Module 2 – MANAGEMENT OF MUNICIPAL SOLID WASTE

OBJECTIVES

By the end of this session students will be able to:

1. Know about the problem of Municipal Solid Waste.

2. Know about what is MSW management.

3. Learn various steps involved in MSW management

i.e. (a) How waste is collected
(b) Transportation of waste, &
(c) Disposal of waste

4. Learn about the difference between municipal waste management in developed and developing countries.

SUMMARY

Man has always produced waste, but the problem caused by high levels of production ad low levels of recycling has never been as serious as they are now. Management of MSW is one of the most important problems of modern society. Management involves collection, transportation and disposal and treatment of solid waste.

For better disposal, segregation of various components of waste at source or after collection is very important. Waste transportation requires proper planning according to the size of the city. Disposal of MSW involves different methods like sanitary landfill, open dumping, recycling, incineration and composting.

Sanitary landfill and incineration are commonly used methods of waste disposal in developed countries, but are not safe and pollute air and water. Best methods to dispose MSW is recycling or composting, which are economic and less polluting. In developing countries including India, composting is very popular method. Best was to solve the problem of MSW is to reduce the use of resources, to follow Gandhian way of life, reduce and recycle materials.

This module discusses the various methods of disposal of municipal solid waste.

TRANSCRIPTION

INTRODUCTION

The production of waste, in general and domestic waste in particular, is one of the most characteristic features of the development of our society in this century. The quality and composition of our waste are indicators of our habits as consumers and our concern for the environment. It is said that by analyzing the contents of a bag of rubbish we can find

out the living standards, way of life and even the age and gender of the people who have helped to fill it.

Man has always produced waste, but the problem caused by high levels of production and low levels of recycling have never been as serious as they are now. Large quantities of refuse, most of which will never be used again, have created large heaps. This has broken what is essential in the economy of ecosystems –continuous cycling by which resources are consumed and renewed.

With the rapid increase in population, the generation of municipal solid wastes in our country has increased several fold during the last few years. For the management of this waste, local municipal bodies are responsible.

Management of solid waste involves various steps. These are:

1. Collection of waste
2. Transportation of waste
3. Disposal and treatment of solid waste

COLLECTION OF WASTE:

For the collection of solid waste two systems are commonly used:

(a) House-to-house collection system

(b) Community bin system.

(a) <u>House-to-house collection system:</u>

House-to-house collection is by far the best method of collecting refuse. This system is very popular in developed countries. In this system house waste is dumped in special plastic bins, from which the waste is collected by vehicles. The days of collection are pre-decided. For the success of this system coordination between people and collection vehicle is essential.

(b) <u>Community bin system:</u>

In the community bin system, first the waste is collected manually by sweepers in small handcarts or baskets and then dumped into nearby community bin. Household waste is also dumped in these bins by people. Once the community bins are filled they are lifted and transported to landfill sites and emptied there. In most developing countries, including India, community bin system is followed for collection of household and roadside waste. In addition to households, waste from markets, schools, hospitals, parks, railway station and bus stand are also collected.

The amount of organic matter in solid waste in India and other developing countries is much higher than in developed countries. This large organic fraction tends to decompose as a faster rate at the ambient temperature. Therefore, it is necessary to collect and remove it as quickly as possible.

TRANSPORTATION

Various types of vehicles are used to transport the collected waste to processing and disposal site. In small towns and cities carts driven by bullocks or buffaloes are used for transportation while in big cities waste is transported by automated vehicles like trucks,

tractor trolleys, etc. Dumper-placer vehicles can carry the large community bin or container which is mechanically lifted and loaded on the vehicle.
Various points need to be considered when deciding on the right system to be used for transporting municipal solid waste.

(a) The vehicle should have a low loading height (1.5 mtrs)
(b) Vehicle should be covered while transporting the waste
(c) Vehicle should be fuel efficient
(d) Vehicle should have rugged construction and with anti-rust paint
(e) Route should not be fragmented or overlapping
(f) Routes with heavy traffic should be served before or after rush hour
(g) Routes should be mapped for more effective transportation.

DISPOSAL OF MSW

For many people, the way to dispose off waste is to simply drop it at some nearby place. Open, unregulated dumps are still the predominant method of waste disposal in most developing countries, including India. Huge heaps of open garbage is a common site in the outskirts of our small & big cities, often visited by rag pickers, domesticated animals, birds, etc., creating environmental hazard and posing a threat to the health of thousands of residents.
Most developed countries forbid open dumping, at least in metropolitan areas, but illegal dumping is still a problem.
A few guidelines need to be followed while selecting a dumping site:

i) Dumping site should be away from city or town; but should be easily approachable throughout the year.
ii) Disposal site should be on downward side of the town or city.
iii) Hydro-geological investigation of the disposal site should be done periodically, because rain water percolating through the waste tends to carry large amounts of pollutants to the ground water if underlying strata is pervious or fissured.

Sanitary Landfills:

Over the last fifty years, most developed countries have recognized the health and environmental hazards of open dumps and have turned to landfills, where solid waste disposal is regulated and controlled. In this method, waste is leveled in layers, compacted and covered with earth. Bacteriological, physical and chemical changes occur in buried waste. The temperature rises above 60°C within seven days and kills all pathogens and hastens the decomposition process, which needs 4-6 months. This method was first tried in England in 1916.
Although it was hoped that much of the land-filled material would biodegrade, but in reality most of the land-filled waste from the past 40 years in the US is still present at landfill sites, due to lack of desirable conditions. Thus, old landfills are serving as “chemical repositories”, releasing pollutants to the groundwater in dissolved form such as salts, heavy metals and synthetic organic compounds; and air in the form of green house gases such as nitrous oxide (N_2O), methane (CH_4) and carbon dioxide (CO_2).

A modern sanitary landfill is more advanced and is designed to meet exacting standards with respect to containment of all kinds. In developed countries, due to more cost and lack of a desirable space, landfills are less preferred. These countries, now-a-days, either recycle and minimize their waste or export it to other, less developed countries.

MSW REDUCTION THROUGH RECYCLING, INCINERATION & COMPOSTING - I:

MSW is reduced or minimized either by ***recycling***, ***incineration*** or ***composting***. These methods are widely used in densely populated areas where land is not available for landfills. For example, in Europe and Japan 85% of MSW is minimized by these methods, while in US only 45% MSW is minimized.

(a) Incineration or combustion:

In incineration waste is hygienically reduced by burning. The heat derived during this process is converted into other forms of energy. By this method 90% volume of waste is reduced, but it causes air pollution. Besides, incinerator ash contains concentrated toxic materials, such as dioxin, furans, lead and cadmium, which make it highly hazardous. Most Indian waste is too wet with loc calorific value (2000kcal/kg) which does not permit self-sustained burning in an incinerator. Only hospital waste, which is particularly hazardous, is best disposed by incineration. Incineration is widely practiced in western countries since municipal solid waste in the west has a much higher calorific value and is dry too. There the community incinerator functions reasonably well & some of them even generate electricity.

MSW REDUCTION THROUGH RECYCLING, INCINERATION & COMPOSTING - II: Recycling:

Recycling involves the collection of certain types of trash, separating them into their components and using these components to make new products. Materials that can be recycled include aluminum cans, plastics, glass, paper, cardboard and metal, etc.
The components of domestic waste commonly extracted for industrial use are:

- Paper for re-pulping
- Textiles for making paper & machinery wipers, etc.
- Metals, for remaking
- Glass, for re-melting
- Rubber for downgrade use
- Plastics for production of inferior grade plastic.

It is necessary to separate these materials before recycling

MSW REDUCTION THROUGH RECYCLING, INCINERATION & COMPOSTING - III: Composting:

Composting is one of the oldest methods of disposing solid waste known to man. By anaerobic degradation biogas can also be generated. Waste with high organic content is ideally suitable for conversion into organic fertilizer, rich in nitrogen, phosphate and potash by composting. In India, composting is the best method of disposal of municipal solid waste. Some of the most popular methods of composting are:

i. Bangalore Method
ii. Indore Method.
iii. Vermi-composting

i. *Bangalore Method:*
In this method alternate layers of waste and night soil are laid out in pits and then allowed to decompose for 4-6 months. When the waste is completely degraded, the resulting compost can be taken out for use.

ii. *Indore Method:*
This method of composting in pits is similar to Bangalore method, except that here turning of waste is done at specific intervals of 4-7 days or 5-10 days. By turning, aerobic conditions are well maintained to ensure high temperature and uniform composting. By this method composting is completed in a period of 13-27 days.

iii. *Vermi-composting:* In recent years earthworms have been used for biodegrading organic household waste. The technique is known as vermin-composting. Through this method high quality odorless manure can be produced. Nowadays household vermin-composting kits are also available for use. Reducing waste by composting is not only economical, but it is by far less polluting and sustainable method too. Through this method, the local municipal bodies can get rid of major amount of solid waste on one hand, and can generate money by selling the compost, on the other.

CONCLUSION

As citizens, we can create awareness amongst the people to produce low waste; about the hazardous effects of sanitary landfills, incinerators, etc. We can organize a network of people who are interested in improving living conditions and creating a hygienic environment.
It is well understood now that to make society free of waste, there is an urgent need to follow the Gandhian principle of simple living. We must understand that the best and cheapest way to deal with waste and pollution created by us is to produce less waste and then reuse and recycle most of the materials we use.

GLOSSARY

1. Aerobic degradation: complex process in which organic molecules combines with oxygen and produce carbon-di-oxide, water, and energy.

2. Anaerobic degradation: Process in which complex organic molecules breaks down into simple compounds in absence of oxygen and release some energy.

3. Ambient : Relating to immediate surrounding of something.

4. Bacteriological change: Change that occur in solid waste due to action of bacteria.

5. Biodegradation: Decomposition of materials by micro-organisms.

6. Decompose: Break down of complex organic materials into smaller molecules by fungi and bacteria.

7. Fissure: Deep crack in rock or soil.

8. Hydrogeological:Concerning the properties of earth's water, especially its movement in relation to land.

9. Minimize : To reduce in volume or weight.

10. Micro-organisms : Small organisms like bacteria and fungi which can be seen only through microscope.

11. Percolation : Liquid or gas filter gradually through a porous surface such as soil.

12. Repository : Place of laying something to rest.

13. Repulping : Process by which paper is again converted into pulp for recycling.

14. Rubbish : Worthless, discarded material.

15. Rugged : Strong and robust.

16. Segregation : To set apart different things according to their properties , like metals , plastics etc.

17. Thermophilic : Heat related.

FAQs

Q1. What can we find out by analyzing a bag of rubbish?
Ans: By analyzing the contents of a bag of rubbish we can find out the living standards, way of life and even the age and gender of the people who have helped to fill it.

Q2. What is essential in the economy of the ecosystem?
Ans: Continuous cycling by which resources are consumed and renewed is essential in the economy of the ecosystem.

Q3. Name the different steps of municipal solid waste management.
Ans: Management of solid waste involves various steps. These are:
i. Collection of waste
ii. Transportation of waste
iii. Disposal and treatment of solid waste

Q4. Name the commonly used system for collection of solid waste. Which one is followed in developing countries?

Ans: For the collection of solid waste two systems are commonly used:
(c) House-to-house collection system
(d) Community bin system.
In developing countries community bin system is generally followed.

Q5. How does the municipal solid waste in developing countries differ from that in developed countries?
Ans: MSW in developing countries has more organic matter as compared to that in developed countries.

Q6. Name various systems used for transportation of MSW.
Ans: MSW can be transported by bullock or buffalo carts, tractor-trolley, auto-rickshaw, carrier-container system, dumper trucks, dumper-placer vehicle system, compactor vehicle system or bulk refuse carrier system.

Q7. What are the major considerations while choosing the right transportation system?
Ans: There are four major considerations while choosing the right transportation system:
(a) Vehicle should have low loading height (1.5 mts)
(b) Vehicle should have covered body
(c) Vehicle should use less expensive fuel, and,
(d) Vehicle should have rugged construction and anti-rust paint.

Q8. What things should be considered wile transporting MSW?
Ans: Three things should be considered while transporting MSW:
(i) Route of vehicle should not be fragmented or overlapping
(ii) Routes having heavy traffic should be served before or after rush hour.
(iii) Mapping of routes should be done for effective transportation.

Q9. Name the methods of disposal and treatment of MSW.
Ans: MSW can be disposed and treated mainly through sanitary landfills, incineration, recycling and composting methods.

Q10. Why are sanitary landfills preferred to open dumps in developed countries?
Ans: Due to health and environmental hazards of open dumps, developed countries prefer sanitary landfills, even though landfills are also not very safe.

Q11. Why are old landfills in the USA called ‘chemical repositories’?
Ans: Old landfills in the USA are called ‘Chemical Repositories’ because most of the waste present in them has not degraded in the past 40 years, due to lack of desirable conditions. Also, these landfill sites are heavily polluted and releasing toxic salts, heavy metals and synthetic organic compounds into groundwater and gases like N_2O, CH_4, and CO_2 into the atmosphere, polluting surrounding air and groundwater.

Q12. What is the advantage of incinerating the waste?
Ans: By incineration the volume of waste can be reduced by 90% and the heat generated can be used to produce electricity.

Q13. Which toxic materials are present in incinerator ash?
Ans: Incinerator ash contains toxic materials such as dioxins, furans, lead and cadmium that make it highly dangerous.

Q14. Which components of waste are recyclable?
Ans: Paper, textiles, metals, glass, rubber and plastics are recyclable.

Q15. Which method is safe for disposing MSW?
Ans: None of the methods is very safe for disposing MSW. However, recycling and compositing are comparatively safe methods.

Q16. What is composting?
Ans: Composting is aerobic or anaerobic, thermophillic degradation of organic material by micro-organisms like bacteria, fungi, etc.

Q17. Name the methods of composting used in India.
Ans: Two methods of composting popularly used in India are:

iv. Bangalore Method
v. Indore Method.

Q18. What is vermi-composting?
Ans: Vermi-composting is a method to reduce organic waste by biodegrading it using earthworms.