Municipal Solid Waste Management
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Lecture - 03
Types and Sources of Solid Waste

So hello student. So today we will start module 2; sources, types, and characteristics of solid waste. This model will consist of two lectures. In the first lecture, I will talk about sources and types of solid waste. This is one of the most important topics before going for further collection and treatment followed by disposal. And one very important is characterization.

Because this characterization is very important to know about what kind of treatment could be possible for the waste and suppose if you are not planning for treatment also the entire waste or mixed waste will go to the disposal site, what could be the issues or what kind of environmental issues like leachate production, air pollution, those issues can be understood once you know the characteristic of the waste.

So today's lecture we will go for type and sources of solid waste, okay. So in this one, I made it like type and source. Because both the types and sources are similar. And based on the sources also we can divide a different kind of or different type of waste and based on the type of waste we can classify the different sources. So I made it like type and sources together.

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So the municipal solid waste or solid waste are broadly classified as the first is the municipal waste, okay which include the garbage or food waste under whatever the waste is producing inside the municipal area, okay that called municipal waste, which includes the food waste, garbage, construction demolition waste, treatment plant waste, special waste. We will go into the detail of this municipal waste.

But whatever the waste is producing inside the corporation or municipal area that is called the municipal waste, okay. But those are solid waste only not we are not talking about here wastewater or sewage, okay. So you can see here one of the photographs, this is the municipal waste. Is disposed of inside the city differently.

Next is industrial waste, which includes all kinds of liquid and solid waste generated from a different kind of industry. So it is an industry, maybe some of the industries may be inside the corporation area, inside the municipal area. But I think the waste generating from the industries are not getting directly going to the or not getting mixed to the municipal waste and not directly going to the municipal disposal site or treatment site.

Because industrial waste depends upon the industry to industry. Some industry is producing a different kind of waste and both kinds of waste are producing like could be a liquid waste also and solid waste also is both are producing in industrial one. And if you see the industry-wise, because every industry has to manage the waste inside their campus, the industrial that particular industry area.

Then only I think the Pollution Control Board will give a proper location for industrial purposes. Because they have to submit the report. Every industry has to submit the report saying what kind of raw material they are using and what kind of product they are producing and what kind of waste is generating. Whether this waste could be liquidwaste , solid waste, or air pollution also.

And what kind of treatment processes they will provide for such kind of issues industries, okay. Then only they will get permission to start the industries. So this will be a different kind of waste. And the third is hazardous waste. The hazardous waste also could be liquid or solid waste or in the gaseous form that is dangerous or potentially harmful to the health and environment.

So now this health could be animal health or human health and these also the hazardous waste is collected separately. We have one special rule, the rule for Hazardous Waste Management Rule 2016. It has been modified. So their collection also is different, transportation is also different and even the treatment and disposal methods are also different. So in this course, I think we are not talking much onto industrial or hazardous waste. We are talking about municipal waste.

So now in the next slides, we will talk only onto the municipal waste. So this entire course is designed especially for municipal waste, which is including a different kind of waste, generating into the municipal area.

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So now we will go for again the classification of Municipal Solid Waste. Now it is this classification based on the sources. So the four sources are residential waste, which is a waste generated from the household activity and consists of leftover food, paper, plastic, clothes, cardboard. Now, these residential waste or household waste is majorly classified again. Earlier the classification was organic and inorganic.

So organic means is a biodegradable and inorganic was knowing as non-biodegradable or recyclable one. But I think there were a lot of issues to define what exactly is organic and what exactly is an inorganic one. So now under Swachh Bharat Mission also they made it a very simple way. From residential waste, there are two types of waste.

One is dry waste, dry waste including the dry material like paper, plastic cardboard, rubber, leather, clothes or inert content, construction, demolition waste. This is the dry waste, does not have much moisture content. And once the special type is wet waste which is including cooked, uncooked both kinds of waste and or such kind of waste which is producing from the kitchen area that is called wet waste.

That is the again classification of residential waste. And one more classification also is given that we will discuss in another lecture about the third part is household hazardous waste. That also has to be separated differently. So and next is commercial waste. So commercial waste includes the waste that mostly is dry.

Especially paper, plastic will be the more or cardboard the quantity will be more from the commercial area, and especially from the hotels and restaurants, biological waste will get produced or wet waste will get produced. So it includes hotels, restaurants, markets, warehouses, or any commercial establishment, a different type of waste will get produced. Now next is the institutional waste.

Now institutional waste, like institutions like our own IIT Guwahati kind of institution, the colleges or universities or some institutions like some civil areas, or some government buildings, they are also producing a different kind of waste. And like this photo is showing that a lot of E-waste is generating from such kind of institutional waste that consists of paper, plastic, glass generated from the educational, administration, or public buildings such as school, college, office, prisons and is government buildings or government institutions.

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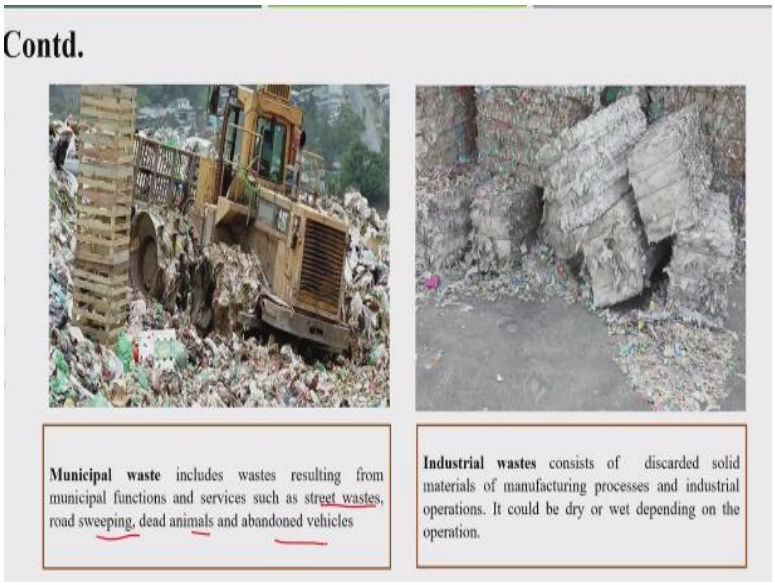

Next is a municipal waste. These municipal waste include the waste resulting from the municipal fraction and service such as street waste or road sweeping waste, dead animal, abandoned vehicle. This is the municipal waste and especially these waste percentage if you see that, that normally we known as an inert material, okay this road sweeping waste.

And because these inert contain more soil and sand concentration. So obviously the weight is also very large. So under density, if you see that very high-density waste we are producing from that. So percentage-wise also if you see that, that goes to 20 to

30% inner production itself into the city areas. Now the other industrial waste. This is the I think I already told that industrial waste does not include municipal waste.

But there are very small industries could be possible, small manufacturing process, which is like discard the small manufacturing process or industrial operation and that could be dry or wet and again depend upon the local authority or the ULB's whether such kind of industry can dispose the waste into the municipal areas or municipal disposal site or can go to the municipal treatment facilities.

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Another is that the construction demolition waste. India has come up with a new rule on how to manage the construction demolition waste because a lot of construction is going on in most of the class I cities or metro cities. And so because of that, a huge amount of demolition waste or construction waste is producing and some of the cities are some literature says that because is highly heavy materials are producing.

Like bricks or any concrete materials is very high-density material. So that percentage also sometimes goes to 40 to 50% itself inside the city waste. So they mainly consist of wood, steel, concrete, dirt, etc. Another is agricultural waste. Now I think most of the agriculture area is not under the municipal area. But I think many people have animals in their house.

And possible very nearby or any local corporation some nearby some small villages under the municipal area and these ruler, some of these villages are producing the

agriculture waste like food grains, vegetables, agriculture remain could be or some animal waste like cow dung, these kinds of waste will get produced in such areas. So this was a different kind of sources.

Now here the major understanding from this lecture is that now we know that different sources. Now based on the different sources, different types we need, we also need to understand what kind of characteristics will come up. Under I think, before going to the characteristics I think when I say characteristic that could be a chemical characteristic or biological characteristics, which need to know for the treatment process.

But initially need to know that whether the waste could be a dry waste or wet waste. Because once you know the dry and wet waste, we can easily design the primary collection or secondary collection facilities. Based on that we can design the vehicle, what kind of vehicle will be required, and along with that, once at least we know how much is the wet and dry waste. So based on that we can design the proper treatment facilities also.

Suppose the biological waste like in the developing country like India, the wet waste itself goes to more than 50%. So if you know the proper sources of that particular material, particularly wet waste and this wet waste mostly is coming from the two major locations like one is the residential area and the other is the commercial area.

If you target the particular restaurants or hotels and target the one particular residential area where a large amount of biological waste is producing, so we can easily design the one proper one composting facility or some biological treatment facility like an anaerobic digestion facility could be possible because this kind of waste once it is mixed into the other waste like another kind of sources waste where mostly is the dry matters are there.

So these wet waste will contaminate the dry waste. So in that case, what could be the possibility, once both the waste will get mixed. So even the wet waste would not degrade properly because it will consist of paper, plastic, the dry matter, and even the

dry matter which is easily get to recycle. Those recycling also would not be possible. Because that will be already contaminated with food waste.

And the same thing is happening in our country, because all entire the mixed waste rather than seeing that whether what kind of particular source or what kind of type of waste is generating from the particular area, the entire waste is collected together in the commingle way, and the entire waste goes to the disposal site or landfill area.

So in that landfill area, I think many cities had tried to have the one composting facility, centralized composting facility, but segregation is very difficult. So suppose in the landfill area or disposal area 200, 300 or up to 500 tons waste tons per day waste is reaching segregation is not possible. And the problem is with us also in the residential area.

I think the way we are disposing of the wet waste, I think what normally we used to do that we will take one plastic bucket, and first we will pack with the plastic and then we will dispose of the wet into that. So the problem in that case even that biological waste also would not degrade properly. We would not be able to produce compost out of that. And this easily recyclable plastic is also is contaminated.

So not able to recycle that particular plastic. So if you understand properly the particular sources and once you know the particular sources, and if you know though how much percentage of dry waste wet waste is getting generated. And once you do the characteristic of that particular dry waste and wet waste, we can easily plan the treatment facilities for the wet waste also and dry waste also.

So what we will do now I think once you know the particular sources and type we will go for in the next lecture, we will go for characteristics of the same waste. I think problem is that we do not have much data, characteristics data. I think already our Pollution Control Board, the Central Pollution Control Board do some kind of characteristics. But the doing characteristics of the entire city waste is also very difficult.

And again the problem when I say the sources, sources, or type with the different climatic conditions, the waste compositions, and characteristics also will change. So I think that is why the source type followed by the characterization is very important before planning for any kind of primary collection or the secondary collection and especially for the treatment.

Without knowing the proper sources of waste and followed by the characteristics of waste, very difficult to plan for the proper collection followed by the treatment one. So thank you for today's lecture.