Municipal Solid Waste Management
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Lecture - 08
Processing at Source

So hello students. Today we will continue the same module, waste handling, separation, storage followed by processing at the source. We will talk about the processing of processing at the source.

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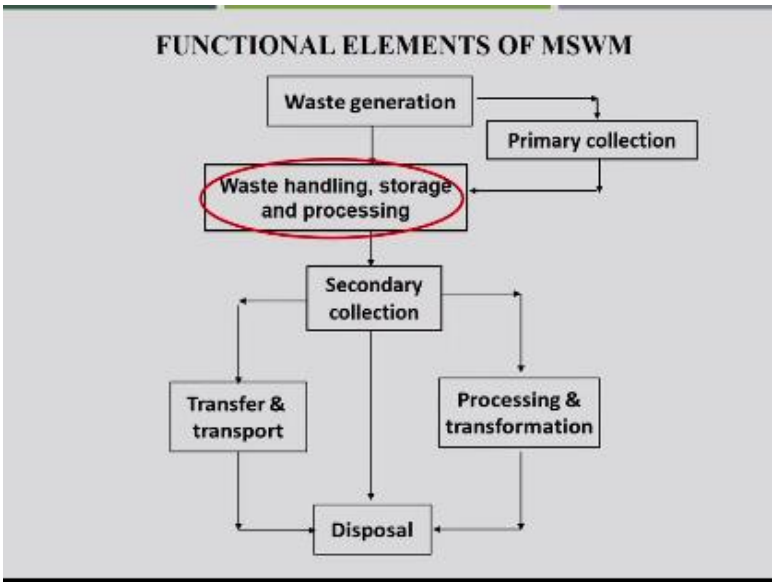

So, this was the functional element. So we are in the second functional element and this lecture is processing at the source. This is one of the important topics of discussion before going for collection and followed by treatment and disposal. Why because see, we had a lot of issues regarding the centralized treatment process, which I am going to talk about during our treatment processes modules.

So before that, we need to discuss processing that could be possible at the source itself. So if you go for processing or treatment at source, not only we will reduce the waste at disposal site but also will reduce the cost of the collection because 100% waste needs not to be collected from the city. And you know that collection is one of the costliest processes in waste management issues.

Also if you can treat a process especially, the wet waste mostly kitchen waste will be one of the best ways to reduce the waste on the disposal site which is getting degraded and the odor and leachate issues will come in the landfill site. So we will start the processing of wet waste.

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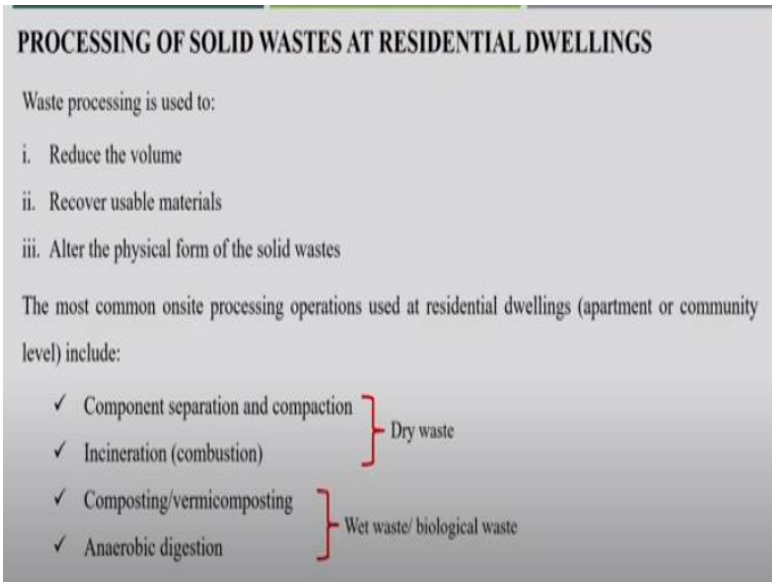

So the processing of solid waste at residential dwellings is used to reduce the volume. The volume for the collection of waste and at the disposal site. Also for the recovering of some useful materials. There are a lot of waste materials that can be used easily and can be changed to other physical forms. This is the main idea behind the processing of waste at the source

So normally these are the few common onsite processing operations like including component separations and compaction, which will increase the treatment processes further and also which will reduce the cost of collection by compaction of the waste. Incineration, although is not possible at a small size of waste, also we will see how best we can go for incineration or combustion at the source.

And the most important one is the composting and vermicomposting process. This is one of the common methods whether it is a single household or as in different house locations. And finally the anaerobic digestion. This is also one of the very important methods. In that way, we can go for processing at the source where we can get methane gas, useful for the kitchen purpose that can be used to produce electricity. So we will go one by one. Before that, there are two methods especially component

separation, compaction, insulation for dry waste, and for wet waste, the composting and vermicomposting, anaerobic digestion process which needs to be discussed.

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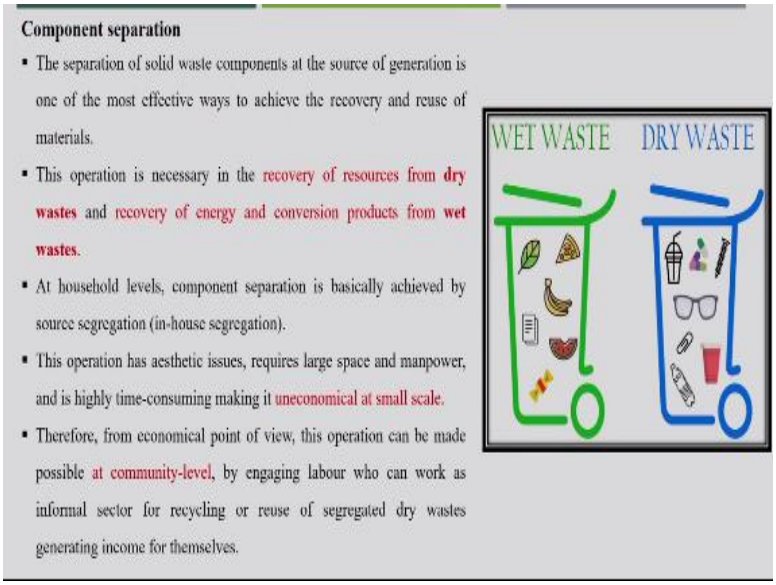

Now, first is the component separation. Normally this component separation already we are doing at the source. Segregated waste, where we are segregating at household level wet waste and dry waste. Suppose if it is not possible at source or every household level, it can also be possible that one particular community can go for component separation.

And here the component separation not only the dry waste or wet waste, but it can also be possible to separate the special kind of waste. Suppose, if you are trying to separate metal or glass materials which easily get recycle then that kind of component separation is possible along with paper and plastic which can also be separated from this method.

So this operation is necessary to recover the resource from the dry waste. Also could possible that if biological waste or wet waste is getting separated here itself, then it can be possible for further treatment like composting and anaerobic digestion processes which we have already discussed. Further, this operation is very useful, source segregated at the household level, or the community level.

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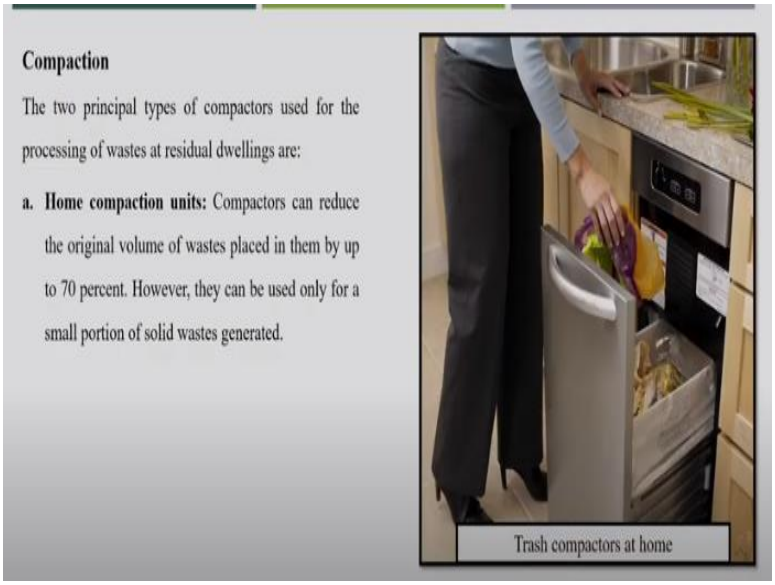

Now, the compaction. Because the major problem in our collection is that lot of dry waste is coming. And these dry waste if you are not compacting that, a huge volume of waste is needed to be collected every day. So if you can go for some kind of compaction process at the source itself, whether is a household level or community level it can also reduce the volume of total waste.

So could it be possible to have a home compaction unit which can reduce 70% of the waste? This is one of the photographs you can see that we can go for the compaction method at the household level.

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And for the apartment buildings or community level, it can be possible. If it is a mixed waste that means dry waste and wet waste are together, do not go for the compaction method. This is specifically for dry waste.

And, suppose if you are not going for further segregation of dry waste, why not we can go for compaction and after that, it will get collected and go to the recycling facilities. But for the wet waste compaction method is not possible. It can directly go for home composting method or community or apartment based composting methods.

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So another method is combustion or incineration. Normally, we are not going for combustion or incineration at the household level. But household hazardous waste normally has to go to the incineration process. So it is good to have segregated this kind of waste which is having more calorific value and that cannot be possible to treat at the household level that we are already segregating.

Containers we are already collecting will directly go to the incineration process because the incineration process cannot be worked for a small quantity of waste. You will be required almost 200 to 300 tons of waste every day or more waste is required for the incineration process. So the household level is not possible. So we can go for a centralized incineration process.

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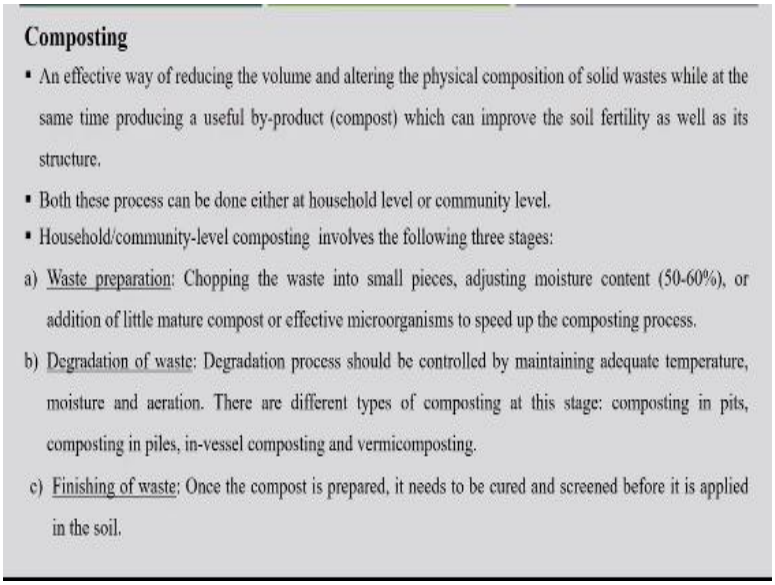

Again, one of the important processes is a composting process. This is also a very good method, where at the source itself we can go for the degradation process. This can be possible at the household level, at the community level, and also at apartments where 60% is construction and the remaining 40% will be the open area. So in that open area, we can have one composting plant or small composting unit, where the entire flat's waste will go to that particular composting area. And there in the composting area first we will be required waste preparation. Waste preparation means we have to chop the waste. Normally if you have the size of waste is one centimeter that is good for the degradation process.

So we need waste preparation that chopping or shredding waste and also the mixing of waste with some kind of dry matter followed by the degradation of waste. And during this degradation, you will be required moisture content and already that is available and also need aeration. This aeration you can do differently, either manual or mechanical.

I will show you some of the photographs of home composting or community level composting plants, where easily we can treat the biological waste at the source itself. And followed by finishing off the waste finally. And this is the same compost prepared in the apartment that can be used for the use in the same area or can be possible to sell such kind of compost.

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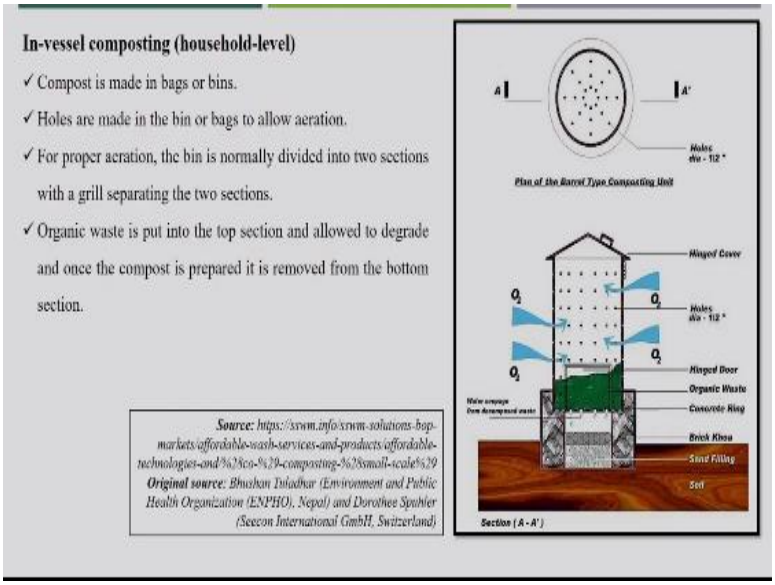

The decentralized composting method is an in-vessel composting process. This compost is made in the bags or bin and for aeration purposes, the holes are provided in those bins or bags so that proper aeration could be possible. You can see it in one of the photographs given below.

I think this kind of method is very good for the community level especially in the apartment area we can have this kind of composting plants, small composting plants, where we do not require more manual requirements, only the chopping is required and mixing followed by the degradation inside the bins or bags.

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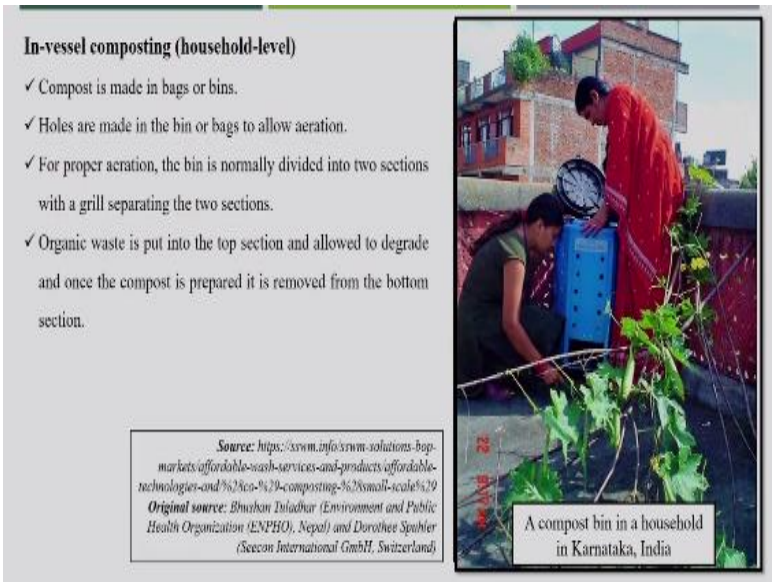

This is another kind of composting bin that can be possible at the household level.

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This you can see that the lady is taking the compost, the final prepared compost from the bottom, and waste is put from the top. And you see that the holes are prepared in the drum so that the aeration could be possible. This can be possible at the household level, also possible at the apartment level or community level.

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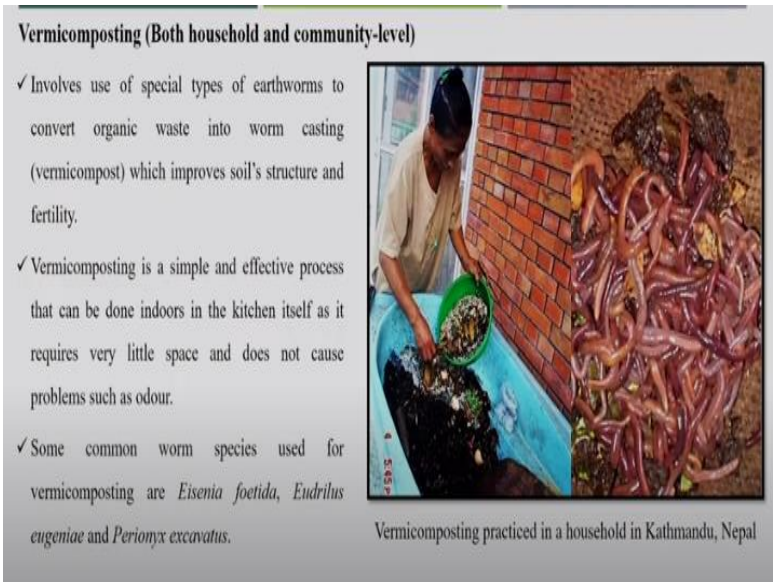

There is another method called the vermicomposting process. I think this is a well-known method. You can have a different kind of vermicompost unit, you can purchase online. Several companies are selling these kinds of vermicomposting units, small vermicomposting units. The management also is not so difficult.

And suppose for household, because every household will produce maybe around 100 to 200 grams of biological waste that can be degraded by this kind of method. They

can purchase a small unit in which earthworms will be required. The management of these earthworms is also not difficult. I think we can get these earthworms from anywhere in the city.

By this method, very good quality of compost will be produced that can be possible to sell. And normally we use special worms like *Eisenia fetida*. This is a well-known species we are using for this kind of vermicomposting process. And already I think most of the cities like Delhi, Mumbai, Kolkata people are purchasing such kind of units and also producing very good quality of compost in their house itself.

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You can see another photograph, the small unit 2 feet by 2 vermicomposting bin, the small bins. The lady in the photograph is known as the composting queen and she is producing vermicompost in 2 feet bin.

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And you can see that some community-level composting plants. So this is a community level vermicomposting plant. So as I said that it is not possible at the household level. But also in the apartment, you cannot have this area, but the small units could be possible. And if suppose is not possible at one apartment maybe three, four apartments together at a community level can have this kind of plant.

You will be required some manpower for such kind of work. And by selling such kind of compost you can easily pay that manpower. And this kind of method is very beneficial for waste management. And under Swachh Bharat Mission also lots of discussions have been given on the decentralized treatment process, especially for biological waste.

Because dry waste easily can be collected by the compaction trucks and easily can be sent to the recycling facility. Further, segregation is somewhat difficult at the household level. Maybe at source, metal and glass could be easily segregated but paper, plastic, and rubber, leather is not possible at the household level or apartment level, or community level.

It is also possible that it will go to the centralized facility especially the dry waste, but the biological waste which is creating lots of problems not only for the disposal site but for collection also it is very difficult. Because this waste within six hours starts degrading and because of that lots of odor issues will come up and leachate issues will come up.

This leachate is highly corrosive which is corrugating the vehicles also. And further in the disposal site also a lot of issues are coming up. And if you see especially in India or developing countries, the quantity of waste is more than 50 to 60%. And if you cant reduce this to 50% at the source itself may be at the household level or apartment level or community level, we can easily treat the dry matter at a centralized facility.

Also, you know that we do not have space for the disposal site and because of the degradation of this waste at the disposal site, lots of issues are coming with groundwater pollution. So also because of this kind of decentralized treatment process, we have lots of advantages to this decentralized treatment process. You can see the size is big, but for small apartments, we can have a small size.

These kinds of units we can easily put in the apartment area. You can change the locations also. Suppose one location is not useful, we can change the location for different units. If someday you are not producing more amount of waste, we need to use such kind of units that produce very good quality vermicompost.

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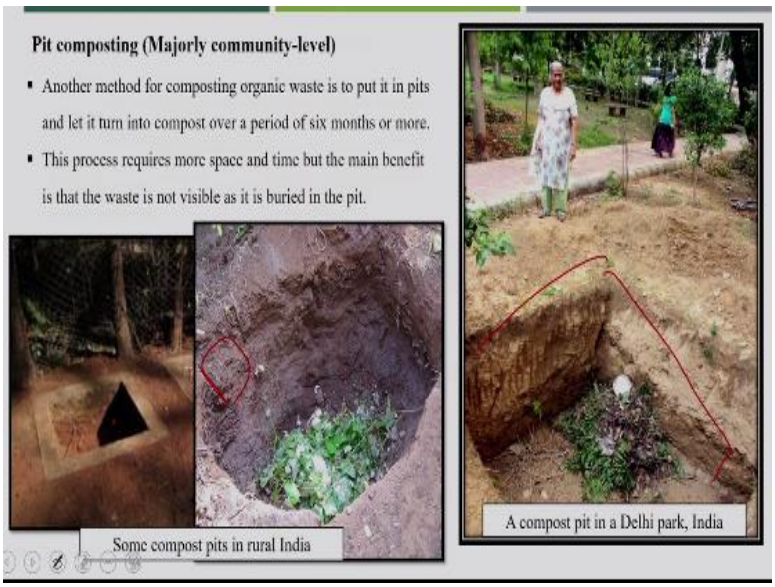

Another method is pit composting that is an old method of doing composting. By that, we can produce the compost majorly on the community level. This is the small pit where we are disposing of the biological waste into the pit and further it is going for the degradation process. This is in the park, you can see this photograph is a community level in which a pit has been established.

Only thing is that it requires more space and time of degradation is more because no proper aeration is provided. It may require 50 to 60 days for the complete degradation of the waste material. There is another unit, you can see in the picture, it is an open unit where waste is filled up. What we can do is that we are disposing of the waste and we can put soil onto it which will not look bad. You can bury the waste in the pit.

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Another method is pile composting where the waste is put into the pile. You can see in the picture. It is also a community level method. The size of the pile may vary depending upon the amount of waste. It should be 1-2 meters of each side, not more than 1.5 meters in height for the proper degradation method. In this method, aeration can be provided very easily. It can be established at the community level very easily. But I think it requires lots of space and in Indian places like Delhi, Mumbai, Jaipur, to find such kind of place is very difficult. But in parks, we can install such kind of composting units where not an only household biological waste but whatever waste is being generated can be utilized for making composting in such kind of composting unit.

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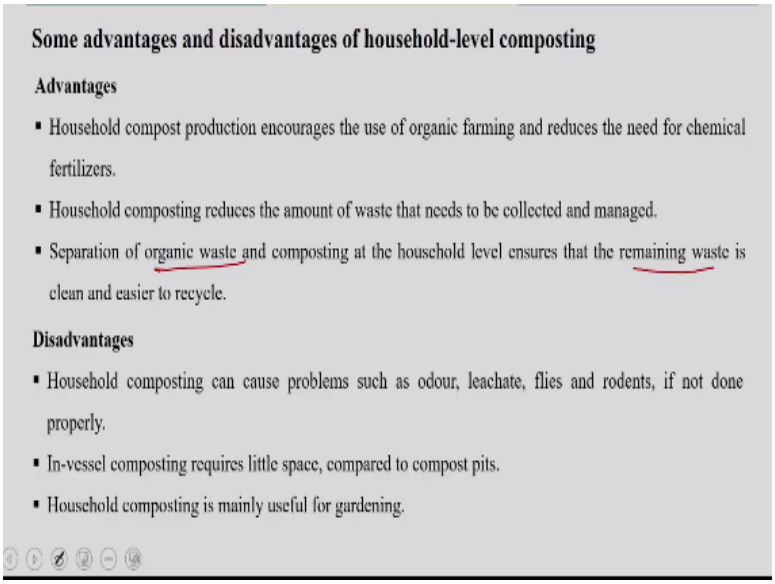

You can see some of the advantages and disadvantages of household-level composting. The main advantage of household compost production is that it encourages the use of organic farming and reduces the need for chemical fertilizer. So, if the household people come to know the importance of compost it can encourage large people to produce a large amount of compost that can be used for farming. The separation of organic waste and composting at the household level ensure that the remaining waste is clean and easily recyclable. So the idea is that if the organic waste is getting separated from the entire commingle waste, the remaining waste that especially the dry waste is cleaned and easy to recycle.

I already told that once this dry waste is polluted, or in some kind of water or some kind of leachate or some kind of pollutants are there, it is very difficult for the recycling process. They have to clean it properly and then only it will go for the recycling methods. So, the composting process is beneficial for getting it cleaned and to recycle dry matters. But along with it, there are some disadvantages too. It can cause some problems like odor formation, leachate production, and flies may come. But household composting is easily manageable. Proper monitoring of the composting pile is required like aeration so that the odor and leachate issue should not come out from this kind of unit. Another issue is the space requirement. But if you are going for an in-vessel composting technique like Rotary drum composting which is a well-known in-vessel composting technique, we require less space. Such kind of unit will require small space also and with maybe 15-20 days, we will be able to produce compost. And the household compost is mainly useful for gardening purposes because

of the quality. Maintenance is difficult, difficult to sell, but we can try to get some kind of money out of that.

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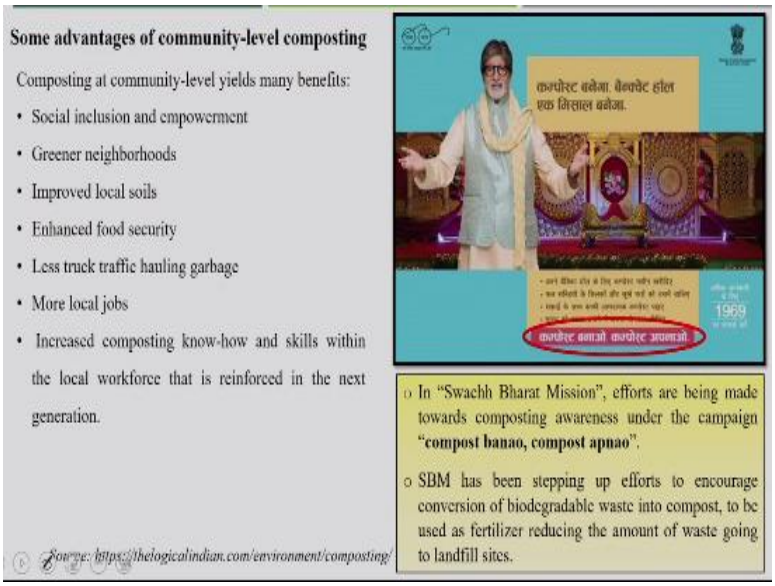

Few other advantages of community-level composting are that as you can see in this photograph where Amitabh Bachchan is saying about 'compost banao and compost apnao'. You can see a lot of videos in Mumbai where he is proposing a composting plant under the Swachh Bharat Mission that will benefit social inclusion and empowerment.

Normally this solid waste management, we say that the corporation has to manage, where community participation is not coming up. But having such kind of community composting plants we can have some kind of participation from the local people. Greener neighborhoods obviously if you can reduce biological waste. So, you would not see the biological waste into the dustbin.

Normally in the dustbins, if you are providing community-level dustbins where you are disposing the biological waste, there, odor and flies. Now because of having the compost plant, I think you would not find it any kind of odor or leachate issue in those areas. Enhance food security, less truck traffic, hauling garbage. We can reduce 50% of waste at the community level itself. You can reduce the collection level by up to 50%. We can employ some people for this as we will be required manpower. There will be local jobs for some people who are jobless since managing these wastes at the community level needs manpower.

So can provide few jobs, maybe two people, three people, five people can get some kind of work into that community-level composting plant. Also, this will increase the skill of composting within the local workforce that will enforce in the next generation. So that is a very good benefit for community-level composting plants. Already, the Swachh Bharat Mission effort made the logo, 'compost banao compost apnao'. The very important step has been given in the Swachh Bharat Mission.

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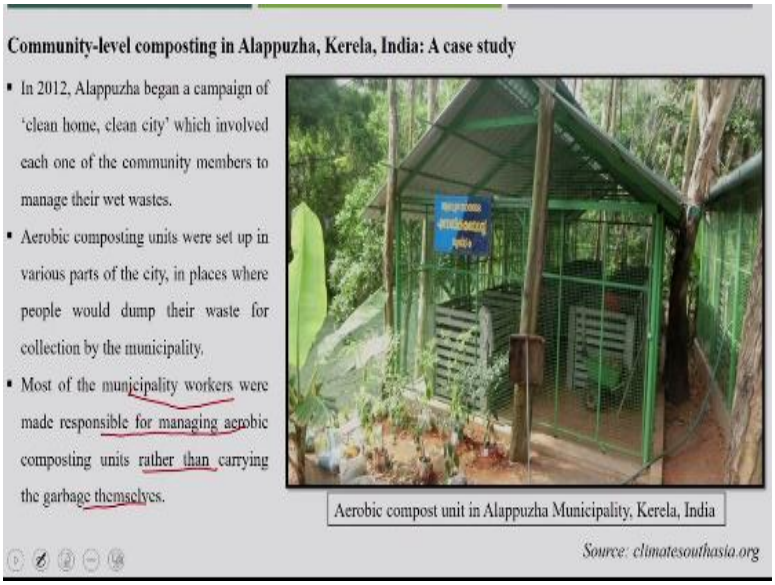

We can see a photograph of a community-level composting plant in Kerala, the case study 2012. This is one of the cities called Alappuzha, which began the campaign of the clean home clean city which involve all the community to manage the wet waste especially. An aerobic composting unit had been set up. Especially the municipal workers were made responsible to manage their aerobic composting unit rather than carry garbage themselves. So municipal workers had been asked to manage such kind of plants.

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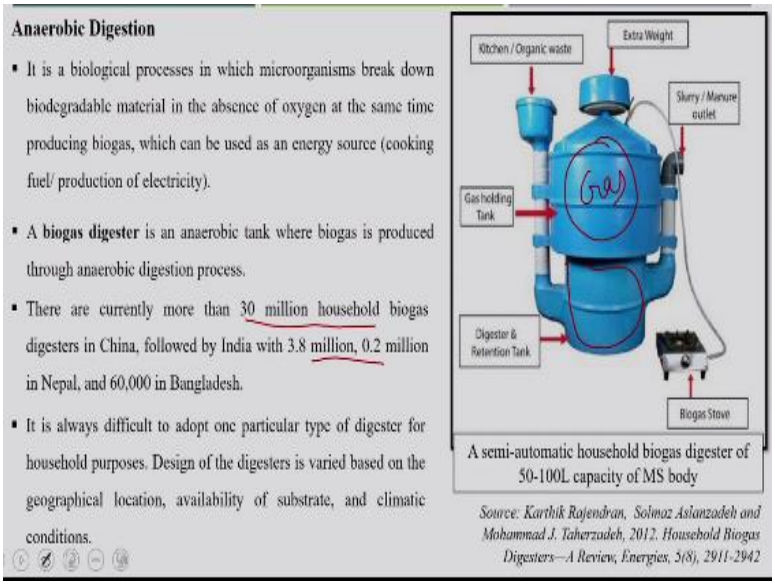

The other method of treating waste is anaerobic digestion. This is another method by which we can have at the household level or community level. So from this one we can produce the gas called methane and this methane is high in calorific value and can be used for kitchen purposes. Also, we can produce some kind of energy out of that. Currently, there is 30 million household biogas digester in China followed by India with 3.8 million.

This is the small photograph, where we can have the different sizes of anaerobic digester where we can feed the digester. The degradation is mostly done in this part and this area for gas storage. This is for gas storage, gas holding tank and it can be used as a biogas stove for the cooking purpose. So there are different kinds of reactors available, smaller size, the bigger size.

At the community level also we will be required, maybe 2-meter cube, 3-meter cube biogas would be possible.

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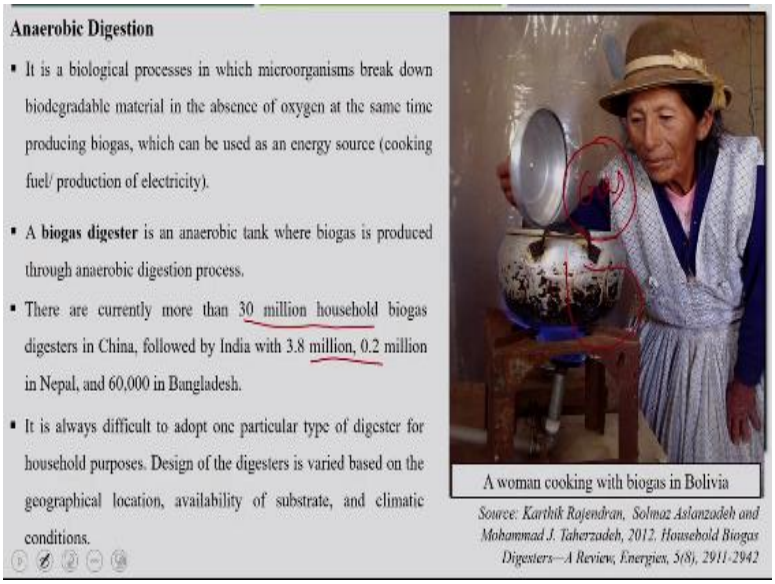

So you can see here the woman cooking with biogas in Bolivia.

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This is one of the well-known reactors, from a company named Biotech in Kerala. You can see most of the household will have this kind of unit and every day we can deposit maybe half a kg or two kg of waste into this kind of reactor and whatever the gas is producing that could be used for the cooking purposes. We don't have to clean this gas. Almost 50 to 60% methane will be there that can be easily used for cooking purposes. See is another household biogas digester, very easy to manage.

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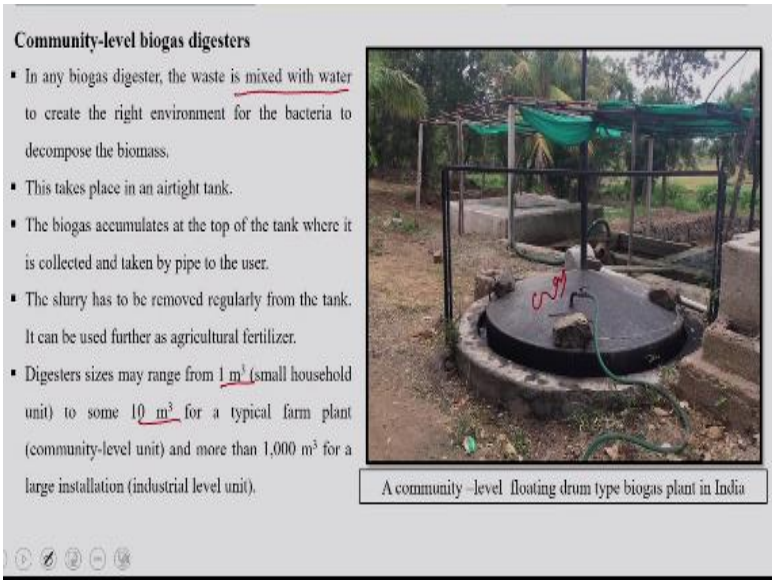

This is the community level biogas unit. Only that biogas waste has to mix with the water and degradation will take place in the airtight tank. So this is the biogas unit. This is the gas where gas is getting stored into the drum. This digester size can go up to a 1 meter cube-10 meter cube unit. Means can be useful for 10 kg of waste per day. Can go up to 200 kg up to 300 kg of waste per day. Can be used for the biogas production unit.

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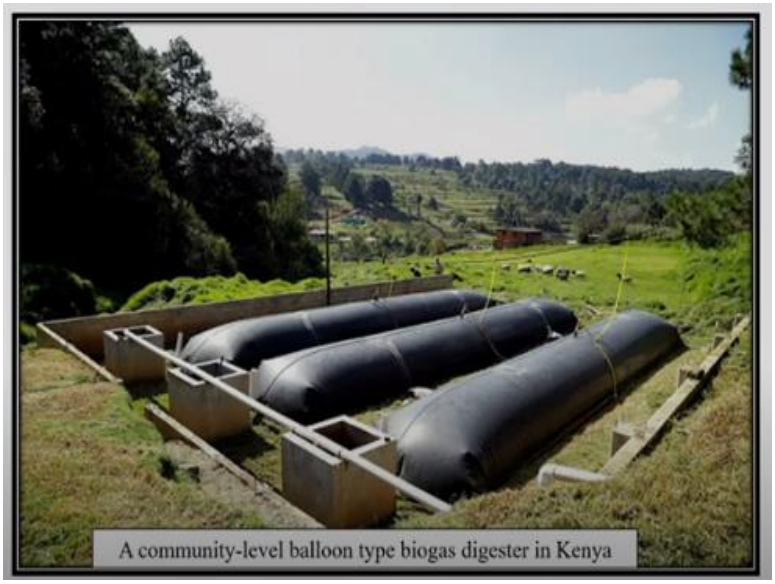

This is another one, the balloon-type biogas digester in Kenya. That is a community level biogas unit.

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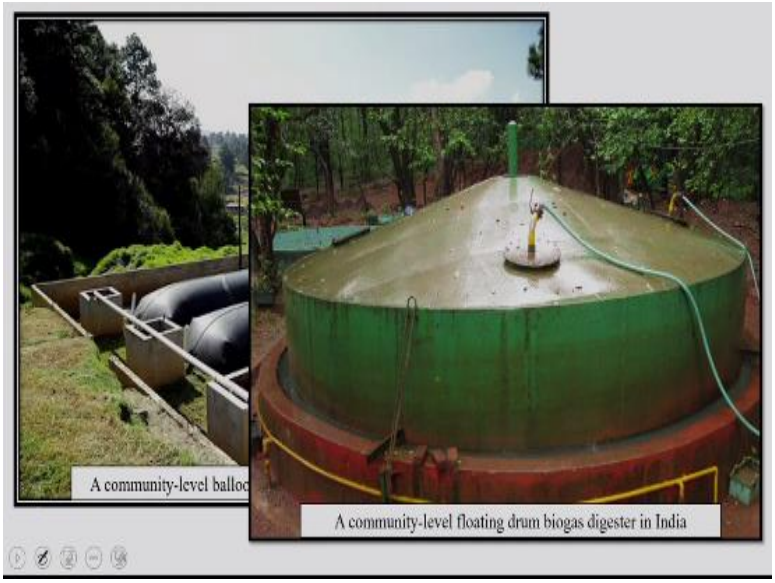

This is a community-level floating drum biogas unit. This is the floating drum digester in India. So in this lecture, I have talked about different treatment units at the household level. And few cities have already started under Swachh Bharat Mission having one small composting unit or biogas unit. I personally believe that decentralized treatment is always beneficial. Because it is not only reducing the waste at the disposal site, also reducing your collection cost. And centralized location running the composting plants is very difficult because you will be required lots of area and space which is a major problem and also required time and if you require a time of 90 days for the degradation, you know that how much space will be required at a centralized location.

So the decentralized location at the household level or community level if at least these biological wastes we can treat it and maybe that compost can be used for some other purposes or gardening purposes for the local community and only the dry waste will reach to the recycling facility. So we easily treat the waste.

I think we will also discuss these treatment methods like composting, anaerobic digestion in the special lectures. We will go for the technical discussion on that. Here I have just talked about the importance of the decentralized units and how best we can operate such kind of units at source at the household level or community level or apartment level. So thank you.