Plastic Waste Management
Prof. Brajesh Kumar Dubey
Department of Civil Engineering
Indian Institute of Technology, Kharagpur

Lecture - 34
Biobased Plastic Products

So welcome back this is the 4th video for week 7. And we are looking at the alternatives to plastic the greener alternatives bio based alternatives. So, this is in this video, I will in the previous video were focused mostly on some of these plastic like a greener product they were also bio based. So, will continue we can say that we are continuing this similar discussion and looking at the other plastic products.

What are the other alternatives sought there? And then to I think in the next video after this we will be looking at how to even quantify, because there are a lot of green washing also happening. Where people are claiming something green, but they are not really green. So, how to quantify if something is green or not will talk about that as well.

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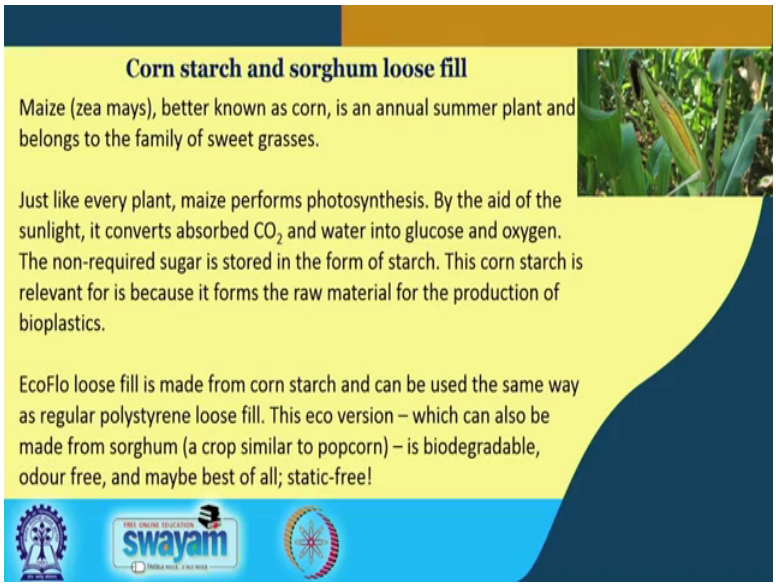

So, in terms of the alternatives Corn starch and sorghum they are also being used quite a bit in making this plastic alternatives. So, Maize better known as corn is in which its produced annual produce, which gets produced in many parts of the world including India, its say its staple food like your conflex and many things are made out of corn. And so again the corn or maize there is a photosynthesis like any other plant. So, it absorbs

CO 2 and water into glucose and oxygen. So, the non required sugar is stored in the form of starch this corn starch is relevant because it forms the raw material for the production of bio plastic.

So, that so you can make with the corn starch you can make bioplastic. So, there is a eco flow loose fill is made from corn starch and can be used the same way as a like a regular polystyrene loose film. But this eco version which can also be made from sorghum which is a crop similar to maize is biodegradable order free and maybe best of all is static free. So, its easier its a so these products are biodegradable they do not have any kind of smell as well and maybe best of all they are also static free.

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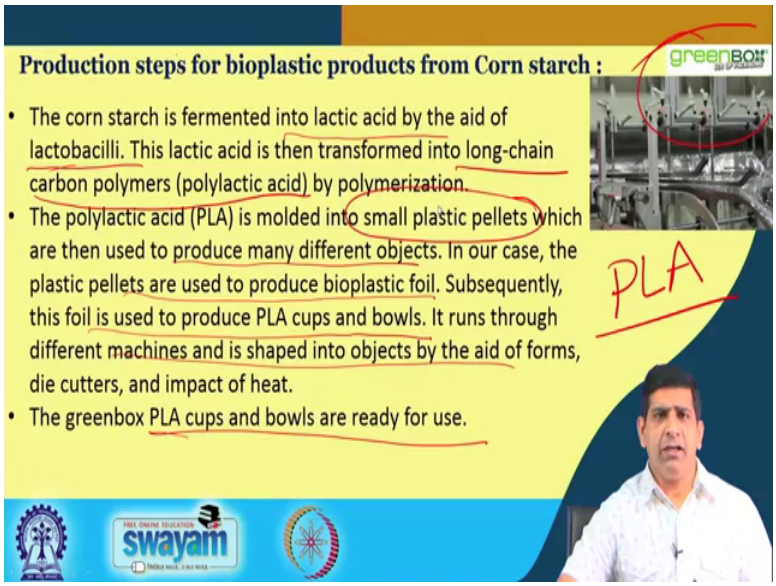

So, there are these are the production steps for bioplastic products from the corn starch the corn starch is fermented into lactic acid. So, if you can look at here they are forming lactic acid and by the aid of lactobacilli. So, in this lactic acid then transformed into a long chain carbon polymers which is called polylactic acid. In the short form you hear a lot PLA. So, PLA based plastic and that is the polyactic acid based plastic and this is molded into human day polymerization.

So, this then molded into small plastic pallets. And this pallets are then used to produce many different objects. So, similarly if you remember from the first video of this week or I think it was in the first video maybe in the second. So, there again when we are trying

to do those mechanical recycling it was doing the same thing we are making those plastic pallets.

So, rather than using those oil based plastic resins we here we are using bio based bio based polymers. So, that is the difference and since these are bio based polymers they are mostly biodegradable. So, and they can biodegrade in traditional like waste management system, whether its a composting anaerobic digestion. So, then you they are used, so they are small plastic pallets which is used to produce many different objects.

So, in this case in a plastic pallets are used to produce bio plastic foil, separately the foil is used to produce PLA cups and bowels and run through different machine shaped into objects different with the form of dye cutters, impact of heat and all that. So, then PLA cups and balls are ready for use. So, you can use and that is for the green box, that particular product brand which should they do is that there are other brands out there using PLA as well.

So, you will see variety of products coming out from polylactic acid which is earlier whenever we used to call bioplastic this polylatic acid was the one which was getting the most like a name although it become like a synonyms for bioplastic.

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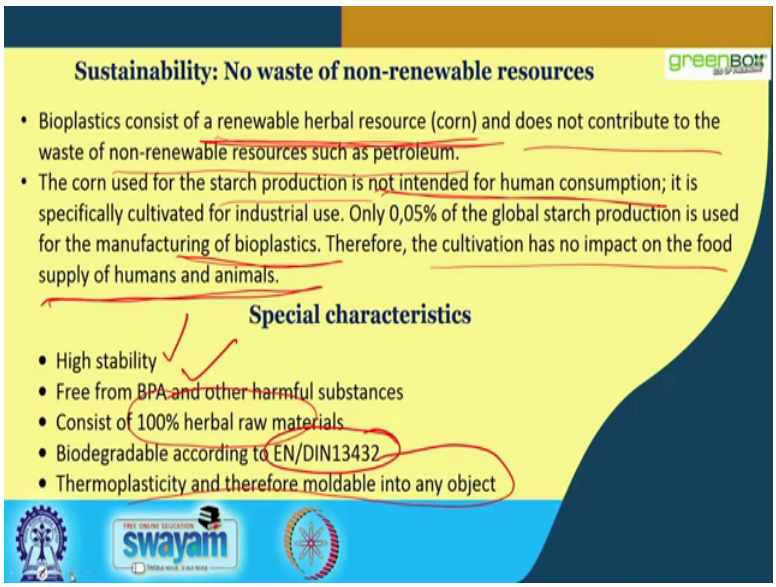

So, PLA based plastic was called bio plastic. And but then since other sources came in so we kind of we are being a bit more when we say PLA based plastic it is part of bioplastic

of course, its a significant portion of bio plastic, but there are other types of bio plastics as well.

So, when you look at the sustainability of in terms of the bio plastic stuff, its a no waste from non renewable non renewable sources. So, its mostly renewable sources which we have, so its a here the bio plastic is contains is a renewable herbal source, which is the corn and does not contribute to the waste of non renewable sources such as petroleum. Corn is used for the starch production which is not intended for human consumption.

So, part of the corn which is not used in human consumption is used for that, otherwise that is also a problem. See when this biofuel industry came in last decade one of the problem that we were facing was because the food prices went up. The reason the food prices went up is many of these corn and other stuff which was supposed to be on our plates in different forms they were being diverted to the bio oil production and when they because they were making more money.

So, when they go for the bio oil production. So, amount of corn goes down in the market food prices goes up as you know demand and supply basic economics. So, since the supply demand is always more population more people affordability going up people are becoming little, I would say in general if you look at the I would say the salary level of people have gone up.

Although there is if we talk to social scientists there are a lot of issues of disparity in the country there are poorers are becoming poorer, not only in country or also Abroad like globally poorers are becoming poorer richers are becoming richer. But that those are true to some extent, but at the same time, in general if you look at there is a upward train of the society the affordability for different stuff has really gone up if you look at the way the market is right now.

So, in that case if you have more demand for food and with the higher population and higher affordability, but you take the corn away from the food market and put it for your like a bio oil or biodiesel the food prices has to go up and that is what happened. So, food prices started going up and then the people realize that this is not the way to go. We can use bio based waste material.

So, we can use the bio waste biodegradable waste or organic waste any food agricultural waste and use that as a source for making these alternative products. But anything which is grown for the sake of consumption which we are used to consuming especially the staple food like maize or whether we this should not go into alternative products, because then it becomes a problem for the food industry.

So, its not it is not intended for human consumption, its only 0.3 0.05 percent of the global search strach production is used for the manufacturing of bioplastic. Therefore, the cultivation has no impact on the food supply on humans and animals. So, that is. So, special characteristics for this is a high stability free from BPA bisphenol a if you remember that from last week videos.

It consists of hundred percent renewable like 100 percent raw material 100 percent natural raw material its biodegradable, as per the European union it meets a that criteria thermoplasticity and therefore, molded into any objects. You can put it in whatever shape and size you want and that becomes like you can put it you can make what different types of products out of that.

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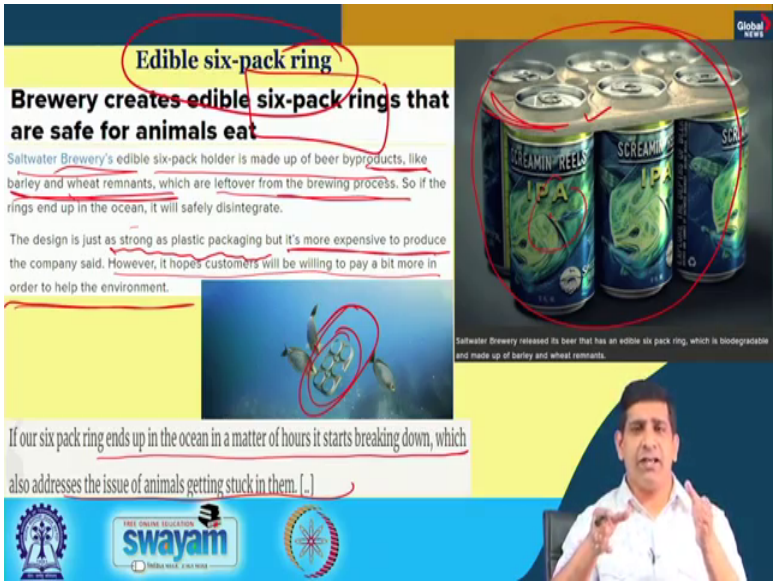

So, then another things are coming up, there is one company which has come up with edible six pack ring. So, this is and you can eat that. So, Brewery has created a edible six pack rings that are safe for animals to eat. This is salt water bribery this is a six pack holder. So, you have six packs together. So, they can be they can be used for different

applications for different this cans are used for soda, cans are being used for beer like even for beer and other stuff cans are. And there are a variety of soda even a lemon this is nasty different types of drinks these cans are used. And so 6 cans together usually are put into a 6 pack ring and that becomes kind of you can buy six together and this is how you see them in a super store.

So, when you put the usually these used to be of made out of plastic and of course, these are your metal stuff aluminum most of the time. But these are your plastic material which used to create problem in the ocean. And this plastics will break down and then it becomes a like micro plastics and then fish used to eat that. So, if its a eatable if its a biodegradable and eatable, so its easily coming from barley and wheat that is what it is being used and its a from the byproduct from the waste product of coming from Brewery industry.

So, these are left over from the brewery process. So, if there is a even in this case if this ring and rather if not its not a plastic ring, but its the like a biodegradable ring. So, are eatable rings so when it goes to ocean even if it when its ends up in the ocean it will its eatable so animals can eat it. And it will degrade it will not the take the time that plastic takes to really plastic stays in the marine environment for a very very long time.

So, the design is just as strong as the plastic packaging. So, that is also very important it should do that function its a bit more expensive to produce. So, that is what I was trying to tell you in the last video that these kind of industries need some sort of support in the beginning, just to get into the market it starts selling a good numbers of their products and mature a little bit, so that they become price competitive any when it comes for the first time they its costly, but once it says it volume it starts and then the prices goes down.

So, that is ah. so that is its a needed for that, more over however, it hopes customer will be willing to pay a bit more in order to help the environment. So, that is what the company is hoping. So, its it usually if its not too much its there are there is a market out there. Now people want to buy green products there is always there is some sort of I would say section of population is already looking at they are ready to pay say 10 percent 15 percent more on any product to buy something greener. But it has to be greener first of all and that there should be a checks and balance on that it should not be

green washing; green washing is when the companies claim something is green, but when you do the real investigation you found that actually its not green.

So, that should not happen and at the same time it should be like it should not be too costly, because every like every families budget is also limited. So, if its too costly then it becomes difficult I would like people can spend a little bit extra maybe 10 to 15 percent extra maximum to buy something greener. I am talking about in general there will be some crazy people who will cook and pay maybe twice the money to get it I wish to call them crazy, but they somehow environmental friendly people who will who can do that.

But they are in general middle class lower middle class upper middle class and their budgets are always limited. So, its so that but if it even will so but these products are useful. And when they end up in the ocean it starts there what has been found, that in a matter of hours it starts breaking down. Which also address the issue of animals getting stuck in them.

So, animals that some we saw that we some of the videos last week where that animals were they were like the plastic rings and even though in one of those there, if I remember correct that is a straw, got to the nose nostrils of one of the Turtle and then, the Turtle was has a lot of wires like plastic wires all around him even if its neck was covered with those plastic wire. And we saw all that and its really sad because we are destroying their habitat with all these waste getting in there, but.

So, this kind of product even if it ends up in ocean of course, if the goal should be that it none of these plastics should end up in ocean. If we have a proper plastic waste management program it will not and that is the again we are talking about lots of plastic products alternatives to plastic products, but the course is the title of the course is plastic waste management and we should not lose that focus that it is plastic is not a problem it is the plastic waste which is a problem.

So, once we dispose that plastic whether its a regular plastic the petroleum based plastic or even the plastic that we are proposing like all these examples, that you are seeing in this video in this particular week and different videos, they also needs a proper plastic waste management. Yes, the managing those plastic will be slightly easier now because they are degradable to most part.

So, I can use it in my composter I can use it in my anaerobic digestion when I say I like I was a city level as a ULB level we can manage it. But these will also produce if biodegradable means they will produce CO 2 they will produce methane and the CO 2 and methane if not captured. Or if its not just if we just leave it to go to the atmosphere I do not know whether we are really solving the like we only solving part of the problem, because it was its more like a problem sifting.

Earlier it was the that is a severe problem that plastic is especially that single use thin plastics getting in a smaller pieces getting into the ocean becomes an issue, but it, but replacing it with this biodegradable plastic and then just do nothing into this, biodegradable waste biodegradable plastic waste management that also is a problem by itself.

So, its we are just we are doing only part of the solution not the complete solution. So, plastic waste management having a proper plastic waste management, which is will be the part of your ULB solid waste management; because plastic waste essentially will most of the plastic waste you will see is coming from the municipal waste. So, that needs a lot of focus that is why this waste management is right now in the country like India, with all this Swatch Bharath mission program smart cities program we need to really focus on a good workable waste management infrastructure.

And that is what some places it is happening. So, will see how it gets done in many parts of the country it is some work already kind of started and its going on. So, regard coming back to this edible six packs ring which is can be eaten up or even if it goes to ocean it is not that bad.

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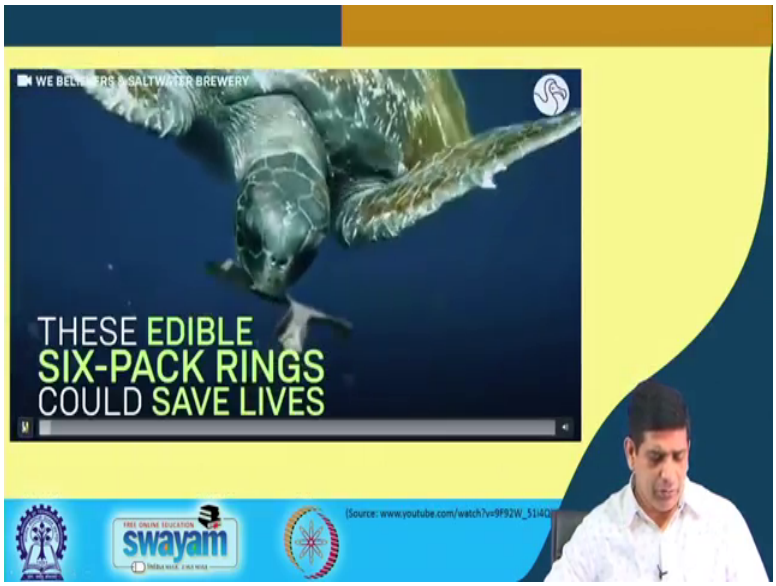

So, let us in this next slide we have a small video which is trying to go over the detail of these six packs.

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So, let us look at that.

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And it has a subtitle there is no we have not put any audio here.

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So, as you can see they are made from leftover from the beer that whatever is the leftover.

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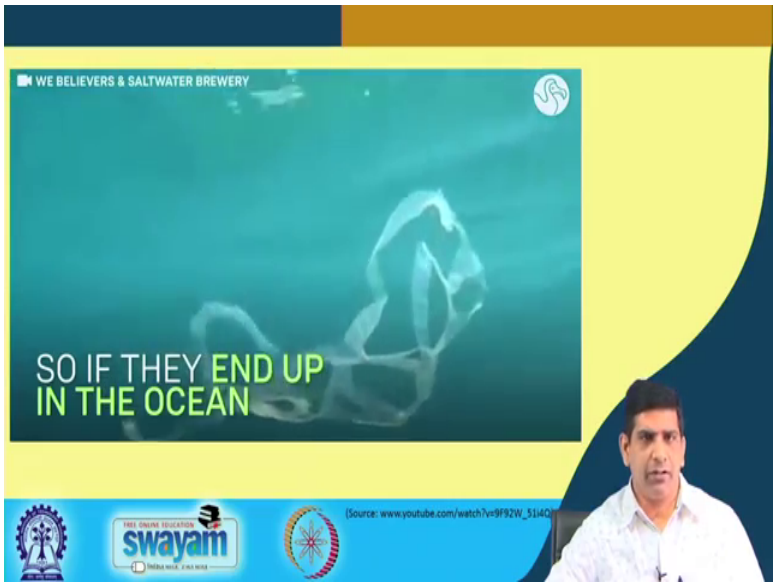

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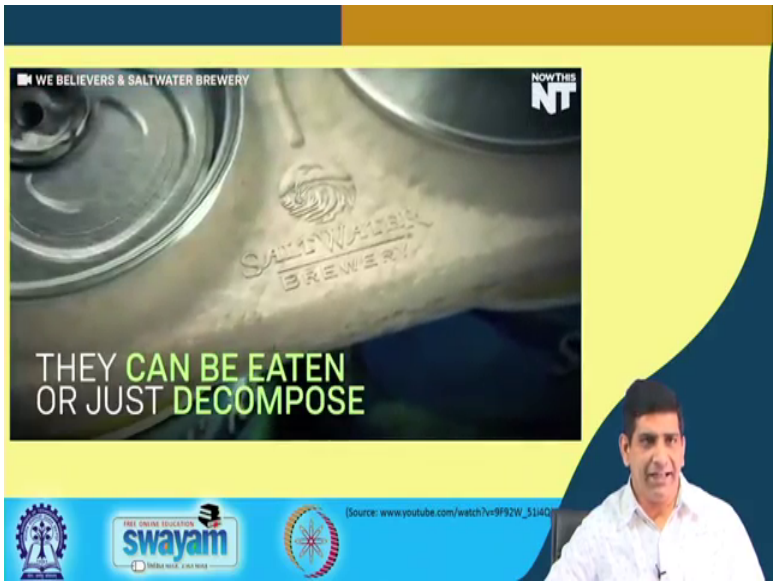

So, even if it they can be eaten or they will just decompose.

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So, even if it ends up in the ocean.

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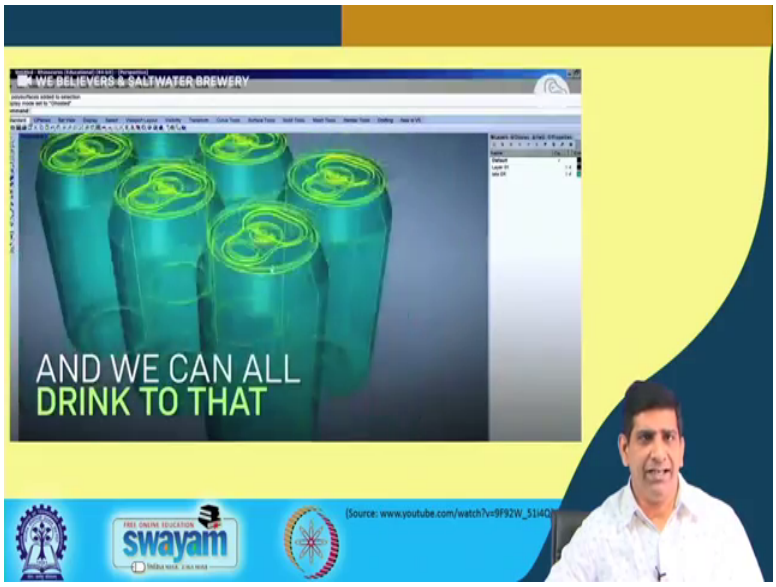

The animals will not be entangled in them and because its easier its it will decompose quite fast.

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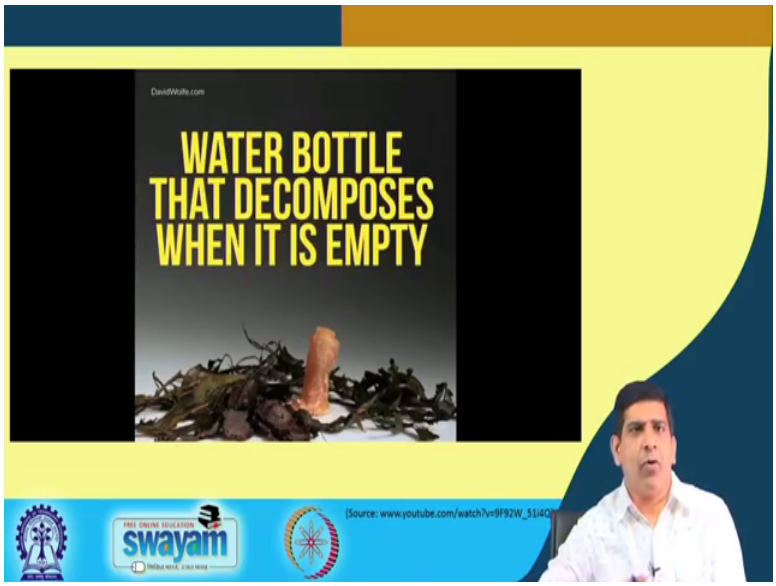

Similarly, there are other bottles out there these water bottles that decompose by itself ah.

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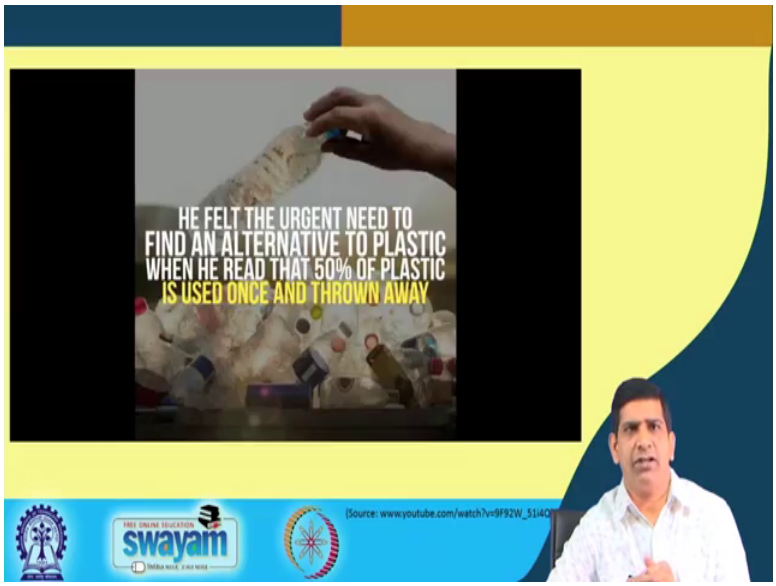

This by one of the Johnson a product design a student he has come up with that and when he looked at all these plastic issues as you can see on that video.

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That several plastic going into the ocean are going of some of them going into the ocean but going at a waste stream.

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So, more than billions plastic bottles are used in the world.

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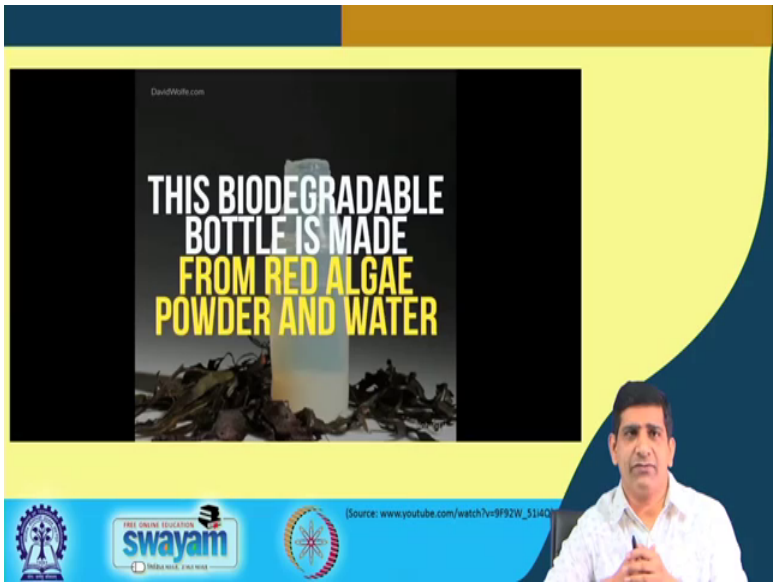

And it takes 1000 years for all those. So, this biodegradable bottle is made from red algae.

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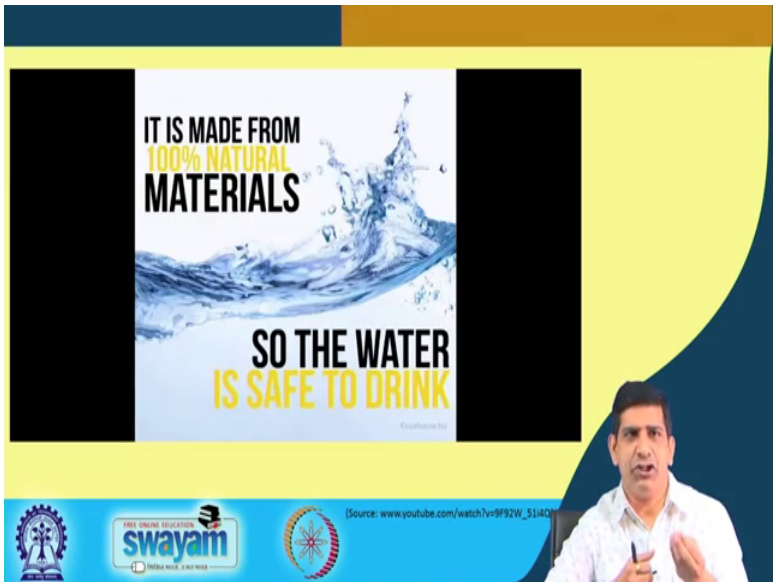

And then its made from 100 percent natural material and you can use that bottle and after you drink that water its it starts after you drink that water it starts melting by itself. So, and then you do not have you do not have to really worry about that water bottle. So, its decomposes and gets used up in by itself like it will become part of your see, if you put in a composter it will compost there to put anaerobic digestion it, it will get an aerobic digested. If you do not use it anywhere it will just decompose in the atmosphere too. So, these are some of the alternatives which is being used and its made from.

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So, many of these are naturally made stuff and so they are coming into the market they have they are picking up, but its still there are limitations to these products in terms of price. And some other aspect in terms of its strength as I said earlier as well many of these bio plastics is still not 100 percent bioplastic they have some traditional plastic blending just to give required strength.

So, those things are being worked into in terms of research right now. So, that was on bio based plastic some other examples there are some paper based products are also coming up which is we used taking the space of what the single use plastic products had. And one of them was a high function packaging material which is the metallised paper, this is silver board metallised paper its a special paper it has a metallic layer vacuum deposited on the surface for decorative effect. And this offers a solution to achieve distinctive metallic finish on packaging with only fraction of the aluminum content of traditional foil.

So, and the material again remains compostable same as paper. So, its can use for labels and packaging of beverage food and they are and consumer products by approximately 300 companies in 80 countries are looking at this product. And earlier it was many of these plastic base product was being used. So, it is replacing those plastic base product by this paper based product and which is environmentally friendly more compostable and all that.

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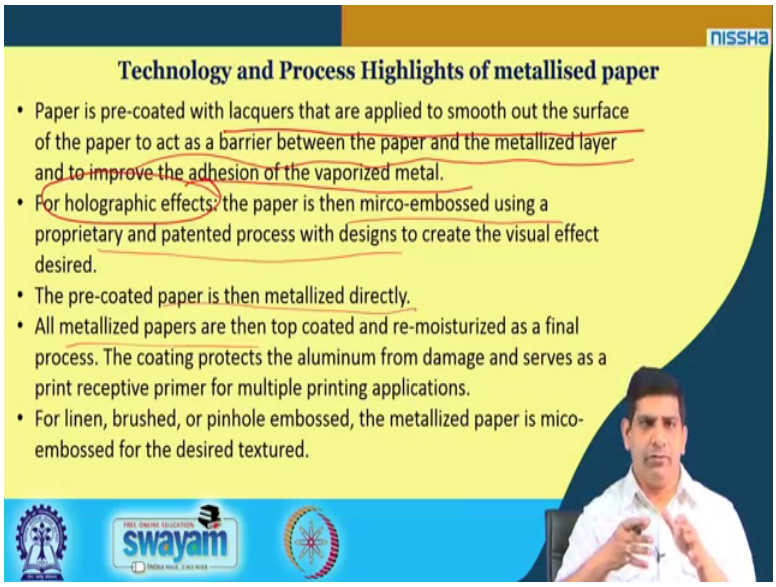

So, that is another area. So, in terms of these metallised paper what they are, this is paper is pre coated in with liquors, that are applied on is to smooth out the surface of the paper to act as a barrier between the paper and the metallised layer and to improve adhesion of the vaporized metal. Then you have a holographic effect, the paper is then micro embossed using a proprietary patent process create the visual effect desired.

Pre coated paper is then metallised directly all metallised paper, then top coated and re moisturized is a final process the coating protects the aluminum foil from damage and serve as a print receptive printer and so, they can print different like a logos and other stuff. For linen brushed or pinhole embossed the metallic paper is micro embossed for the desired texture.

So, there are this is kind of the basic of the production process, we do not as a waste management person we do not have to worry too much about the production process. What we worry more about the what is the waste coming out of it production? We can leave it to our chemical engineering friends.

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But in terms of what is its key feature where it can be used, and then when it comes to the environment what could it will potentially problem may arise from that or what can we do the resource recovery, what kind of resource recovery we can do? So, here in terms of key features of this metallised paper; its excellent print ability it prints really well, it works with all printing technique like offset rotogravure UV flexography and

some digital. And also different types of ink solvent based water based UV curable it can it facilitates cutting it resists a curling labeling and recycling peels off with washing to ensure ease of handling by the customer.

So, when you are peeling it can easily be peeled off during the recyclingthat is really good. You do not need that glue I think over there that is typically there with the other label material, its stable quality high productivity, low cost, higher biodegradability of paper over the film because we used to use a lot of plastic film. So, if you can replace those plastic film by this it becomes easier. And they already are being used in 80 countries, but more than three 300 companies. So, this is a this power market is this product is already there which is replacing the film plastic by this metallised paper which is environmentally friendly than others.

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So, you see here some of the applications of the metallised paper, so these are different labels from different companies, different products. So, these are all these labels are all metallised paper. So, this is from this silver board is a company name and you see that different applications here for some containers, some box even for different types of boxes. You can put as a label for drinks even part of the for the tissue paper container or tissue paper boxes and different applications. So, you can use these applications are used for metallised paper which is already been used for different product.

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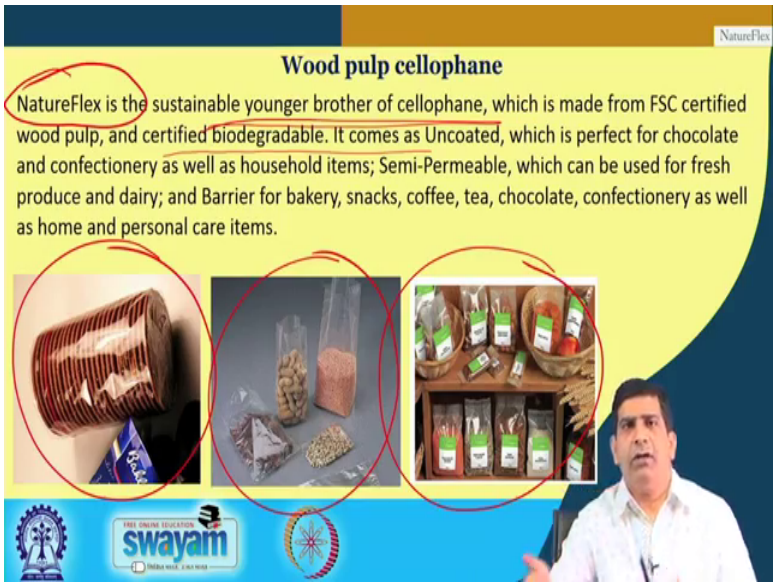

And there are some other there is say wood pulp cellophane is also cellophane, which again for its like a packaging different product. So, there is there are which has a lot of plastic in it was plastic based. Now when we say plastic based means the traditional plastic based now there is a another variety of it is coming out in terms of using from wood pulp.

So, the company here the NatureFlex is the sustainability, sustainable younger brother of cellophane. So, cellophane is what we have used which is made from food certified wood pulp. And certified biodegradable it comes as uncoated, you can use it for chocolate confectionary as well as household items semipermeable. Which can be used for fresh produce and dairy and barrier you can for bakery snacks coffee, tea, chocolate. So, you can have semi permeable as well as like a non permeable coffee, tea, chocolate confectionary; as you can see the pictures here all different types of packaging can be done using these material.

So, this is again its coming from wood pulp, rather than its a plastic based. So, these are the alternatives which is environmentally more greener alternatives. And when we are claiming we are suggesting many things are environmentally greener, but we will talk we will also talk about its very in this week itself, like how to quantify that. How to really say that something is green, because that is important because otherwise how will know how much green it is? Because whenever you come up with a newer product or newer

process and then you say that this is better than my older process or older product we need to know how much better? How to quantify that? So that those kind of discussion will do in maybe in the next video.

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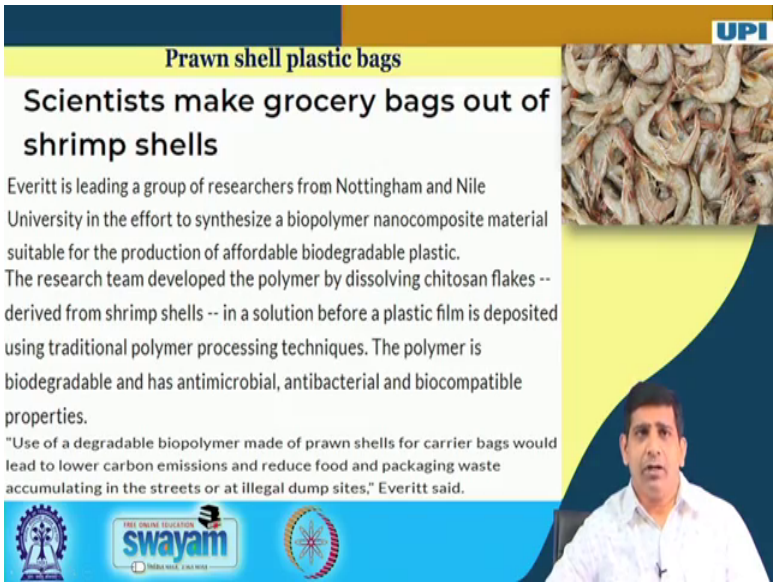

So, there are some scientists have made grocery bags out of shrimp shells. So, that is another from the shrimp shell, this in researchers from Nottingham and Nile university, they have synthesized a biopolymer nano composite material, which can make production of affordable biodegradable plastic. So, there they have taken they have developed the polymer, but is dissolving the chitosan flakes, derived from the shrimp shells in a solution before a plastic film is deposited uses a traditional polymer processing technique. Its a degradable antimicrobial, antibacterial, biocompatible property.

So, it makes use it makes its useful and the researcher says that use of a degradable polymer made up on cells for carrier bags would lead to lower carbon emissions and reduce food and packaging waste, accumulating in the (Refer Time: 26:33) legal terms site. So, that is so you are basically you can many times we hear the term you are trying to kill 2 birds with 1 stone. So, here if you do that you are also reducing the food waste, coming from this particular industry or this particular stream. And that is a win because and your product is being made and at the same time we do not have to manage it as the waste in a dump site or in a landfill.

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So, these are some of these examples of shopping bags and other containers made from shrimp shells. So, as you can see different types of containers, cups, shopping bags they are all coming from shrimp shells; so which is already in the market.

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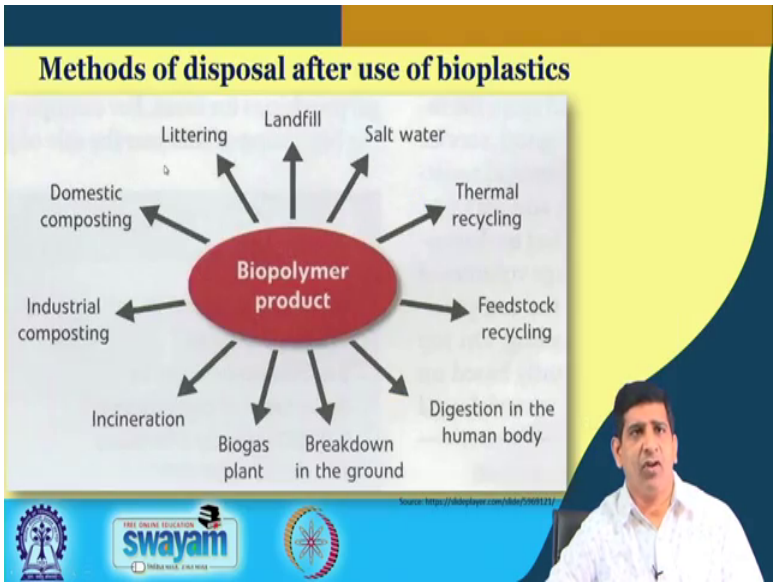

So, once this bioplastics are used up, what we what are the different ways which it comes to the environment? Because we are saying traditional plastic is bad. So, we let us replace with bioplastic, greener plastic whatever we call it environmental friendly plastic. In this environmental friendly plastic also needs their disposal after its use. So, that is a

very very important part of it. So, there are different ways it can be their disposed, it can go to a landfill, it can go to littering, domestic composting, industrial composting, incineration biogas, breakdown in the ground itself. It can go into our body too you can go for recycling different types of recycling.

So, there are variety of ways it can go into the environment. So, let us will spend some more time on this will start from this particular slide in the next video; we will explain each one of those a little bit in detail. And then it will also look at how to quantify the environmental impact, overall environmental impact when we move from one type of plastic to another type of plastic. So, the whole concept of lifecycle analysis that cradle to grave or cradle to cradle concept, that will discuss and that will kind of lead us nicely to the next week which is on circular economy for plastics.

So, again I hope that you are enjoying the course so far, this is a week 7 4th video is this is we kind of end of the 4th video. There is one more video in this week which will have it right after this. And again if you have any questions put it on the discussion forum we will be very happy to answer any question that you have.

And at the same time if you find some new information, if you find some interesting information regarding plastic waste management plastics in general which you think is relevant for this course, put it in the discussion forum which will help us enrich as all of us including our team the instruction team. As I said several times in this course so far, there is no a standard textbook on plastic waste management yet. So, information presented here is essentially collation from different sources, that is why we have given you a lot of reading materials as well every week. So, look at that and do your quiz carefully, nicely and all the best and see you again in the next video.