Plastic Waste Management
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Lecture – 06
Plastic Waste Sources

So welcome back. So, this is now we are in week 2. So, this will be the first lecture video for the week 2 and today we will start looking at Plastic Waste Sources. So, if you remember from the last week, even that week 1 that covered the 5 videos, I was discussing mostly what is plastic. Now we will start getting into what is plastic waste.

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And then what are the sources associated like where the sources production global and Indian statistics in terms of how much waste is, plastic waste is being produced and out of that how much is coming from Indian scenario, how much is the global scenario.

So, you will see lots of data in the form of tables mostly in the form of figures, you will see most of the datas in the terms of figures. So, in this week ah we will be looking at in terms of in this particular week we will be talking about sources, we will talking about production, we will talking about the global and Indian statistics associated with that. So, this is what we will cover in the entire 5 videos that will be part of week 2 and

so, we will start with looking at sources right now and some definitions associated with plastic waste like, what is plastic waste.

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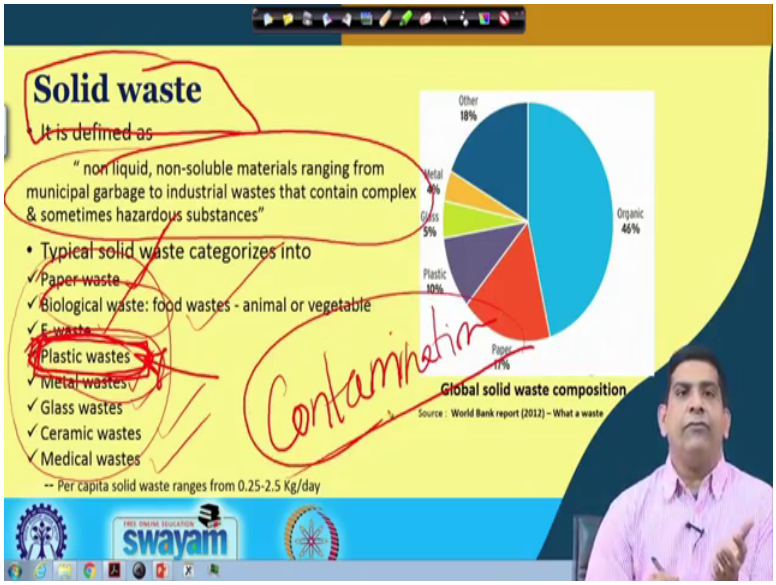

So, to start with if you think about when we say waste we are looking at plastic waste is a component of solid waste stream. So, the plastic waste is actually part of solid waste. So, solid waste some of you may have taken a course from somewhere we also had an NPTEL course which was I think offered twice already and maybe next time again it will be offered. So, it solid waste there is a definition very simple example in terms of very simple definition for a Layman in terms of solid waste is anything which has no value for the person who is discarding that particular waste material. But there is a legal definition, there is a regulatory definition.

So, if I if we go by the legal or the regulatory definition it is defined as it is a non liquid, non soluble material ranging from municipal garbage to industrial waste that contain complex and sometimes hazardous substances. So, that is kind of the legal definition or more formal definition for solid waste so, but what are what is in there typically you will find paper, you find plastics. So, we are focusing on plastic this is what this course is all about.

So, but this is this course is part; this plastic waste is actually part of this big solid waste stream. So, it is nothing is nothing new words as such, when we talk about solid waste we did talk about plastic waste a little bit. But then why we are talking about plastic

waste is a separate course, because plastic waste as of today is one of the major concern in terms of waste management globally. And especially those fill plastic thin plastic that I was referring to in the week 1 as well is creating a lot of environmental problems. And we will be look talking about those issues in this week and the week after says well because, that is kind of the focus looking at the plastic waste, but other than plastic which you will have some paper, you have food waste, animal, vegetables, you can have E-waste.

We also actually this particular semester we have a parallel course running on E waste which was run, this is actually rerun then metal waste, glass waste, ceramic waste, medical waste. So, there is a lot of different types of waste out there plastic waste is one component in which this course is focusing on, many times you will have plastic waste in combination of the other waste stream.

So, say for you go to the vegetable market, you go to a restaurant you buy certain food until very recently many places you will get that in a polythene bag, now in many of the Indian states not all, but many Indian states have gradually banning those plastic. So, you may be getting back in paper bag or some sort of other containers, but those plastic bags are used as a storage with you go and buy some stuff, they will give you that in plastic bag and that plastic when you would say you eat those food for a little bit then you did not, probably did not like it or you are to full you do not want to finish that food and then you just wrap around the plastic and throw it in the dustbin.

Now, there we have this biological waste and plastic waste together. So, we have to separate it, biological waste has to be treated in a different way; plastic waste has to be treated in a different way. So, many times you will see plastic actually in combination of many of the other waste stream. So, that is what I am trying to emphasize. So, you will have plastic ah, but there will be other waste streams also attached with it.

And to proper recycling plastic or even to proper recycling those other waste stream we have to separate them, we have we have to separate them individually and that is what is known as source segregation. Or basically that is known as segregation of the waste and if you do it at the source it is called source segregation which we talked about in the, which we usually we talk in great detail in a waste management course and since this is also a plastic waste management. So, we will; so we have to keep this plastic free from

other waste stream, to for effective reuse of that plastic or effective recycling of that plastic. If we have lot of other components present that is known as contamination.

Contamination although contamination of what? Contamination of other material other than plastic because here our focus is on treating the plastic, getting the plastic making fuel out of that use it in road construction, making new plastic products out of that. If you have other material mixed with that it becomes very difficult to handle. So, that is why we call them a contamination of other material which should not be present in that to make a effective use of plastic.

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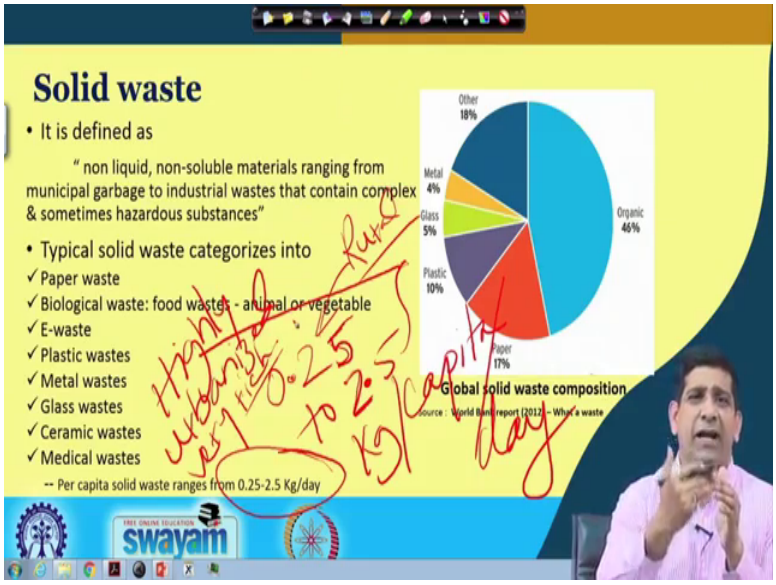

So, in general if you think about the waste that is produced it kind of ranges from 0.25 to 2.5, it is 0.25 to 2.5 kg per person per day. So, per person we many times we use the term per capita per day; so, 0.25 this is a 0.25 to 2.5.

So, this is the range so usually you will see 0.25 happening mostly in the rural area, in the rural area you will have 0.25 very less ways that is produced 2.5 is highly urbanized area and in highly urbanized as well as I would say very rich neighborhood. So, it is you it will be highly urbanized as well as very rich very rich neighborhood, why very rich neighborhood? Those of you who has taken solid waste cores should be able to answer that.

So, but just to if you should have the answer because we talked about that in that course as well or any solid waste cores whether my cores or any other course that you have taken. So, rural areas still we do not have that much packaging material, still we do not have that much Amazon or Flipkart and other things coming there. So, it waste production is much less, as we less of packaging material as well not much more culture not more packaging.

When you go to say Spencer or this Big Bazaar and all those is you get a lot of packaging material, but as you go in an urban area lot of packaging, that is why you see more and more waste being produced and that is why the number keeps on going up to around maximum of 2.5.

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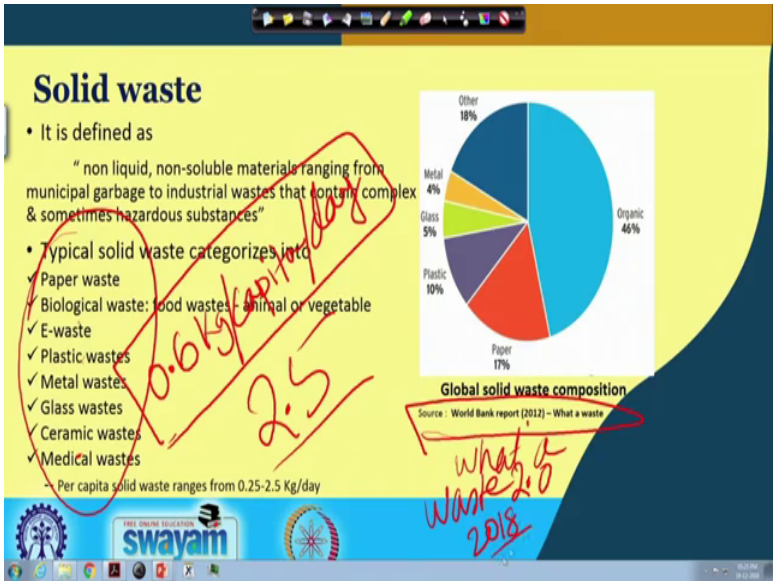

That we talked about 2.5 kg per person per day and 2.5 is its pretty high that you typically see in a western wall scenario, very rich neighborhood not in all western world as well. Very rich neighborhood they are wasting too much paper, they are wasting all the plastics, lot of packaging material, not much cooking basically at home they are buying lot of semi cooked food in those containers and other stuff.

So, that is where you will find 2.5 kg per person per day that is a lot of waste that is being produced. In India the value that we have as per as per the latest we what we known as a CPHO manual is 0.6 kg per person. So, per person we call it capita per day. So, that is the value we use in most of the design calculation in the Indian scenario 0.6 kg

per person per day, but that is the total waste. Out of that plastic is typically nowadays showing up some sometime in between 10 to 20 percent in some places plastic is as high as 20 percent, we were we did some we are working in Guwahati right now on some solid waste management work over there with Guwahati municipal corporation.

So, we did very elaborate sampling of waste composition again whenever we should go for design of any waste management system first thing we should focus on how much waste is produced, quantity and what is there in the waste. What is the quality of the waste, the waste composition and that is very very that is like your blood, your blood report and urine reports. Say if you go to a medical doctor and you have some problem the first thing that and the problem is not that kind of little bit complicated the first thing the doctor says that go for certain testing, blood test, urine test those are very common tests they will ask the doctor will ask you to do.

Similarly, if you are looking at the waste management problem or a particular city the first thing you should actually look at is how much waste is produced number 1. Number 2, how much waste is actually what is the point what is the type of waste is it mostly biodegradable, how much plastic, how much paper all those different components that you see over here. What are the break up because different component needs different type of treatment and plastic is one of them.

So, that is very very important so you cannot write as doctor will not write you a good, a good doctor will not write your prescription without going through certain test or if it is a complicated scenario. Similarly a good consultant or a good engineer or a good professional will not just come up with any design or any proposal for waste, waste management of a city without really understanding what is how much the waste is produced there and what is the type of waste that is produced there. So, that is very important and that is important for plastic waste as well.

So, when we talk about plastic waste there are variety of plastic, if you remember from last week that we talked about in those videos if you do not remember go back and redo relook at those videos of course, you have you must have taken the quest to which has kind of helps you revise those concept. So, there variety of plastic so when we start getting into plastic waste not one like there are different categories and they require different kind of, they can potentially reused in different application.

So, we have to now go into whether its p whether its number 1, remember that number 1 through 7 which is a PT HTP Npp poly properly those different LDPE and different. So, we have to start looking at different components and sometimes they may be mixed together as well. So, things starts getting little bit complicated, but we will we will talk about that we will go in more detail in that in the class. So, take our message for this particular slide we will we will talk about this graph in a minute.

So, but typically waste is produced, as a an plastic waste is part of municipal solid waste, plastic waste is increasing in a in many cities we see that component of plastic waste is getting higher and higher as part of municipal solid waste stream. And typically if you think about the global solid waste composition which is shown over here this is a based on the World Bank report. This is very recently we have a new report out there as well which is known as what a waste 2.0 and well as part of the reading material I will put that put that its waste what waste 2.0, it just came out it just came out in 2018.

So, I will put this report as well in your in the as part of the like a assignment for reading and I want you to focus on the plastic aspect, I will tell you which pay in the in the announcement discussion board will mention that which chapter you need to focus on. So, there we again they talk about plastic and how the plastic waste is changing globally. So, if you look at in general in terms of plastic waste composition. So, in terms of global solid waste production if you look at the global solid waste production organic is 46 percent.

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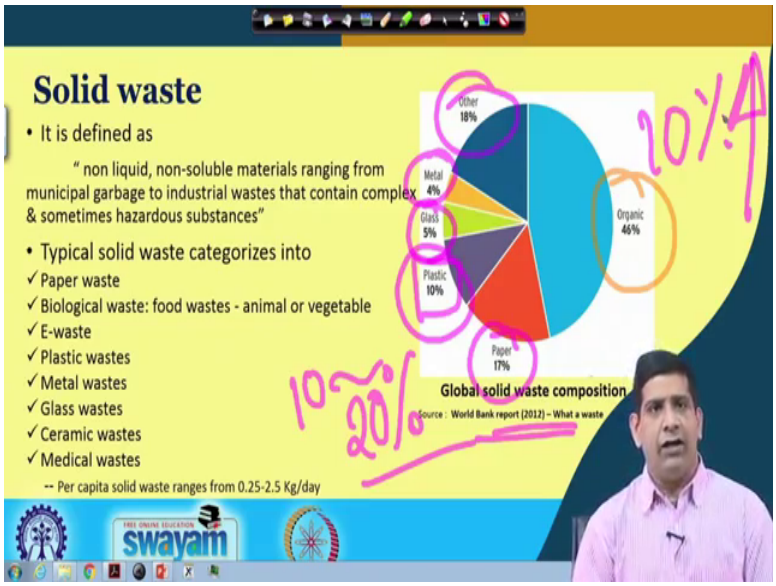

46 percent of the waste is organic in nature then we have paper is 17 percent, plastic is 10 percent glass 5 percent metal 4 percent others 18 percent so right.

Now, in and this 10 percent was in 2012. So, now, this number actually is kind of inching towards 20 percent lot of increase. So, nearly plastic has doubled in last 10 years that is what just yesterday I was reading a report from Ireland, where they have Ireland EPA has published a report where they documented that actually plastic waste has doubled.

Similarly its it is plastic waste as you can go around and see the waste stream in India, you saw you will see that there is a substantial amount of plastic present now, different types of plastic together whether substantial amount of plastic, but. So, the number was 10 percent, but now there is a increase in number, we are seeing a numbers going up it is around 15, 20 percent which also you in subsequent weeks when we talk about that as well.

So, this is a typical waste composition out of that plastic is a significant portion and we are in this particular week this particular course.

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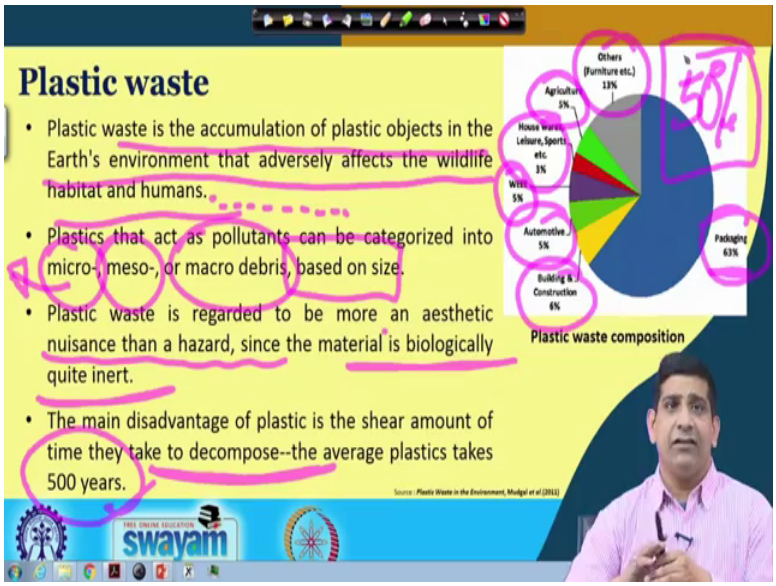

We will be focusing on the plastic waste. Now we talked about solid waste plastic waste is subset of solid waste. Now let us talk about what is plastic waste, now plastic waste is essentially as the as is a accumulation of plastic objects in the earth's environment which is adversely affecting wildlife, habitats, environmental issues, groundwater pollution, surface water pollution. Groundwater not that much surface water, marine environment, human health you have, these days we have a separate week just focus you on human and environmental health. But just so we are seeing lots of plastic in ocean which is getting into the fish, look plastic from surface water getting into the fish body and we are those of us who consume fish can get exposed.

Recent studies have also shown that plastics are showing up in salt, it like we cannot have any food isn't it we need salt pretty much in most of the food that we eat rather than sweet stuff. So, salt is getting micro plastic because the source of salt many times is the is our sea and there micro plastics are showing up, like very very tiny plastic which is really nasty stuff not good for our body, but it is showing up in the salt as well.

So, we will talk about those reports in coming weeks. So, plastic waste what is if you have to define plastic waste i it is the accumulation of plastic objects in the earth's environment that adversely affects the wildlife habitats and humans. And then we can add there are a lot of other stuff in there as well, like not only wildlife habitats and humans also the environment and other species out there.

So, there are different types so if you going to talk about plastic there are some micro plastic which is actually a small based on the particle size, we have meso plastic or macro debris, meso or macro debris based on size. So, micro is considered more dangerous, that is why you hear many times that ban on plastic is actually on thinner plastic. Single use plastic thin fill plastic that is what being banned because when it is kind of disintegrates gets into smaller smaller particle size it becomes bad for the environment.

So, right now it is regarded more as an aesthetic nuisance than a hazard since the material is biologically quite inert, it is biologically inert it does not creates, does not probably plastic was designed to be biologically inert. So, it is biologically inert, but at the same time plastic in we do not want plastic in food, we do not want plastic in our water, we do not want plastic in our salt. So, big plastic has certain toxicity associated with that as well.

So, we will we will be looking at those aspect. So, the main disadvantage is the shear amount it does not decompose, it takes other or average plastic takes more than 500 years to decompose. So, plastic is a problem that way, it does not decompose very easily it takes very very long time to decompose and that becomes an issue. So, in terms of plastic, where the way from the plastic waste is coming? In the previous slide I showed you as part of the municipal solid waste what are the different components.

Now, in this if the plastic waste what are the sources of plastic waste, where the sources are coming from packaging. That is a big problem today and that problem is not going to go away unfortunately because, we may replace the material we other than using we may probably use some other material, but the packaging the way our lifestyle has become where we are everybody is so busy we are ordering lot of stuff online and even if you go to a mall and other places lots of packaging.

So, packaging is because you can see 63 percent of plastic waste is actually coming from packaging. So, that is that is a lot of plastic in packaging industry, building and construction industry around 6 percent, automotive 5 percent, electronics WEEE is the electronic waste, waste electronics and electrical products. House wares, leisure and the sports products 3 percent agriculture another 5 percent, furnitures which furnitures and some other items is in 13 percent.

So, if you look at packaging compared to the others is the differences more than like around 50 percent. So, it is the packaging industry that is producing most and most of plastic as we saw in the previous week and that is this these are producing more and more plastic waste as well. So, lot of plastic is coming from the packaging of the material, of the packaging waste that is generated and packaging waste is generated very fast. Say you ordered something on Amazon or Flipkart, the amount that product comes to you just take your you order a nice cell phone then your you took your cell you took the cell phone and rest of all the material that it came with it with lots of plastics in there cardboards and other stuff it just gets dumped.

So, that the packaging material is its becomes waste in a much there is self life of packaging material is [laugher] very very low. So, that is what I am trying to say and that is it creates lots of volume. Of course, we can so recycle them and it should be recycled. So, that things does not comes in the waste stream, the problem especially in the western world or even in the Indian contest now is that there is a lot of legality legal issues out there.

So, packaging material once used if it used again if something happens to the product if the because many of the products when its packaged like that it is the packaging is needed that way to keep the product safe during the transportation before it reaches your hand or before it gets delivered to a factory. So, if the start using this recycled stuff and somehow if the that product called that packaging product quality was compromised people are afraid to take the legal ah like a legal blame for that because that may lead to a lot of like a financial loss.

So, what, to be on the safer side every time they will go for the newer material, newer material which is clean which is you cannot is not contaminated. So, that is why you start seeing many many waste coming from this packaging stuff.

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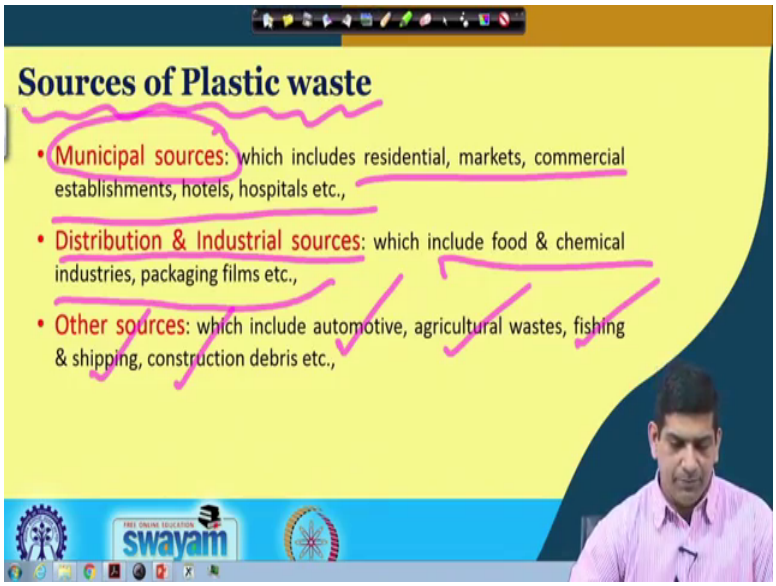

So, sources where it is coming from you probably got some idea already in the last two slides. So, in terms of the sources. So, basically where the waste is coming from municipal, you saw as part of the municipal waste plastic was around 10 percent 7 years ago and as I told you the number is increasing, number actually is going a little bit higher now.

So, but the municipal sources which includes residential, markets, commercial establishment, hotels, hospitals, then hospitals biomedical waste has a lot of plastic there as well. Now then distribution and industrial sources all the packaging material which includes food and chemical industries, packaging films those are your distribution and industrial sources. And there are other sources like automotive agricultural waste fishing and fishing, shipping, construction debris and some more you will see the, you will can you can come up with other categories out there as well.

So, there where most of the plastic waste is generated. So, where these are the stuff where we get most of the plastic waste coming into our environment.

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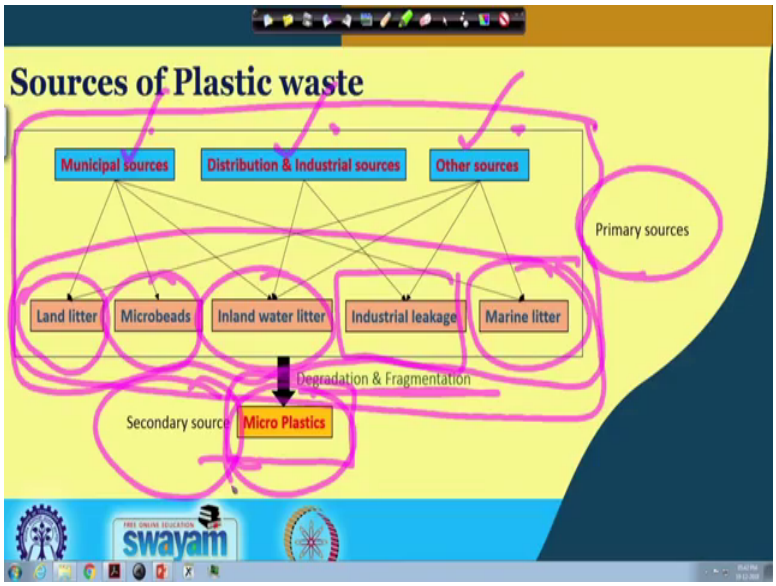

So, again and then where they are typically end up, say if you look at plastic waste coming into the environment and if we think about what is how they are happening. So, here is the small kind of a flowchart trying to explain that. So, we what we have try to see distinguish here is in terms of plastic sources, a primary source and a secondary source.

Now, from the primary source we already talked about municipal source distribution and industrial source and other sources, just now in the previous slide. Now from the municipal source it leads to land litter, it can also leads to micro you will have some micro beads you can have some inland water litter, litters you can have some marine litter. So, those all these things are possible from your municipal sources, distribution and industrial source again you can have some inland litter and industrial leakages other sources basically all pretty much everything is possible from other sources as well.

Now, once these plastic stuff gets into the environment and it starts degrading, degrading when I talking about where not talking about the bio bio degradation we are talking about just breaking it down it will it gets broken down into smaller pieces it leads to what is known as micro plastics. So, micro plastics are formed during the degradation and fragmentation of these different types of plastic. So, micro plastics are very very tiny particles which can move very easily which is what shows up in like a salt and other stuff

which gets into the water and even there are studies now which has said that micro plastics are even there in the air.

So, even in the air the micro plastics are available. So, it is not so what plastics are showing up in water, plastics are showing up in land, plastics are showing up in the air. So, that is the reason why the government around the world is really looking at plastic waste in a very very critical way as up today and that was I kind of the motivation for doing this course because as I told you earlier there is no textbook for this course.

So, hopefully by the end of this course we will try I will probably try to if you can have one, but it is a challenging where because there are a lot of information out there, but there is no ah as those of you who are taking this course. I again I strongly encourages you look for newer information share it on discussion board this will really be this would be a unique course that you have ever taken in your life where you are teaching the instructor and we all are learning together, it will really be fun.

Where I want the discussion board to be really lively, where please post it stuff whatever new stuff that you find, Google go on different stuff and then what do see if we miss something in this particular course we are missing in certain topics please compliment, we are trying our best not to miss anything significant, but just in case if there is something please do that.

So, in this particular video what we try to do, we were looking at sources of plastic waste. So, we started first with defining what is waste and from the waste what are the different categories of waste, different components of waste then we talked a little bit about the municipal solid waste. And what is the typical generation rate and how much of that is plastic then we started looking plastic is around 10 percent was there around 7 8 years ago.

Now, as I said told you that it is kind of going towards 20 percent, now this 20 percent plastic is coming from where. So, 20 percent plastic out of the total municipal waste steam. So, this 20 percent plastic is what is the source of this 20; 20 percent plastic and what we found it was major chunk is coming from packaging industry.

So, we had the packaging industry which was the major chunk and there were others the construction agricultural and there were other sources out there, but the in the electrical,

biomedical applications. So, plastics is used in different applications, but the packaging industry was close to 65 percent, I think 63 percent to be precise and in then if in terms of the sources there are. So, you we have municipal source, we have distribution and electrical source.

We have some other sources and they are leading to land litter my inland water litter industrial leakage marine litter which we talked about in detail as well and when the thing starts breaking down if they make micro plastics. And this micro plastics are something which we nearly need to be worried about in terms of managing that, in the environment because it has there it gets into the water stream it gets into air stream and it gets into land waste land like soil as well. So, it can have different spheres, it can have an impact and since plastic is totally man made material it is not a natural material.

So, naturally mother earth does not really know how to deal with it, although our biota is kind of trying to get adjusted there are some bacteria's out there which even is started degrading plastic because they have to kind of survive, its always you adopt to the condition. So, but at the same time since they do not degrade they just gets broken down, get dig into tiny pieces it kind of gets into the food chain it also get through either water, air and maybe through soil as well and it contains several chemicals which we do no, which certain way which has certain like a harmful effect.

So, so that is kind of a the different aspect of source and distribution. We will continue this discussion in our next video as well where we will look at further in terms of the source distribution as well as the global and Indian context.

So, again thank you for taking this course I hope you are enjoying it let us know if you are not later and we will try to fix if there is anything we can do. But at the same time please while put your questions on the discussion board, we will be very happy to answer actually we want the discussion board to be very very active where we can have a come would like a back and forth discussion and of course, we will have some of the live session as well as part of this course so.

Thank you and again I will see you in the next video.