, egg shell etc . Of diameter less then0.2 mm.Next, the effluent moves to the grit tanks. These tanksreduce the velocity of the effluent so that heavy particlesmay fall to the bottom. The solids are pumped to an augerpump which separates the water from the grit while thewater moves onward. The grit (mostly inorganic solids)goes to a dumpster which is taken to a landfill. There aretwo complete grit removal systems which are rotated inoperation for equal hours.

8. Skimming TankFats, waxes, fatty acid, soap, minerals and vegetable oilpresent in waste water are collectively called as oil and grease.As oil and grease are lighter than water they are normallyseparated by natural flotation .The bubbles of air are passed on the bottom of the tank andfloating matter rises and remain on the surface of waste waterwhich can be separated easily.

9. SedimentationSettling down of suspended particles at the bottom of water iscalled Sedimentation. This process is also known asclarification.In this process water is collected into big pond , slowly- slowlyimpurities are settled down by gravitation. The process ofsedimentation can be accelerated by adding Alum.The main objective of Sedimentation are :- The suspended and colloidal impurities are separated insedimentation tank by gravitation.- It reduce heavy sediment load before treating water forother purposes.

10. -The main principle of sedimentation is to allow water to restor flow at a very slow velocity. So that heavier particles settledown due to gravity.- The process of settling of particles depend mainly onvelocity of flow, size, shape and specific gravity of particlesand viscosity of liquid.- The velocity of water decreased by increasing the length offlow. This principle is used in the process of sedimentation.- The size and shape of particles are increased by formationof precipitates because of addition of coagulants.

11. Coagulation- In plain sedimentation, the heavier particles settle down. However fineparticles take many hours or sometimes days to settle down.- Colloidal particles which are fine particles of size finer than 0.0001 mmcarry electric charges on them.- The water possesses colour which is mainly due to colloidal matter anddissolve organic matter in water.- The turbidity in water is mainly due to the presence of very fine particlesof clay, silt and organic matter.- Sedimentation alone is not sufficient o remove all the suspended matter. The process of coagulation is used to remove colloidal particles from water.- Coagulation is the process in which certain chemical agent is mixedwith water then colloidal and suspended particles are agglomerated andform insoluble metal hydroxide known as flocks.

12. Filtration- Filtration is done in order to remove colloidal and suspendedmatter remaining after sedimentation and to remove bacterialload.- The process of filtration usually consist of allowing the waterpass through thick layer of sand or porous material whichretain coarse impurities on its surface and in pores.- The apparatus used for filtration is called filter and theporous material that fill the filter is known as filtering medium.

13. Types of Filter:1. Single flow closed pressure filter2. Horizontal flow pressure filter3. Dual media filter4. Unflow Sand Filter5. Mechanical Filter- Radical Filter- Multiple Chamber Filter

14. -Coagulant is adopted when turbidity of water exceeds about40 ppm. By coagulation process the fine particles are removedrapidly and turbidity is reduced to about 20 ppm.- The most common coagulant are aluminum sulfhate,chlorinated copper, ferrous sulpahte, lime, magnesiumcarbonate, polyelectrolyte and sodium aluminates.- Aluminum sulphate, (Al2 (SO4)3 . 18 H2O is also known asalum. It is most common coagulant that is available and usedin the form of flakes.

15. FlocculatorsIn recent years flocculators or polyelectrolytes have widelybeen used. Flocculators are organic high molecular weightcompound comprising many inorganic group.- These group groups undergo ionisation when dissolve in water.- - Two important flocculators are polyacryalamide and BA-2 flocculator (cation exchange type).- - The BA-2 polyelectrolyte is employed without any coagulant because it bring about coagulation of colloids itself. Most of colloidal particles carry negative surface charge but molecule of BA- 2 are positively charged . Hence neutralisation of charges take place.- -

16. The water compounds are classified into three categories :suspended solids, colloidal particles (less than 1 micron) anddissolved substances (less than several nanometers).The coagulation-flocculation processes facilitate the removal ofSS and colloidal particles. It’s used in the final stage of solids-liquids separation: settling, flotation or filtration.Coagulation is the destabilization of colloidal particles broughtabout by the addition of a chemical reagent called ascoagulant.

17. Flocculation is the agglomeration of destabilizedparticles into microfloc and after into bulkyfloccules which can be settled called floc. Theaddition of another reagent called flocculants or aflocculants aid may promote the formation of thefloc.The factors, which can promote the coagulation-flocculation, are the velocity gradient, the time,and the pH. The time and the velocity gradientare important to increase the probability of theparticles to come

18. Secondary Treatment or Biological TreatmentIt is the process in which microorganism play a very importantrole for the treatment of effluent. Microorganism like bacteria,fungi decompose the organic waste and convert into simplerform. The main function of secondary treatment is to convertthe reaming organic matter of sewage into stable form byoxidation and nitrification.Biological Treatment Can be classified into1. Aerobic Treatment a) Activated Sludge Process b) Trickling Filter c)2. Anaerobic Treatment

19. Aerobic Treatment :The treatment which is carried out by microorganism in thepresence of oxygen.Anaerobic Treatment :The treatment which is carried out by aerobes in the absenceof oxygen. The need of oxygen is supplied by oxidation ofoxygenated compound for e.g SO2

20. Activated Sludge Process- This is most versatile biological oxidation process employed for thetreatment of waste water contain dissolve solid, collides, coarse solid andorganic matter.- Sewage from sedimentation tank enter into aeration tank. Here 20 – 30% of active sludge is mixed. The mixture is aerated and mixed in the tankfor about 4 to 8 hours .- An efficient aeration for 3 – 6 hour is occupied for sludge while forindustrial waste 6 – 24 hour of aeration is required.- The microorganism oxidize organic matter , in the presence of abundantquantity of oxygen in the aeration tank. Sewage is allowed to settle insecondary sedimentation tank.- This settled sewage has undergo aeration and has activemicroorganism. So some portion of activated sludge is recalculated intothe aeration tank.

21. The activated sludge is obtained by settling sewage in thepresence of excess oxygen. Thus activated sludge is thatsludge which settle down after the sewage has been freelyaerated and agitated for a certain time.- The activated sludge is biologically active and contain alarge number of aerobic bacteria and other microorganism.- When activate d sludge is mixed with effluent , the aerobicbacteria oxidize the organic matter and promotecoagulation and flocculation.- Some advantages of activated sludge method isi) The effluent is free from bed smell and odourii) Give Clear sparkling treated liquid

22. Activated Sludge Process

23. Trickling Filter- After primary treatment the effluent is passed through the the bed the filter medium which is consisting of bed of stone in which microorganism or bacteria are present.- Bacteria get nutrient . Bacteria attack on carbohydrate, protein, oil, fats which is essential for the growth of bacteria.

24. Oxidation Pond (Lagoon)New bilogical method have been introduced now days forwaste water treatment. The oxygen pond is shallow pondwhere waste water is purified by action of algae andaerobic bacteria.Organic matter are decomposed by bacteria and areconsumed by algae.Latter on oxygen is released during the process ofphotosynthesis.Aerobic bacteria get O2 from atmosphere and convertthe organic matter present in sewage and liberate CO2which is again taken by algae during the process ofphotosynthesis.

25. The contents of the aeration tanks, which require a delicatebalance of food and oxygen, are commonly referred to as themixed liquor suspended solids (MLSS) or activated sludge.The activated sludge converts organic substances intooxidized products and a settleable floc which is settled out inthe secondary clarifiers. The aeration tanks have a great dealof flexibility built into them. Raw sewage can be introduced invarious locations and be aerated and mixed for varyinglengths of time and intensity.

26. Carbon Cycle - Metabolism ReactionBacterial Decomposition of Organic WasterMetabolism occurs in animals, humans, and in this caseBacteria, after the ingestion of organic plant or animalfoods. Organic materials contain at least carbon andhydrogen and may include oxygen. In the cells a series ofcomplex reactions occurs with oxygen to convert forexample glucose sugar into the products of carbon dioxideand water and ENERGY. This reaction is also carried outby bacteria in the decomposition/decay of organicwaste materials in the water.

27. An important summary statement is that duringcombustion/metabolism of organic waste, oxygen isused and carbon dioxide is a product. The wholepurpose of the process is to decompose andbreakdown organic waste into carbon dioxide, a gasemitted to the atmosphere, and unreacted solidswhich may be removed by settling and filtration.

28. Tertiary Treatment (Advance waste water treatment)The main function of tertiary treatment is to decrease theload of nitrogen and phosphorous compound present in theeffluent by the following process. a) Precipitation b) Nitrogen Stripping c) Chlorination a) Precipitation: The effluent received after the secondary treatment is mixed with calcium oxide. The lime then react with phosphorous compound in waste to from insoluble calcium phosphate, which then settle down a the bottom of settling tank.

29. b) Nitrogen StrippingNitrogen present in waste water is generally in the form of ammonia gas ,nitrates and nitrites. Ammonia is highly undesirable in streams and lakesbecause it is extremely lethal to aquatic biota. Nitrogen eventually enhanceEutrophicationIn order to remove nitrogen air is forced through the effluent which therebyresult in the removal of ammonia gas.C) ChlorinationIt is the process in which chlorine is used to kill micro-organism .The mainpurpose of chlorination are- To assist in the formation of floc in the process of coagulation togetherwith other chemical.- To prevent corrosion of sewers.- To prevent spread of epidemic.

30. Ultraviolet LightThe water is passed through banks of cylindrical,quartz-jacketed fluorescent bulbs. Some dissolvedmaterials, such as iron and some organic compounds,can also absorb some of the light. Ultravioletdisinfection is becoming more popular because of theincreasing complications associated with the use ofchlorine.Ozone:Ozone is too unstable to store, and has to be made as it isused. It is produced by passing an electrical dischargethrough air, which is then bubbled through the water. Whilechlorine can be dosed at a high enough concentration sothat some of it remains in the water for a considerable time,ozone is consumed very rapidly and leaves no residual. Itmay also produce some chemical byproducts, but probablynot as harmful as those produced by chlorine.

31. Sludge/Solids Treatment1. Anaerobic digesters. In the anaerobic digesters another group of bacteriabegin to digest and dissolve the solids to their basiccomponents. This process uses bacteria which do notneed atmospheric oxygen to survive, so therefore, noair is bubbled into the tanks. In fact, air mixed with thegasses may be explosive, so we strive to keep all airout. The anaerobic digesters produce a stable sludgewhich is readily dewatered. The process is also asource of methane gas, which is used as a fuelsource for heating the digesters, heating severalbuildings, and fueling the engine generator to produceelectricity.

32. Sludge Dewatering and Drying:The engine generator runs on digester or natural gas. The generatorsupplies electrical power to essential pieces of treatment plantequipment. In the event of a complete power outage, importantequipment will be powered by the engine generator. Waste heat is usedto help heat surrounding buildings.After most of the organic solids have been digested, the sludge ispumped to sand drying beds or to the belt filter presses. The belt filterpresses use a chemical flocculent to separate the water from the solids.The dewatered solids are then squeezed between two belts to furtherdewater them. The resulting solids are in the range of 18-20 percentsolids. These solids are applied to agricultural land. The solids can alsobe taken to a landfill. The sludge drying beds also provide a means ofdrying the sludge treated by the anaerobic digesters. As an alternative,the digested sludge may be pumped to the truck loading station to behauled to other locations for drying or for use as fertilizer. Sludge is agood soil conditioner as well as fertilizer.

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