Water Quality Management Practices
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Week – 01
Lecture – 05

Hello everyone, welcome to this NPTEL online certification course on Water Quality Management Practices. This is the last lecture of the module 1, where I will be discussing about the Commonly Used Terminologies and the definitions in the Water Quality Management Practices. To start with my name is Gourav, I am Professor Gourav Dhar Bhowmick from the Department of Agricultural and Food Engineering from Indian Institute of Technology, Kharagpur. In this particular lecture, I will be discussing about the different terminologies involved with the wastewater treatment technologies and specifically whenever we will be designing the wastewater treatment plant, what are the terminologies that we need to be well adhere to those are the things that we will be discussing. In this particular lecture video starts with wastewater, what is industrial wastewater municipal sewage, sanitary sewage, sewage sewage sewage and the sewage treatment plants. To start with when we talk about the wastewater we as we discussed earlier also, it is majorly is a constituent of different kind of pollutant right.

This pollutant based pollutant when it is majorly placing in the wastewater which is coming out of the industrial municipality or any other sources like agriculture and all can be considered as wastewater which has nothing, but it is a misplaced resource of different nutrient I would say. Other than that, it may also have a high amount of minerals, it may have organic or inorganic other constituents, it may have a biological component as well based on the types of pathogens which can cause harm to the human body. It can also have different inorganic compounds like nitrogen and all and phosphorus etcetera. Majorly the industrial, agricultural, municipalities are the major sources of this wastewater that we will be talking about today.

Industrial wastewater if you know the most of the cases the most of the industries, they use a huge amount of water for the processing purposes or for the for the then a cooling purposes for any other regulations and all. So, whenever they use this huge amount of water so, that water when it comes out of this processing plant comes out of this cooling tower comes out of this treatment units what happened? That water will definitely be added with some amount of some kind of chemicals some its physical or the chemical properties will change. Once its physical and chemical properties will change it can be constitute it can be considered as wastewater right. So, this physical this industrial wastewater has its own chemical and the physical properties that we will be discussing in

detail ah in coming ah slides also. Majorly it can contain the objectionable organic and inorganic inorganic compounds, it can also be having a huge amount of minerals, it can be having a huge amount of ah radioactive pollutants, it can be high temperature it can be like the if the temperature of this kind of wastewater can be very high ah based on the ah place from which we are actually ah the effluent is coming from.

It can also be having a huge amount of pathogens if we consider the industries like slaughter houses or like you know the food processing industries etcetera. So, in general we this industrial effluent have sometimes a very specific type of pollutant, but it can be very high compared to the regular in a municipality ah sewage is concerned. So, when we talk about the municipality sewage is nothing, but the wastewater that is coming out of your household to to make it much easier. Other than that if you realize the in your locality what are the different stuffs that is present. Majorly the all the apartments building all the places where people are staying right next to it there are some small shops ah small ah you know the restaurants small ah you know the playground the you know small gardens the parks and all.

So, whatever the water which is coming out the wastewater that is coming out of all these places are come in contact with a single conduit line and it is collected for treatment. So, it should be treated properly. So, this is called the municipality waste municipal wastewater or municipal sewage. So, it is not only ah the domestic purposes, but also it can also add added with the some additional wastewater coming of the local ah the the shops ah the recreational centers etcetera. It can also it can majorly contain the high concentration of organic matter, suspended solids and numerous pathogenic microorganisms which can cause ah very ah drastic diseases and all.

The decomposition of this this municipal sewage it leads to the production of definitely the malodorous ah very much malodorous gases. if you see in the open drain if you have in in your locality you can see it smells very bad if it is like stuck somehow it it is not properly treated and the flow is not maintained. The characteristics of the sewage is actually very much depending upon the effluent contribution from the industries of the commercial establishment in the nearby. It may contain different type of pollutant at different concentration and ah the types compared to the sanitary sewage and all. You can see this is the very standard ah structure of how you can see the far behind there is a city.

So, this from the city the water wastewater is coming in coming into this treatment plant the sewage treatment plant this is called the sewage treatment plant where the sewage is coming from the municipal or the city area nearby and it is being treated there after it is

being treated in this ah you can see this plant then only the water is discharged into the river that you can see in the near in the in the middle of the picture. So, this is how the structure is done maybe the city it the treatment plant is not treating the as the sewage coming from the city we can see in the picture maybe from which is on the other side of the like you know the the the screen. So, and it is treating and it is the ah that the water is being discharged to the surface water body on the ah the surface water line that you can see in the middle of the picture. There are sanitary sewage what is this sanitary sewage? It is majorly constituting the residential buildings and institutions when the wastewater is coming out of this residential buildings or the apartments or the ah specific institutions we call it a sanitary sewage. So, it majorly originates from the laboratories basins urinals water closets and is often the foul smelling and all.

It also known as the domestic wastewater and contains majorly the organic matter in suspended on the soluble form. It also has a presence of high amount of pathogens which is one of the significant concern for this kind of sanitary sewage and it can also contain high amount of nutrient like nitrogen and phosphorus which we normally you know do not use it after the kind of a uneaten feed that actually somehow ah get in contact with the wastewater treatment system. This ah kind of nitrogen phosphorus it can also support the biological wastewater treatment processes we will be discussing about it in coming modules. And however, if it is untreated that can ah be you know make the water discharge line or say like in a conduit line stagnant and it can contribute to a ah like in a very ah malodorous smell and not only that it will be ah it will be very foul it will be creating a breed will be can be the breeding ground of lot of different kind of vectors. And it can also contribute to the eutrophication in the local ah the whatever the water body where it is placing because of the high amount of nitrogen and phosphorus which is just perfect for the algal bloom.

So, algae will bloom algae will ah like you know they will be ah chlorophyllating like chlorophyllating like anything and it will cause a huge amount of algal bloom and at the end it will end up having a eutrophication phenomena as I have discussed in the earlier slides. So, this actually refer to only the wastewater coming from bathroom, kitchen, washing places and the wash machine. So, do not ah we do not add the black water here ok. The black water it is actually once it is also synonymously called grey water, but this grey water and the black water is quite different. Black water is what black water is majorly we use the human and the water which is coming out of the along with the human and animal excreta and all ok.

So, this is majorly the human excreta that we consider the black water which is coming out of the apartment buildings and all. So, which normally being treated in the in the septic tanks and all. However, the grey water which actually are the other than the the our washroom I mean like majorly our ah the the purposes for which we use ah the human excreta we I mean like we normally ah use it. So, that other than the human

excreta all the other wastewater waste that is coming out of our household is actually considered under the grey water category or the silage category ok. The silage contains in the lower concentration of the organic matter majorly the different kind of surfactant and the genobiotics can be very high.

Another important term is the night soil which refer to the human and the animal excreta that enters to the sewer through the water carriage systems. Storm water ah signifies the rain water surface ah runoff which generated from the local area and that rain water excess water which can during the rainfall you can see the our normal drainage systems can also carry it also carries the storm water runoff. This storm water is nothing, but this additional rain water runoff which can which can be connected through this drains open drains and all. We will be discussing about it why what are the different type of this drainage systems in coming slides. Before that what is the subsoil water the groundwater which enters ah into the sewer systems through different cracks and leakages in the sewer line.

What is sewer line? It is nothing, but the conduit line or the pipe line or say like in the concrete line through which the sewage is actually like you know transfer from the from its source to the treatment plant. We have the sewer as I was mentioning the its underground ah conduit line which to convey the sewage from to a treatment plant from its source. Majorly there are three types of sewer systems. One is a separate sewer like for which you know one sewer system will be carrying the household and industrial wastewater and for storm water there is a different drainage system at all. Combined sewer when the sewage as well as the storm water is collected through a same conduit line.

You can see most of the Indian cities and the ah the rural areas we have this kind of systems combined sewer where the drainage line is actually used for storm water ah collection line as well. Then we have a partial ah partially separate systems where is a sewer handle some amount of storm runoff and while the rest is directed to a separate storm water drainage systems and all. So, this kind of systems are actually helpful to you know somehow ah diluting the wastewater constituents. So, that it will be easier for the further treatment and it sometimes can cause further load to the treatment plant as well both are possible. Home sewer or the drain is nothing, but the discharge line that your building is having ok.

To and from where that this sewer line is collecting the sewage from the households and it will throw it into the and it will like you know convey it into the nearby lateral sewer. In the lateral sewers it collect the sewage from the house sewers and it will take it to the branch sewer or the sub main sewer. In the sub main sewer it collects from the small area and discharge into the main sewer line. So, this is the sewer line you can see the underground sewer conduit lines how it looks like. Then there come the main sewer

line or the trunk sewer which is like which gathers the sewage from various tributary branches and makes or sub line sub main sewers and serving as a ah in a huge long territory and it transfer the sewage to the treatment plant at the end.

There is a depressed sewer when some cases the you know we have to lower the sewer lines because maybe it will pass under any obstacles or running fully under like you know it normally runs fully under gravity and in during this depressed sewer it it works at higher than atmospheric pressure. Only the entry point and the exit point is in the atmospheric pressure, but during the inside of this depressed sewer it is higher than the atmospheric pressure. Then we have a intercepting sewer line which transversely laid sewers that intercept the dry dry weather sewage flow and it actually flows parallel to the natural drainage systems ok. Then we have the outfall sewer which collects the sewage from the entire collection systems and discharge into a common point and then we have a relief sewer or overflow sewer. In case of emergency when you know to main manage the flow which is exiting the capacity of the existing sewer this kind of relief sewers are used.

It normally stays dry for the most of the time of the year, but during the heavy rainfall only it actually normally being useful not only that even some case of community program and the cultural event also this even this kind of relief sewers are being used. Then there come the sewerages. Sewerage is nothing, but it encompasses the whole infrastructure the device the equipment and the all the apparent tenses that we use from its beginning to the end till the treatment plant we call and for its efficient collection transportation and the pumping of sewage. Earlier the STPs the sewage treatment plant as I was telling just now we it normally we excluded from the definition of this sewerage. However nowadays we more on focusing on the decentralized sewage treatment systems in the smart cities forget about smart cities even there are some retrofitting is done with the existing cities and all what they are doing they are retrofitting the existing sewage treatment systems and they prepare more of a decentralized sewage treatment systems.

So, that the water can be re-circulate back and can be reused for its maximum economic return and all ok. So, this is this because of all this growing acceptance of this decentralized wastewater treatment systems nowadays even the sewage treatment facilities are also considered under the sewerage schemes. Specially this sewerage it is nothing, but this water carriage systems designed and built to collect and transport the sewage from sewer to a point where adequate treatment is provided to meet the effluent quality norms. So, based on the desired like in a mode of quality the desired quality that it requires for based on the suggestions or the regulations given by the regulatory body local regulatory bodies. This is the you can see the pictures here of you know how it looks like the sewerage systems in the smart cities and all.

We have this next comes the sewage treatment plant. So, you may think like you know all the treatment that is that all the sewage systems sewerage and sewer that were the discussions that we have everything ends actually in a sewage treatment plant. We need to treat that wastewater we need to treat that sewage right whether it be coming from industrial or whether it be coming from the municipality. If it is like the in industrial it will be called effluent treatment plant, if it is like industry we call it sewage treatment plant. So, this sewage treatment plants it majorly treated treat the water which is coming into the plant from the various nearby sources majorly the industrial or the municipality establishments and all.

It what it does it remove the pollutant present in the wastewater and it somehow try to reduce the wastewater try to make the effluent quality good enough to discharge it to the surface water body. So, what it is doing? It has a different system of operations, it has a different units, it we call it unit operations or unit processes through which it is it we actually make a certain sequence. So, that in those sequence the treatment efficacy can be maximum. So, that the pollutant those are not good for us those are not good for the other ecosystems also we try to eliminate those. In a sustainable manner and this is the process is this process is done in the sewage treatment plant.

You may be confused with the term unit process and unit operation majorly the word unit operations we use when we use any physical separation processes. Can you tell me one say like screening? Screening is a physical separation process right it is a unit operation. When we talk about say like grid chamber. So, it is a physical separation process with the grids are sedimented due to the force of gravity gravity. So, and because of that it is called the the physical unit operations.

Then there come the unit processes what are the different unit processes majorly the biological or the chemical chemical processes are considered under the unit process. The what are the chemical process flocculation coagulation. When we do the biological when we most of the biological treatment plant are falling under this category this unit process. So, we either have the unit operations or the unit processes or the combination of both in a different particular sequential manner. So, that we can treat the sewage which is coming from the nearby municipality and treated in a certain standard.

So, that it will fall to the nearby it will when it will be released to the nearby water body or the surface water body it will be considered as safe for discharge ok. So, this treatment plant will be designing for the next couple of weeks will be talking about the different design and different unit process and the unit operations of this treatment plant. And we will that is our major goal for this particular course to be precise. We normally try to meet the regulatory the quality standard defined by the regulatory authorities for effectively treating the sewage and for its safe disposal of this treated effluents and all.

You can say this is also another very nice picture I would say the pictographic representation of you know how actually sewage treatment plant looks like.

So, here you can see there are some cylindrical structure there you can see there is a huge cylindrical structures and all you can see some lines and all. it I will be discussing you will be quite confident at the end of this lecture module at the end of this lecture series that how the treatment of water is being taking place in the sewage treatment plant like majority of the sewage treatment sewage is that is coming out of the municipalities and all. So, in conclusion we discussed about the various type of waste water that is generated from different sources. We discussed that the sewage are serving as a to as a as a you know conduit line which is conveying the sewage to treatment plants or the disposal point from its source. Three common type of sewage also we discussed what are those separate sewage, combined sewage and the partially separate sewage.

We also discussed about the sewerage systems which majorly encompasses the sewage collection, transportation and the pumping units, but nowadays even the sewage treatment facilities are also coming into the picture like we there is also integral component of this sewerage systems. The storm water we discussed about the storm water it is nothing, but the it is a definition we can we can say that in it is nothing, but the rain water runoff or the subsoil water which can infiltrate the the rain water runoff which can actually be considered as a storm water and for that only we have to have separate sewerage systems time to time. Subsoil water is nothing, but when the groundwater is infiltrating in a sewer systems we call it subsoil water. Salage or the grey water it is comes from the sources like bathrooms, kitchens with minimal fecal contamination and we also discuss about the black water or the night soil which is nothing, but the addition of human excreter or the animal excreter into the sewerage into the sewer systems. Majorly we discussed that the waste water it contains the high concentration of organic and inorganic constituents of a often requiring the biological or the physicochemical processes or the methods for it is removal and we also discussed what is the difference between the unit operation and unit process.

So, I hope you have some got to know some very basic information's and the necessary data or the knowledge that is required for you to go ahead with the further tougher level I would say. So, in this particular module in this introductory introduction module we only discussed about some basic steps for us to understand the concept and to more in details that and what we will be discussing for the next 11 weeks. We will continue with this discussion in the coming week till then. Thank you so much.