Wastewater Treatment and Recycling
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Lecture - 52
Concept of Wastewater Reuse and Recycling

Hello friends and welcome to this new week for the course Wastewater treatment and Recycling. So, we have eventually ventured in to the eleventh week. So, we will be discussing the last lec of this course which is more focused on the Reuse and Recycling aspects of Wastewater. So, far we have basically talked about various aspect related to the production, characterization, then its natural attenuation, engineering engineered purification systems. For all those things we discussed the objective of treatment is either to dispose of the wastewater or to make it fit for reuse or recyclable purposes.

So, it is as the stress on water resources are going on there is more and more emphasis on the recycling aspect and the disposal of the wastewater is strongly being discouraged by the government, by the regulatory agencies, by the society as well. So, all though still large portion is just disposed of very little recycling is there particularly in the developing word including India, there is a very minimal waste water which goes to the recycling and majority of them is actually disposed off and in fact, most of them disposed of untreated that is the unfortunate scenario.

In developed word also the, it is not the recycling is something which is just caching up, so, a still not as such all of the wastewater which is produced is recycled. In fact, the Singapore has done pretty well in this domain. So, they produce they kind of recycle the savage, they produced and augmented with the domestic water systems in the name of new water systems. So, we will be talking about these various aspects in concept of waste water treatment and recycling in this last couple of weeks starting this week.

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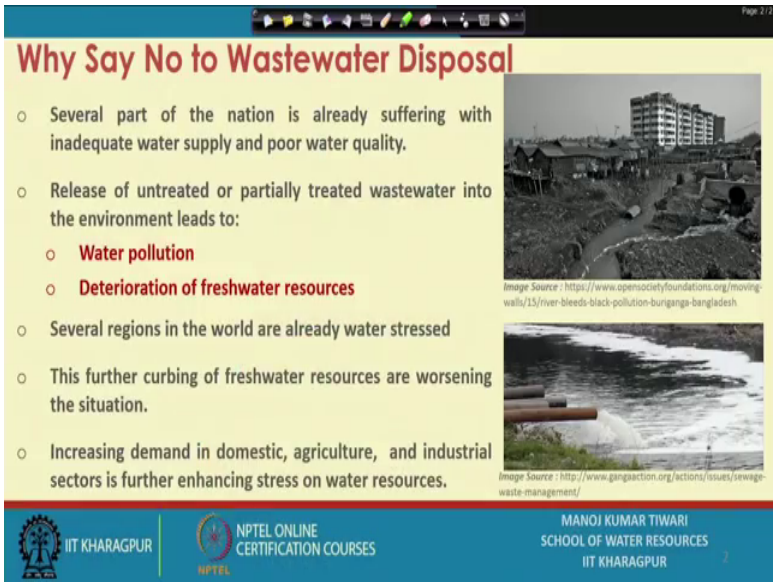

So, let us begin with first thing, why we should say no to the wastewater disposal because waste water is something which we have been disposing of since edges ok. Since we get into this civilized systems; so, more and more civilization or development has taken place, the more and more concentrated growth has taken place and that way we have generated, concentrated or in terms of volume I am saying.

So, concentrated amount of the waste waters which we have traditionally being disposing of to the natural system; so, either a land systems or the conventional or typical water resources system. So, this is the practice that people have been adopting since quite long, but it is high time that we should think re think rather over this. So, in what sense we like we have to make a decision that whether we keep on continuing the practice which we have been doing since ages or are there scope for the improvements.

So, the waste water disposal which we have been kind of engaged with which we have been doing since quite some time now. So, there are basically if you see the scenario there are several parts of the nation is already suffering with any adequate water supply and poor water quality. Every now and then we see that there is draught in this state, drought in that state particularly the western states and central states in the country are more suffered to these kind of drought situations. So, we do not have adequate amount of water for fulfilling our domestic needs, industrial needs, agricultural needs ok.

At the same time, we are facing poor water quality in our natural water resources. It is almost known to everyone that how our rivers has basically turned in to the polluted water storage systems ok. Majority of the river in the country are not having good enough water quality which one can go and straight forward utilize it for some purpose. Even many of the rivers it is not even safe to take just bath in the river ok. So, the quality of water in the Ganga, Yamuna, all major rivers Kaveri; there has been basically quality issues with the majority of the river systems in India ok.

So, is the condition of our lakes, our other systems and. In fact, we more often than now we see that the ground waters are also increasingly getting contaminated at various places with verity of contaminates which not only includes the gynogenic or natural contaminant, but also with lot of anthropogenic contribution as well.

So, our water resources are suffering in terms of poor water quality and less water quantity and that is putting more emphasis on to the supply systems as well because there is no adequate water quantity available for supplying. Supply we are not essentially saying for the domestic purpose, supply means the fulfilling water requirements of all different sectors which includes industrial sector, municipal sector, agricultural sector and to some extent environmental and re creational sector as well.

So, that is the kind of condition which exists. Now over and above that when we release this untreated or partially treated wastewater into the environment, what it does? So, if your water this water this water like the quality of your water resources is not very good at first place itself and then you are basically adding, so, like say the exam take the example of river Gangas. So, in river Ganga, we already have so, much discussion of improving the water quality of the river Ganga. In spite of that we are adding more pollutant to the river in terms of waste water flows ok.

So, what it will lead to? It will lead to basically further water pollution and when we keep on polluting our resources in that way either lakes or rivers, so that eventually deteriorates our fresh water resources because we are loading pollutants into the nature that is just one aspect, second aspect is whatsoever the fresh water resource we have in terms of water in terms of say rivers even if you are let us say having start with a clean river, but if you start disposing waste into that so, for how long that is going to remain clean.

So, what eventfully will happen, that this river system itself will get polluted. So, the one that we are considering fresh water resource the one we are considering good enough water to be basically use for normal applications that water is also getting polluted. So, that is kind of deterioration of fresh water resources in terms of quantity as well ok. So, there is qualitative burden, there is quantitative burden and several reasons in this world are already water stressed. So, is basically several parts of India.

Now, this further curbing of fresh water resources are worsening the situation, in terms of quality or in terms of quantity both way. So, at one place we are actually like getting we are actually getting our water resources more polluted and the quantities also getting affected that way decrease that way. So, there is one us like this is the problem from the natural resource side. And if you see the demand side, so, there is increase demand in domestic, agricultural industrial sector ok; so, which is basically kind of further increasing a stress on these recourses, ok.

So, demand is increasing, resources are depleting rather because it is not just limited recourses with adding more and more pollutant to the recourses, the quality of or the usable recourses in fact, are actually depleting that way. Our several lakes or several ponds have turn in a that data condition may be in a septic condition that that water still even if the water is there it is definitely not usable ok.

So, that is the kind of situation which has arised. So, these are the problems. Now, these problems as we have discussing is mostly because of the disposal of the waste which we are making. So, there is industrial waste water, there is municipal waste water, there is kind of agricultural waste water. So, all those waste which we are actually disposing in the system are creating these kind of issues or these kind of problems.

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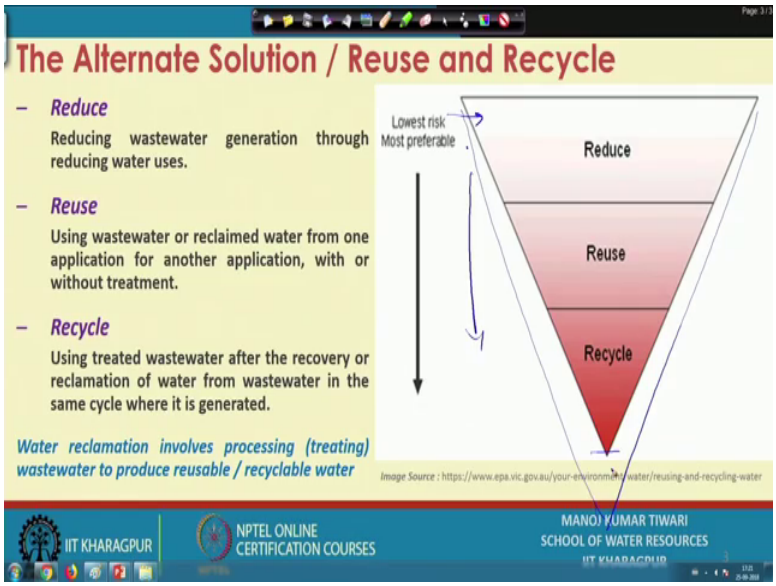

Now, if we see what are what is the alternate solution to this. So, when we say that there is a problem due to the disposal of the waste in the nature, so, what is the problem, what is what is the kind of solution for this? The solution is reuse and recycle of the waste water ok. So, what you see here is actually the like this is the most preferable part and then that way we are the risk is lowest and then we are moving towards the lesser and lesser preferable options ok, but all these are preferable at least ok. So, we are discussing here preferable options. If we need to bring, if we need to say include the disposal option also; then disposal would probably come even in the lower ok.

So, that is the kind of hierarchy of the preferred option. So, first thing we reduce the waste water generation itself. So, how we can reduce the waste water generation? The waste water generation, we can reduce by reducing the water uses because whatever water we consume majority of that eventually converts to the waste water. So, if we reduce our water consumption, if we go for say water saving devices, water saving measure, so, for say if you are using a toilet flush ok; which is flushing 20 liters in just one single step and then as oppose to that you are going to a dwell flush system which may be flushing just 5 liter you have dwell for flush option. So, that my might be 2-3 liter flushing in one just one step and if you need more you can say go for 10 liter flushing.

So, instead of just flushing 20 liters or 10 liters water in just one go, if you are just urinating your requirement of flush is low there is not lot of solid mass to be solid mass to be disposed off, so, you can go with a lesser amount of water for flushing. So, that way we can say if significant amount of water; the say these washers, washing machines, so, which are basically the water consuming devices.

If we go for efficient devices, like we have done in a power sector ok. Traditionally we use to have those like glass bulb with tungsten or those kind of element, so, say 100 watt bulb people use to I have 60 watt, 100 watt, 200 watt bulbs they used to have. Now, slowly we move to the next step of CFLs which reduce the consumption, so, we kind of went to lower what is of CFLs. Now, it is ages of LED. So, with this for the same amount of light, we are just spending 7 watt, 8 watts of power as oppose to the 100 watts.

So, see more than 92-93 percent reduction has been achieved in that way. Similarly, there are devices which are water efficient as well. So, if we instead of like going for those water consuming devices which consume high or heavy quantities of water, we go for water saving devices to produce the same effect or same output same degree of cleaning, so, why not go for that ok.

So, that way or let us say the shower, so, per minute how much water is being flushed from your shower, what is what is your actual requirement if you go for the efficient shower just your for the same amount of bathing hours, you can reduce your water consumption up to 40 percent. So, that way and there has been success stories on this ok. So, that way we can actually reduce the consumption ok.

When there was a millennium draught in Australia, the various cities including Melbourne was able to reduce say their water consumption by 40 percent by just making these replacing those like may be unsustainable or high water consuming devices to the water efficient devices. So, there is a huge potential in water reducing the water consumption and when you reduce your water consumption because your waste water is generated from the water that you consume. So, your waste water generation we will also get reduced. Then the second option is reuse ok. So, reuse is something when we use the water which has been used ones for some other application ok.

So, we may go for a moderate degree of treatment or we may not go for treatment at all. So, with or without treatment, if we are able to reuse that water, let us say you collected

the water from house like the gray water that you have collected, now you are putting it for irrigation for what agriculture purpose ok, for gardening or flowers ok, for watering your flowers, for watering your gardens. So, that kind of application when you is kind of reuse of water, the water that you have produced you have just reuse that water where you may provide or may not provide a treatment then there is something called recycle which is usually kind of done after treatment. So, we treat that water, we reclaim the water and then the recovered water we use kind of in the same cycle where it was generated.

So, if water is being generated say from house hold, so, you treat it and supply back it for the household activities. So, that is what is recycling ok. So, the water you have generated say, from bathroom you have treated that and again supplied back there. So, those kinds of systems are called recycled and for the purpose of recycle we have to kind of treat the water first and that is known as kind reclamation. So, water reclamation is the process of treating water to produce the reusable or recyclable quality of water.

So, we go for whether partial treatment or full treatment, but from a waste material if we are able to reclaim the water, if we are able to produce the water which is having certain uses we call that as a reclamation and we call that water is the reclaimed water. So, that reclaimed water like Singapore, reclaim its municipal sewage and then argument their water supply is with that reclaimed water. So, that is kind of reclamation of water. So, these are common terminologies which are used in this sector. So, reducing the consumption, water reuse, water recycle, water reclamation, so, these have their own distinctive significant meanings which actually is different from each other.

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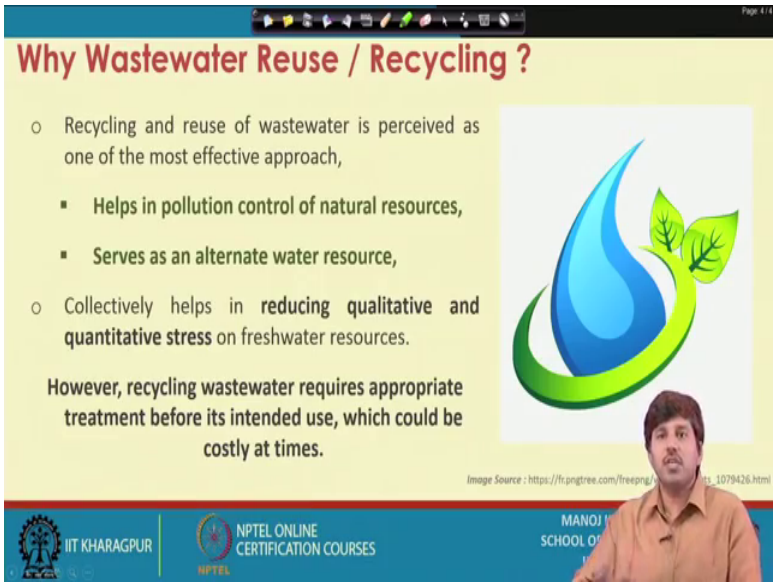

So, why we are talking about waste water reuse or recycling? So, as just we were discussing that there are two folds of problem when we let water go into the natural recourses. One is the, or natural recourses get polluted and as a result our fresh water supply is gets affected because we loose on the fresh water recourse front ok. So, these two problems can actually we solved or we can get that with similarly if we able to reuse or recycle the water, we get two way benefit also ok.

So, by recycling and reuse of the waste water which is kind of considered as the most talked about approach in today's age, we help in pollution control of the natural recourses because we are not letting pollutant mask entering in to the natural recourses.

If we are using water at some stage in within our community or that way we are not letting that water go to a pond or we are not letting water go to a river. So that means, we are actually reducing the water pollution in those recourses and second and the most important part and that is why actually the people are more concerned about wastewater reuse and recycling is that it serves as an alternate water resource. So, there is lot of stress on our water utilities for fulfilling the demand. Our natural water recourses are depleting. So, and we at same time we are producing huge amount of waste water which we are letting go to the natural systems.

So, if we are able to reclaimed water from this waste water which have been produced and put it back into a u circle, so, that way we are actually able to convert this waste in to

recourse and we need such resources. We need alternate resources of waste water because our existing fresh water recourses are turning inadequate in quantity to meet the demands. So, when we are lacking the water resources to fulfill the demand and at same time we are having a huge bulk amount of waste water present, so, why not consider why not consider that as a recourse and process it to turn process it to kind of improve its characteristics and reclaim the water from this waste water for the using purpose.

So, if we can do that our like our requirement on the fresh water resources will also decrease because at least part of this we can use part of the demand can be met from recycling this waste water itself. So, that way there is a kind of collective help in reducing qualitative as well as quantitative stress on the fresh water resources. Qualitative stress because we are not loading the pollutants in the nature. So, quality of the natural water resources will improve and quantitative because we will be abstracting less water from those recourses as some of the demands could be fulfilled from these recycled water. So, that way there is reduction in the quantitative stress as well.

However, the point is that recycling waste water requires appropriate degree of treatment. The water is polluted and we cannot like straight away put it for certain uses. So, if we want to use that water we have to process this water for producing usable or kind of fit for the purpose quality of the water ok.

And this a times could be a costly process because for the treatment purpose for water treatment when we get water from natural resources its relatively far more superior quality. So, with little degree of treatment, we can put that water for a supply purpose, but if you want to use the waste water if you want convert highly polluted waste water in to a kind of water which could be reused say a domestic scale, we have to go for high and treatments and those high and treatments may prove quit costly. So, there is a financial aspect to the water recycling decisions which we will discuss in the later part of the discussions in the, this week and the following week.

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So, what are the deriving factors for waste water reuse and recycling? As we have been discussing there is a issue with the water availability. So, the resource sustainability is one of the deriving factors because if we are able to reuse or recycle the water, we are reducing the stress on your resources and your that way resources are more sustainable. Then water consumption that could be use for meeting water demand. So, that is another major factor and the environmental protection by improving the water quality when we do not load the pollutants in to the nature that is going to be the, another factor another important factor which motivates us for going for waste water reuse and recycling projects.

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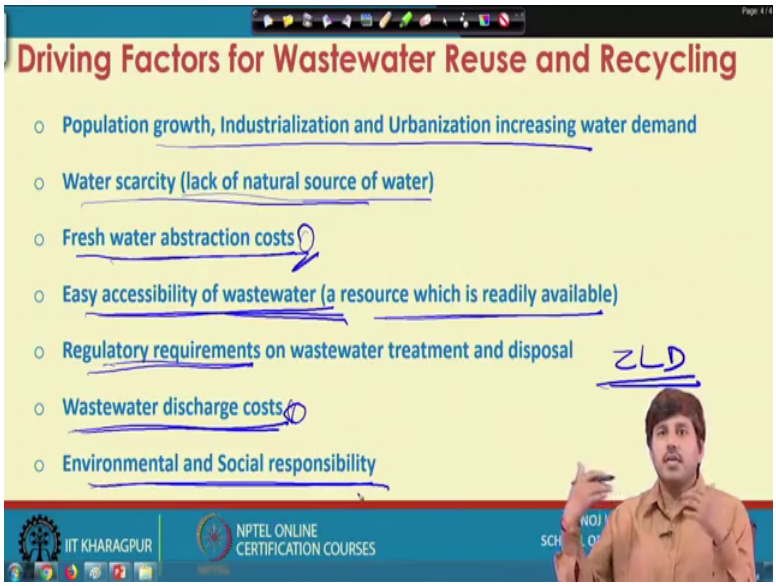

Now, if we see in for more like detail scale, so, if kind of you see that various deriving factors for waste water reuse and recycling, so, there is a population growth, industrialization and urbanization which is increasing water demand ok. Now, for this increasing water demand you have to have water resources and your fresh water your waste water could be actually alternate resource for the water that is one of the most one of the most important deriving factors one of the most valuable deriving factor for the purpose ok.

So, if you see there is a water scarcity, lack of natural resources of the water and there is a increasing water demand. So, these two collectively leads two kind of emphasis these two collectively emphasis or these two collectively highlights the need for an alternate water resource which is readily available which can be kind of which can be utilized for the purpose and the easy accessibility of this waste water makes that option of using it as a resource. So, there is lot of water unit, of course, there are some contaminant. So, if we remove those contaminants we can use this as a resource which is quiet readily available ok.

Now, apart from this there is a fresh water abstraction cost. So, when we have when we go for the meeting freshwater demands, we have to withdraw fresh water from the resources. So, let us say we are withdrawing water from river or withdrawing water from ground waters. So, there is a pumping cost we have to make for this intake infrastructure

for that purpose. So, there is an abstraction cost of that. Whereas, the wastewater like there is a associated cost with waste water discharge also.

So, waste water that we are producing we are like we have to make this wastewater pass through several stages. So, it is has being generated at some point then we have to put through a sewer network sewerage system which kind of collects this wastewater and then treatment to whatsoever degree treatment is needed we have to give this a treatment and then if we go if we just want to discharge it. So, that is the kind of like for again to connected to the river system.

So, excluding the externalities, excluding the environmental cost positive and negative externalities associated with it there is a huge cost of the wastewater discharge as well. So, there is a freshwater abstraction cost and there is a waste water discharge cost if we start using waste water as a resource ok. So, we are actually going to get rid of these two ok. We will be getting rid of wastewater discharge cost because we are not going to discharge waste water and we are going to get rid of the freshwater abstraction cost not completely, but whatsoever fraction that we are actually reusing it. So, that much water we will not need to withdraw from the resources. So, that decrease in the waste in the freshwater abstraction cost will also be there.

Then another and kind of more important driving factor is the regulatory requirements of wastewater treatment and disposal and this is far more important for industrial purposes. So, like the regulatory agencies that we have; so, for our case it is say central pollution control board or state pollution control boards or ministry of environment forest and climate changes which looks after these respect. So, these different regulatory bodies that we have they have certain regulatory requirements for wastewater treatment and disposal. So, if we want to say a dispose of a wastewater, we have to meet those regulatory requirements ok.

Now, for the purpose of meeting those regulatory requirements, those regulatory requirements could be of particularly in this age. These regulatory requirements are getting more and more stringent. So, if you have to kind of dispose the wastewater, you have to treat it still you have to treat it at certain degree. So, municipal supply is we do not have option we cannot cut actually the municipal supply is that way. So, whatsoever sewage is being generated whether there is a facility or not available or not available

what is done often is that even if there is no facility the untreated water is goes into the disposal, through a disposal system to a natural water body all reverse those kind of thing, but for industries these regulatory requirements are pretty stringent.

So, if a industry is not meeting the discharge quality standards those industry can be shut off ok. So, like CPCB or Central Pollution Control Board does that almost every year they issues notices and shutdown certain industries for not meeting these are environmental norms ok. So, that kind of requirements or that kind of regulatory requirements are also deriving factor for wastewater reuse and recycling more so into the industrial sector or if you are let us say having a big housing complex coming up, so, there might be like the regulatory requirement from the development authority of the city that ok, we will permit this we will license this construction only when you have come up with a waste water treatment and recycling system within the premises of your housing complex.

So, those kinds of norms are also upcoming particularly in the big cities. There are financial rewards for having this kind of system in housing complexes. So, that way there is kind of additional advantages are also being offered for going from the our regulatory agencies for going for such systems and industries are being more pressurized to go for system which is called ZLD which is in fact, Zero Liquid Discharge ok.

So, this ZLD system, zero liquid discharge systems are kind of requirement where the industry does not discharge any liquid outside its premises. So, it has two kind of treat and reuse the entire wastewater entire effluent that it is generating out of the industrial processes within its own premises that is what is called ZLD; zero liquid discharge means, there is no discharge there is no liquid which is being disposed off from the industry ok. So, that again kind of emphasizes that the 100 percent reuse or 100 percent recycling of the waste water or the effluent which is being generated from this industries ok.

So, that is those kind of regulatory requirements are another reason or they may not be kind of motivation that way ok, but kind of enforcement from the regulatory bodies making industries compelled to go for the it is treatment and recycling of the waste water which is being produced from the industries. Then there are environmental and social responsibilities which is another factor another driving factor for wastewater reuse and

recycling. So, what happens that often like, there are various environmental agencies or NGOs who come up with kind of protest if somebody is polluting water to a large scale. So, and it gets into these days there are media is quite active. So, those kinds of issues could be highlighted and they also kind of a put pressure on to the industries or even the government bodies public sector bodies also for going for the treatment or reuse and recycling system ok.

So, the social responsibility of cleaning the environment keeping the environment clean also is there. So, with all like combination of all these driving factors may be the motivation or the kind of need for going for the wastewater reuse and recycling system. So, that is what is the basic idea basic motivation or requirement which kind of forces the utilities or the system or the industries to go for wastewater reuse and recycling systems.

So, we will conclude this week's this class discussion here itself and in the next class we will further start discussing the various aspects of the reuse and recycling of the waste water, what we can reuse and recycled and what are the various opportunities where we can use the recycling recycled water. So, see you in the next class and.

Thank you for joining.