Plastic Waste Management
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Lecture - 33
Greener Plastic Products

So, welcome back I will continue our discussion on alternative and greener material to plastic which we started looking at in this particular week. So, this is the third video for the week 7 and in this video we will continue what we were doing in the previous video as well looking at the greener plastic products. So, this plastic products mostly bio based and you saw some examples earlier. So, let us look at some more examples.

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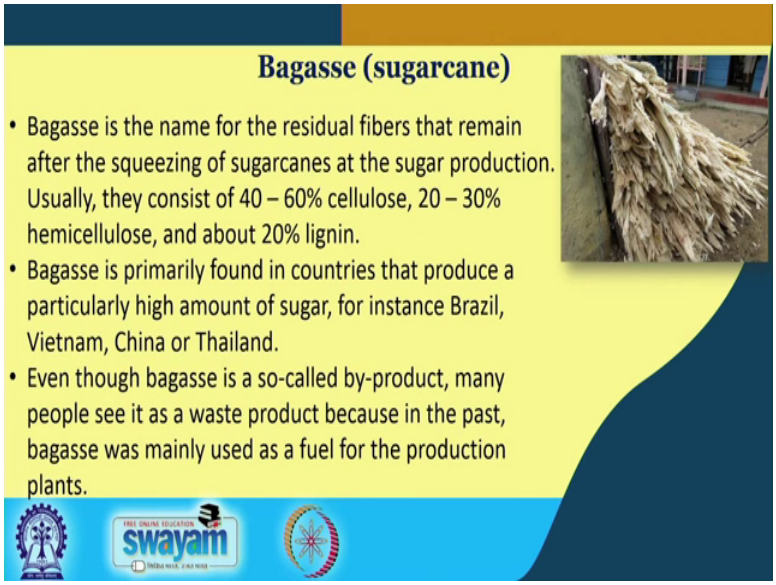

Now, one of the thing we are looking at towards the end of the last video was plastics plastic products or replaced replacement of plastic products from using the raw material of Bagasse, which is essentially coming from sugarcane India is a we do produce quite a bit of sugarcane in India, there are several other countries like Brazil, Vietnam, China or Thailand they also have lot of sugarcane industry. So, in these in these countries there have been some push in terms of using this bagasse which is essentially a waste product and try to make single use material which is a plastic which we use for plastic those plastic plates plastic cutleries so, replace those with material with plates made from

bagasse and this is and these are environmental friendly because they are bio degradable so, it can degrade.

So, when we say environmental friendly we need to also try to quantify that environmental friendliness and we will talk about that in terms of later in this particular week. So, what is what is bagasse is essentially is coming from the sugarcane it is residual fiber once the sugarcane juice as been used up say it can be it is used for so, it is once the sugarcane juice has used up. So, it is a whatever is the left product it is around 40 to 50 percent of cellulose, 20 to 30 percent of hemicelluloses, and about 20 percent of lignin.

So, we have 20 percent, lignin 40 to 60 percent cellulose, 20 to 20 percent hemicellulose. So, that is what we are looking at and of course, it would be found in countries that produce a particularly higher amount of sugar which does include India as well. And it is although it is called a byproduct, but may people see it as a waste product because in the past it has mainly used as a fuel for the production plants and that was also many places it is just dumped into the atmosphere other than being beneficially reused.

So, this kind of helps in terms of so, in terms of like there use of this material for making a alternative to plastic and which essentially coming out to be environmental friendly.

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So, it is a by product of sugar production does not require additional cultivation area. So, it is the unlike other bio fuels and bio based resource where if you are producing those resource. So, you are you are changing the land use, here you are not changing the land use, you are producing sugarcane and you are producing sugar or other products on the sugarcane, but whatever is the residual you are trying to use it for this like a single use replacement for single use plastic products.

So, it is it is also used for building materials, packaging materials, disposable table ware. The paper industry is replacing wood fibers with sugarcane fiber to produce napkins, toilet papers and cardboards so that is also happening. So, since there is no additional cultivation area required so, we are not impacting any land use changes, so we are not impacting any forests. So, that is the benefit of going for this particular raw material coming from sugarcane.

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So, it is they have been found to be stronger than plastic. So, that is also a good can things to know because in terms of if you look at many start ups are finding alternatives. So, these bagasse fibrous remains left behind after extracting sugarcane juice can be used to make disposable cutleries and containers.

There is a company called Pappco which you see all these product over here and this product has been found to be even stronger than plastic in many cases. So, that is really a increasing finding because we can use this product, we can use this waste material and

make single used disposable cutleries and containers and which is essentially bio degradable of course, we need to manage these waste as well properly once they are discarded. But whenever this product is discarded that needs to be managed properly because when anything bio degradable means it has the it will have methane potential.

Methane is a green house gas so, we need to make sure it is managed properly in the gas is collected we are not contributing to climate change. So, it is not that we are solving one problem, but we are creating the other problems. So, that is always should looked into and we will talk about some of those discussion later in this class as well.

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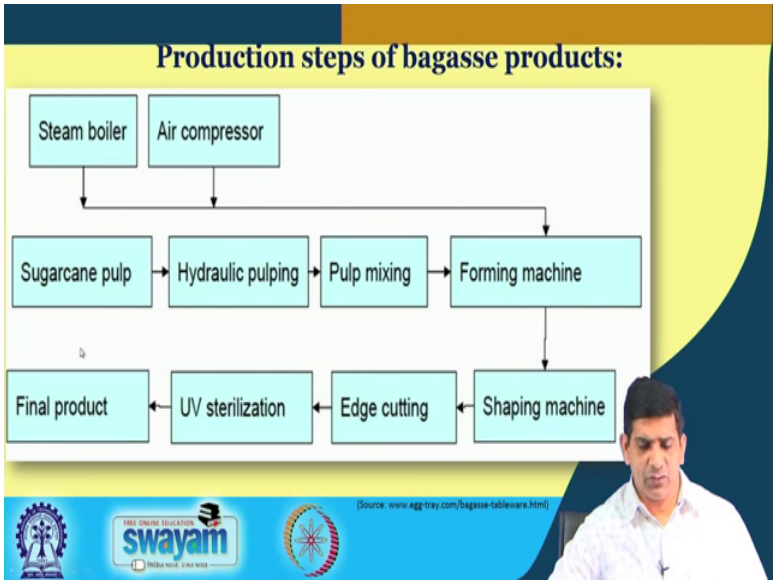

So, what how they are made it is from a steam boiler air compressor you will have a sugarcane pulp and that goes to hydraulic pulping, pulp mixing, forming machine, shaping machine, edge cutting, UV sterilization then you have the final product which is used for making those single use containers.

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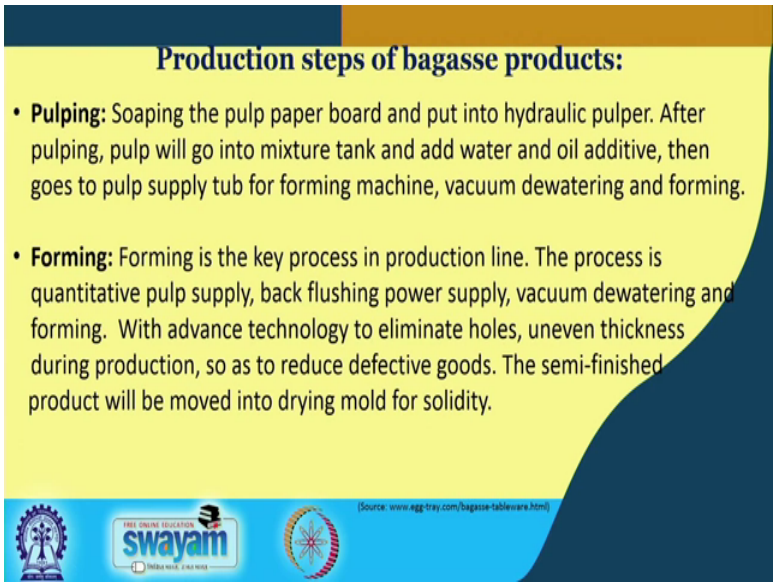

So, the in terms of there is steps if we look at one by one it is starts from pulping, pulping as you know pulping is also done for paper pulping which you are soaping the pulp paper board and put into hydraulic pulp so, that is what it is all about. So, here rather than using like a fibers from trees we have the fibers coming from this sugarcane. So, it will be put into the hydraulic pulper after pulping the pulp will go into the mixture tank, where water and oil additives are added then it goes to the pulp supply tub for forming machine vacuum dewatering and forming so, that is the next step.

So, in forming this is the one of the key process in the production line, it is process is quantitative pulp supply and then you have vacuum dewatering with advanced technology to eliminate holes and even thickness during production. So, the semi finished products moves to the drying mold for solidity. So, you have pulping, then forming as you saw in the previous slide in terms of layout of the process. So, very similar to what kind of you see it for any paper based product as well.

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Then there is a shaping and drying, which steam is used for heat drying and 70 percent if you use heat drying compared to electrical energy you are saving 70 percent of the energy you will be saved, emitting the hygiene requirement for food packaging. So, qualified production rate is up to 99 percent so, that is it is it is used in then we have after shaping and drying, it has to be cut and sterilized because as you know it would be used for food usage. So, it helps us to be really free from any pathogens bacterias. So, product taken out from shaper will be moved to edge cutting machine where the extra edge is framed UV sterilization is applied to make sure production meets the hygiene requirement and then finally, product is packed and stored.

So, that is how the and it is not say if you look at that it is not it is not thing anything special over here it is only that rather than using the fibers from other sources now we are focusing using the fibers from the sugarcane waste which is also called bagasse. So, we are taking from the bagasse we are extracting those fibers and using it for making this product and since it is coming from a material like a bio based material, it is a bio degradable material and it and it can be used for those like a for after say after it is end of life potentially it can be used for energy generation as well. So, it is either as bio based energy or it can be used for thermal energy too. So, thermal waste energy plants can use it as well because since these will have relatively higher calligraphic value as well as long as it is gets it is kept dry.

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So, special characteristics so, they are very stable, they sturdy, they are not very flexible though. So, it is you cannot give a lot of shapes to it, but it is it is not it is it is a stable, it is a sturdy and it has good thermal property and it can and it has a it can withstand the temperature of minus 25 to 220 degree centigrade. So, which is kind of much beyond what a typical temperature range will be for human settlements. So, even for very very cold climate inside temperature is less than minus and is above minus 25 outside it may be less, but that is only for few days few weeks may be in the year, but other, but even in those weathers the since the temperature is control and you are pretty much above 0 degree centigrade all the time.

So, then you have a it is a water repellent, it is a grease proof, it is suitable for hot and very oily and greasy dishes, it is completely biodegradable and compostable. So, that really helps in terms of going for the greener alternatives as we as we said in the beginning of this particular video that in this section this particular module the focus will be looking at the greener alternatives to plastic and this would be one alternative to plastic. So, many many of these initially are costly as I said I think in the previous video as well things are starts with costly, but as the market picks up.

So, that is why in my view although many people may not agree with me, but in my that is my in my personal opinion the government should help these kind of industries and that is what I have seen it happening in the western world. Although western world we

say they are the capitalist society they are not socialist, but many times I feel the way the policies are been done in even in u s or in or in Australia or new Zealand or Canada for example, I found them to be since I have stayed there for quite sometimes so, I have followed their polices a bit as well.

So, I found them to be kind of more socialist day then what we are in India many many cases. So, especially from when we come when we have our interaction with the industry. So, industry many times need little bit of hand holding by the government and when I say hand holding it is to provide them with required support. So, that they can taken with stand especially the initial hiccups, because say for example, this if I setup a company or if you setup a company are using this bagasse product, initially since you will have lot of infrastructure to be to be in placed there are lot of research involved in it to come up with all these products. So, the cost of this will most slightly will be higher sometimes much substantially higher then the alternate the plastic product which it is planning to replace.

So, there the government rule needs to come in play where there the government needs to kind of incentives some place to consumer to buy this product and at the same time gives subsidy to this company so, that the products are at cheaper relatively competitive price should be there. So, and that could be in the form of tax credit, providing land or giving some electricity bill, repay or whatever, but there has to be some sort of mechanism and western world has lot of mechanisms like that.

So, and they also fund research like a for example, in US they have a concept called small business innovative research and that SBIR it is a short form is SBIR and that is industry can put 1 dollar and the research fund they put 3 dollars up there. So, it is a kind of in 25000 dollar, you can have a 100,000 dollar project and that has to be totally focused on industry something which improves the industrial process something which improves the job prospects so, you can create more jobs.

So, it has to be totally applied not basic, but at the same time you will get some things coming out of that. In Indian contest unfortunately still we are so much stuck in that whenever you go for any funding they will say where is the signs here, see signs is already there, but it is a application as a engineer we are also we have also look at the application, we should focus we should move beyond that there we need basic science

research I am not doubt doubting that, but we also need applied research and it is not only the consulting part, it is the research funding also needs to be there because sometimes consulting does not really help, because consulting requires quick solution and where we this kind of many times this kind of work takes times. So, it is more like a research funding rather than a consulting funding. So, that was a bit a site track, but just wanted to talked about that because to put things in perspective.

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So, if you look at the some of the products coming out of it lots of containers different types of containers can be made from a bagasse products as you can see.

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Then there are some others products are also out there this one is seaweed based water pouch, where this in the water will be in the pouch and you can it is a it is kind of a bubble design it looks like a water bubble.

So, it is in it is plastic bottles, why the plastic bottles are being used because it is easy to transport water in there, but of course, it takes energy to make those bottles and when you are done with the drink it takes more energy to unmake the bottles like to treat to treat those plastic wastes so, as plastic son on fully degrade on their own. Now there is some start ups coming up where they say let us skip the plastic bottles entirely it is called it has made a capsule called "Ooho" for transporting water that is not only biodegradable it is edible. So, you can eat that, Ooho is a bubble design by skipping rocks lab that enriches drinking water with an eatable membrane made from an natural seaweed extract.

So, you have a natural seaweed extract and if you do not feel like eating it the flexible bubble like packaging biodegrades in just 4 to 6 weeks. So, even if you put at in a biodegradable container for compositing or digestion it will go there and the membrane can be flavored or colored it can also be used for other liquids just soft drinks, sprites, spirits or cosmetics so, there are lot of other applications also there. So, this is the goal for these kind of thing is that we will eliminate the plastic bottle.

So, this is kind of alternative to plastic you can consume the that, but at the same, but if you do not want to you can put it in your wet waste container as well because this can be composted or anaerobic digested. So, there are lot of examples there we have picked few which we thought is more kind of relevant and kind of making lot of news so, lot of lot of attention, but there are several others out there as well which I would strongly encourage you to look at those.

We are also put we are putting up some other examples as a online that reading material, but so, as I said other than these slides you will have the some more reading materials to look at, but make sure you also look at some of this Google search, do some Google search, do some YouTube searches and look for alternatives and you will find some cool stuff, if you if you really feel something is really kind of interesting, cool and lot of promising, put that link in the discussion forum and it will help all of us including me to learn about that.

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So, these in terms of production of Ooho how it is done, you have dissolved sodium alginate in water. So, you take sodium alginate dissolve in water, dissolve calcium lactate in a separate bowl, transfer them together in a in a bath in a sodium alginate to calcium lactate bath you mix the solution and stir transfer water balls to water balls to water bowl. So, you just make it in a water bowl and then you fill water in there. So, that is that is another that is one example. So, how it is done it is not that like it does not seems to be

to technical to difficult to do that and this already you see it at least for a trial basis it is already out there.

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Now, there is another alternative like we use lot of containers at our homes from which is made out of plastic whether you are talking about your shower dispenser. So, rather than using soaps like a solid soap these days there is also a concept of using liquid soap like liquid your body wash or shampoos and other stuff and of course, sampoo is always a liquid, but body wash we used to use like a different type of soap, but these days there are liquid soaps available if you go to many many hotels you see that the liquid soaps are there and then liquid soaps are also coming with a dispenser now. So, that you that become little bit easier for reduces the wastage and those dispensers very similar to what you see over here is mostly made of plastic so, but there are alternatives coming in terms of safe paper bottle.

So, first ever shower shape paper bottle is in the market. So, I will Loreal they have just they have launched eco beauty range seed phytonutrients the product themselves sound lovely made from 93 to 100 percent natural ingredients cruelty free, paraben free, etcetera, but the packaging is the real innovation is. So, made by ecologic that is the outer card is recycled, recyclable, compostable, glue free and water resistant. The inner liner is made with recyclable plastic and uses 65 percent less material than regular plastic bottle.

So, we cannot really able to eliminate the 100 percent plastic, because seems the inner layer where you will have the contact of liquid with the surface if you have just the pure paper the paper will you will have a paper will get soggy, it is structural integrity will get compromised in contact with water, but that is why we need a liner. And that liner is there in many places, even the coffee cups if you go to Nescafe and other places when you take the coffee and you take it in a paper cup it is not 100 percent paper there is a liner of plastic in there as well inside.

So, that you are you can hold on to liquid there, otherwise you will not be able to hold on to liquid because liquid will make it make your cup a not usable make it soggy, it is strength will go and you will lose your coffee or tea in between while you are consuming so, that is that is not going to work. So, that is why we have a liner like a thin liner of plastic there.

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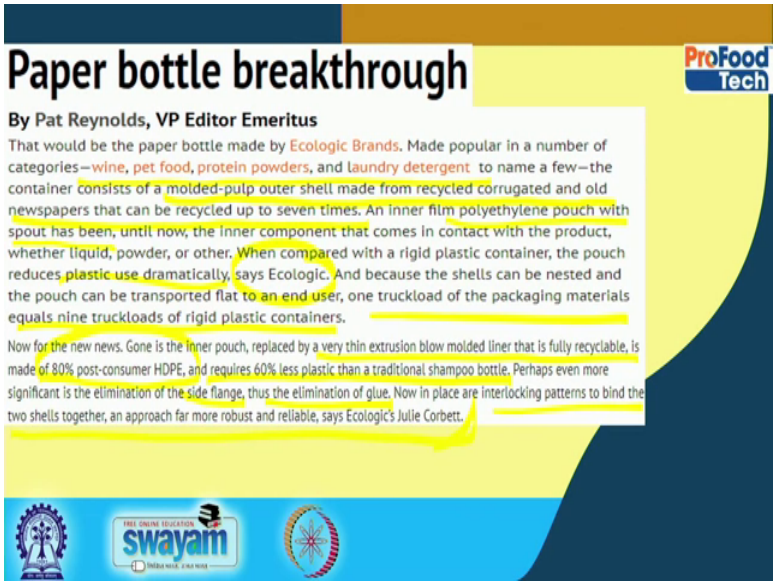

And there are some paper bottle like again paper bottle that the same thing it will be paper bottle by ecologic brand and they are they popular in number of categories can be used for wine, pet food, protein powders, laundry detergent to name a few it consists of molded pulp outer shell made from recycled corrugated old newspaper that can be recycled up to 7 times the inner film which is the polyethylene pouch with spout has been until now the inner component comes with the it is it is a plastic and inner component that comes in contact with the product whether liquid powder or rather when

compared with the rigid plastic container the pouch reduces plastic use dramatically. So, we are making some effort we are making some benefit, but it is still not 100 percent plastic free and because the this cells which are there can be nested the pouch can be transported flat to an end user so, you can so, even the transportation cost can go down.

So, one track truck load of packaging material equals 9 truck load of rigid plastic container so, you are reducing a the transportation cost. So, in terms of inner pouch what they are it is they are trying to by a very thin extrusion blow molded liner that is fully recyclable made of 80 percent post consumer HDPE, requires 60 percent less plastic than traditional shampoo bottle. Perhaps and then they do not have the side flange, thus the elimination of glue, interlocking patterns to bind the 2 shells together and that is that is again helps in terms of coming up with environmental friendly material.

So, there are lot of I would say lot of innovations coming in into this area where you see that many newer products are coming out many greener products are coming out.

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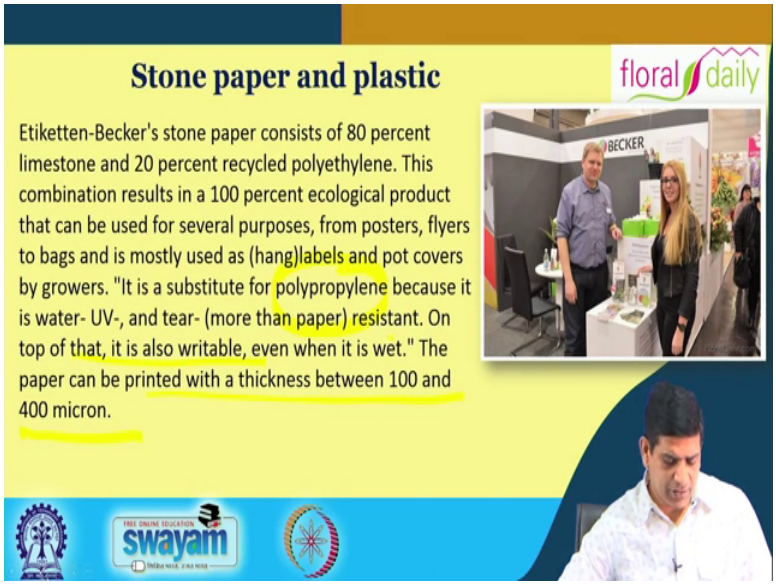

Another example this is the stone paper and plastic this is Etiketten – Becker's stone paper consists of 80 percent limestone and 20 percent recycled polyethylene. This combination takes a 100 percent ecological product that can be used for several purposes, from posters, flyers to bags, hang labels, pot covers. It is a substitute for polypropylene that is what because it is a water UV and tear more than paper resistance on top of that it is also writable. So, even when it is wet you can write on it the paper can

be printed with thickness between 100 and 400 micron so, you can have different quality paper as well.

So, that is because of this issues related to plastics initially what happens, if we look at the industry the way it has evolved initially we moved pretty much many products from non plastic to plastic, we started using plastic for those products. Then we realized that plastic is actually a not good in terms of long term environmental issues, it does not degrade, it becomes it chokes our strum water system, it is floating on many of the surface water and it is also it is getting into the sea impacting our sea life, impacting several species. So, then we realize that this is not the way to go out.

So, we made a mistake by using plastic very very like I would say in a huge way probably the use of plastic I think it is a most kind of you can say that in from a from a economical point of view plastic has done phenomenal over last 3 4 5 decade, but from environmental point of view as more and more plastic waste is coming into the ocean there issues has becoming more and more griever more and more challenging to handle those.

So, there is, but so, that is the reason why there is a push to look for greener material better alternatives in terms of environmental performance. So, that is what we are talking about in this particular video.

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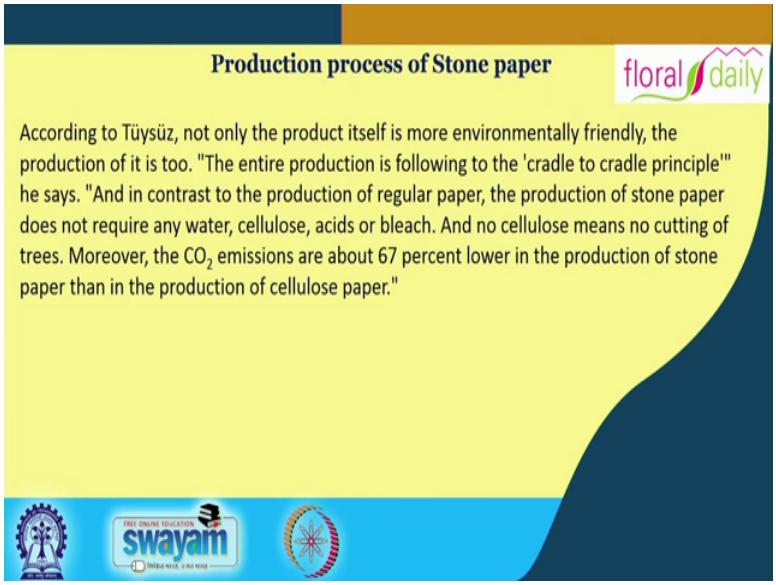

So, for the stone paper how they are make it is a it is environmental friendly entire production is from “cradle to cradle principle” and in contrast. Now what is cradle to cradle, earlier we you may have heard talk we talk about cradle to grave or cradle to gate, cradle to grave when you start for any product from the very beginning to all the way to the end that is your cradle to grave.

Cradle to gate is many times the companies will make a argument that I do have no control on how the my product is been used after I product is being used or disposed after I have sold it so, I do not have control on that part so, that is becomes cradle to gate. So, we have to stop the LCA right there, which is a calculation to find out what is the environmental foot print. So, and then the third option when many times people talk about is gate to gate as well. So, within the process if you have certain modification, that becomes gate to gate other things before and after upstream downstream remains the same.

So, in terms of now cradle to cradle is where you are talking about the recycling, reusing and bringing that material back into the into the change so, that becomes your cradle. So, that is the whole concept of this circular economy which we will talk about in the next video in next weeks video. So, cradle to cradle there is even a book title cradle to cradle which talks about all these basic principles which came in think in late 90’s when the ((Refer Time: 26:27)) was first published. Now this concept has become very popular and you see many documents, many reports, many many writings, turn on circular economy and cradle to cradle concept.

So, if you look at production on regular paper production of stone paper does not require water cellulose acids or bleach. So, that no cellulose means no cutting of trees CO 2 emissions are 67 percent lower than production of a stone paper than production of cellulose paper. So, there are so, you can see the benefit which is coming out of it with all the innovation that is coming into the into the picture.

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So, these are some of the application of stone paper products. So, pretty much all the things that you can do from a paper product different type of containers, straws, plates, cups and all that which is we kind of need for any for our usage in different different usage in homes and even as a community level.

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So, that is on the stone paper part which is essentially focused on a plastic as well as paper, next we have is palm leaf product which is could be perfect alternative to plastic as well. So, there is another company called Biopac, which is environmental packaging

specialist they were looking at they increases the range of palm leaf products and they offers it in 10 percent discount, this range is aimed at street food retailers who are looking for something a bit difference.

So, here the Mark Brigden, who is the technical director at Biopacs said our palm leaf products are suitable for most foods both hot and cold. So, you can use it for food they use for many mobile caterers and street food traders who are looking for bit different packaging. The fact that they are eco friendly and compost in let and in around 12 weeks time also reduces the level of impact. So, it is a palm leafs sheaths which is a bio packing uses for the production provide valuable employment for a small village small village community and their harvesting.

So, we are looking so, there are variety of alternative sources which are being looked into once we saw all the issues of plastic waste management. So, you can say from the palm leaf you can make different containers as you can see over here on our right on top and that is kind of gives like a newer type of material coming out which we can use to not replace the plastic. So, that will help in replacing the plastic.

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So, in terms of alternatives of palm leafs they have 2 they were 2 young women from Berlin they developed an interesting alternative, there can be easily thrown onto the compost after shopping or can be used in an alternative way. The 2 students came up with the leafs of an areca palm which is grown on the grown on plantations as you can

see there are different types of plates, spoons, forks and some other bowl containers and all though it is also there.

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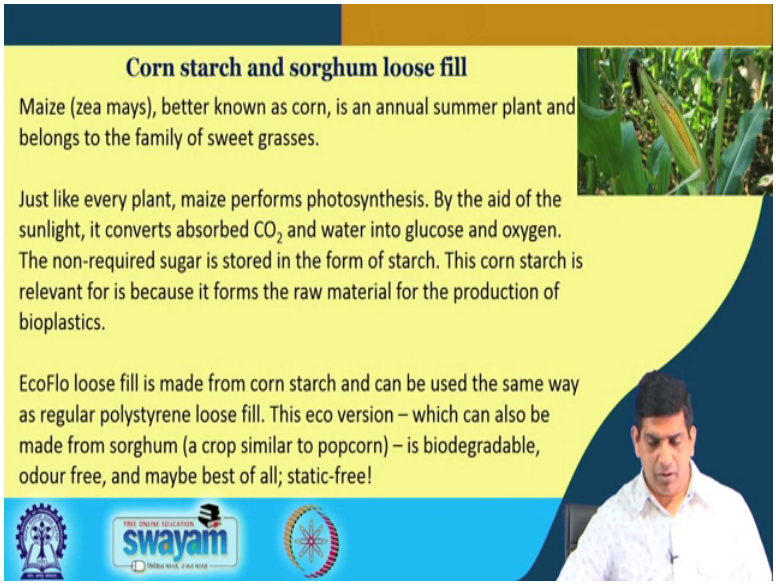

So, let us stop here and then we will continue on our discussion on this looking at greener material and towards the end of video this week will also look at the impact the how to calculate the impact. So, when we talk about we are lessening the environmental impact how can we quantify that will have a quick discussion on that as well.

So, with this we are finished the third video of week 7, again as usual I keep on reminding you go over the lecture material in time make sure you do your quizzes on time because you should take. In fact, all the quiz although I think you are allowed to miss may be one or maybe I do not remember right now, but you are allowed to is may be 1 or 2 quiz, because it says based of certain number, but again more you take better it is that is gives you good practice.

And if you should those of you have registered for the exam again all the best and I hope that all of you should have registered for the exam, because it would be interesting once you have registered, you should take the exam and get the certificate, because otherwise putting all these effort and not getting the certificate it does not really make sense ok. So, let us close this video here and we will continue our discussion from this point in the next video.

Thank you.