

Q: Discuss solid waste disposal techniques in detail. Also discuss the challenges and opportunities for Solid Waste Management in Pakistan.

Solid Waste Disposal Techniques

Solid waste disposal techniques refer to the methods that are used to manage and dispose of solid wastes for preventing environmental contamination and safeguarding public health.

According to **Global Waste Management Outlook** (outlook) published by UNEP in 2023, municipal solid wastes would increase from 2.3 billion tons in 2023 to 3.8 billion tons by 2050. Thus, proper solid waste disposal techniques are needed to mitigate the pollution caused by solid wastes.

Explicating Modern Solid Waste Disposal Techniques

→ **Modern Sanitary Landfilling:**

Sanitary landfills feature liners ^{systems} to prevent leachate contamination of groundwater. When landfills reach their capacity, they use closure

procedures to seal waste mass for preventing future contamination.

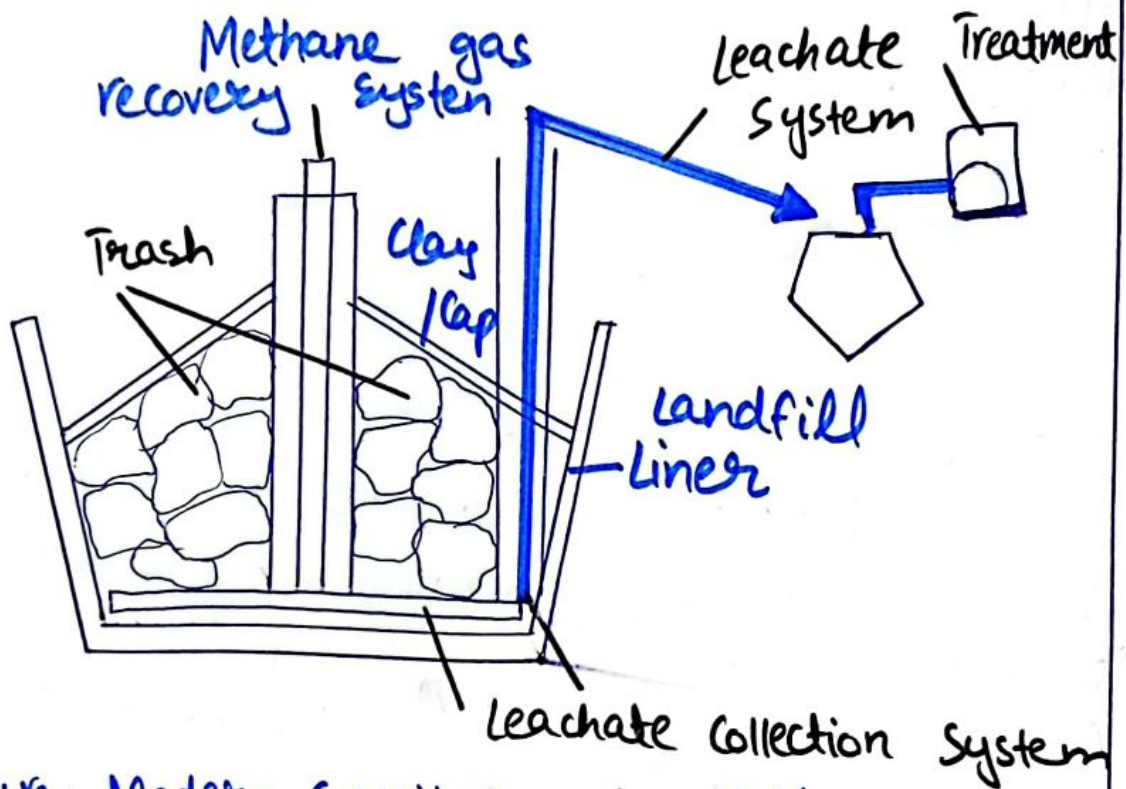


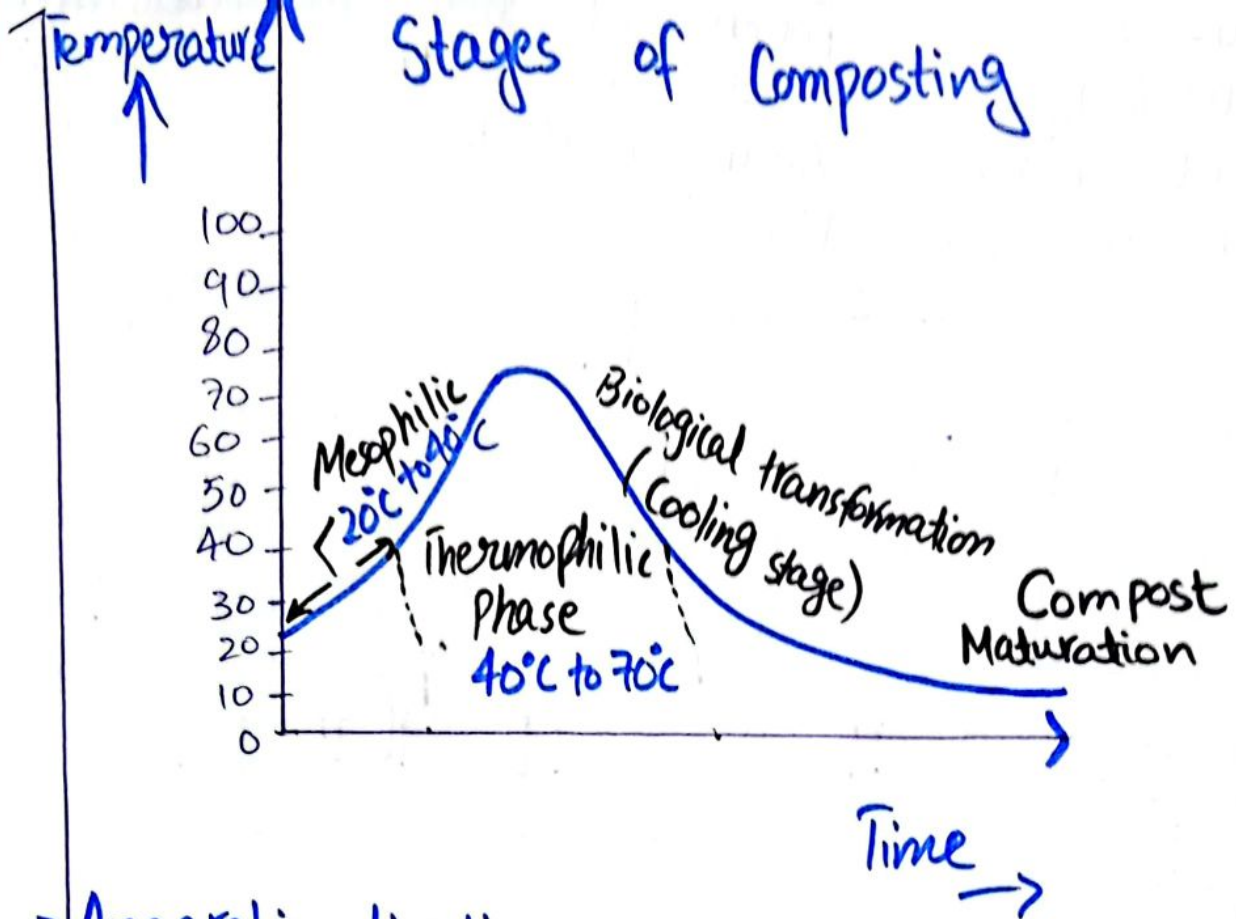
Figure: Modern Sanitary Landfilling

→ Pyrolysis :

Pyrolysis is a solid waste disposal technique that can effectively be used for solid waste management. It is thermal decomposition of organic waste materials into bio-char, bio-oil and syngas in the absence of oxygen.

→ Composting :

Composting takes place in three stages : mesophilic, thermophilic and maturation stage. It is conversion of organic wastes into nutrient rich compost through the action of micro-organisms.



→ Anaerobic digestion:

In this technique, organic waste materials like animal manure, food wastes, sewage sludge are broken down by micro-organisms in the absence of oxygen to produce bio-gas which is used for electricity generation.

→ Plasma Arc Gasification:

It is a technique in which heat generated by plasma arc is utilized to convert organic waste materials into syngas. It has advantages of minimal emissions, potential recovery system and efficient waste conversion.

→ Incineration:

This solid waste disposal technique is used for solid waste management where combustible

and organic components of wastes are oxidized and inorganic materials are converted into ash. Heat generated during combustion is used for energy generation.

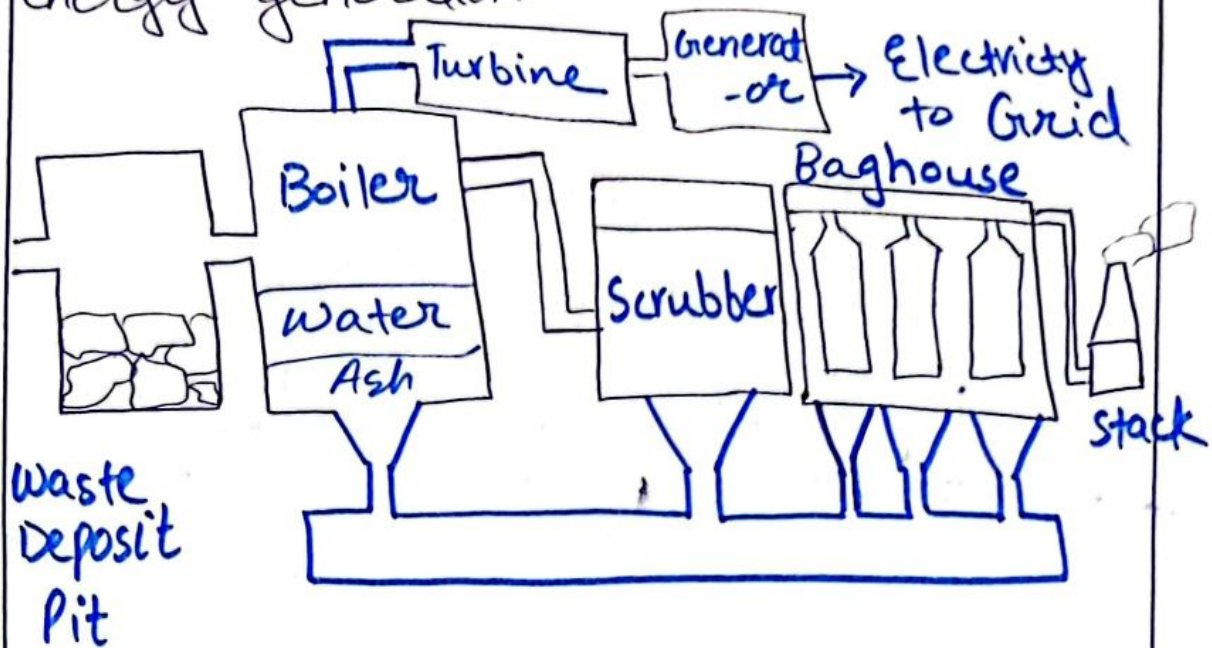


Figure : Incineration

Opportunities of Solid Waste Management in Pakistan

According to Global Climate Risk Index, Pakistan is ranked as fifth most vulnerable country to climate change because it produces millions of tons of solid waste annually. However, Pakistan has numerous opportunities of solid waste management.

→ Waste-to-Energy Projects in Pakistan

One of the opportunities of solid waste management in Pakistan is waste-to-energy projects of Pakistan. Mayor Karachi has ^{recently} announced three waste-to-energy projects in 2023. As per reports

Green Waste Energy project will produce synthetic gas from waste, while Khan Renewable Company will generate 45MW of electricity from waste. Engro Energy company is working on a project to produce RDF while companies have been allocated space at landfill site Jam Chakro and Gondras for the project (Tribune, Waste to Energy Projects in Karachi, Jan 2024).

→ Recycling and Resource Recovery Opportunities in Pakistan

Another opportunity that Pakistan offers for solid waste management is recycling and resource recovery opportunities (of Pakistan). For instance, over 2.5 tons of discarded Shell lubricant bottles were recycled for the construction of a 730 feet long and 60 feet wide road in Karachi (Dawn, Recycling carried out by Shell, July 2023). Such opportunities are also evident by the fact that Tetra Pak of Pakistan has higher rate of recycling than the global rate with nearly 41% of Tetra Pak products in Pakistan, successfully recycled.

→ Community-based initiatives of Pakistan

Pakistani government is taking community based initiatives to reduce solid wastes, which is a great opportunity of solid waste management in Pakistan. For instance, in a ground-breaking effort to address solid waste management in Pakistan's urban areas Green Urban Development (GUD) initiative has been launched to strengthen youth's capacity for waste-recycling in urban centres of the country.

→ Circular Economy Initiatives of Pakistan

Pakistan offers opportunity for solid waste management by introducing circular economy initiatives in the country. The Institute of Urbanism has presented a panel titled "Circular Economy in Pakistan" at Sustainable Development Policy Institute^{in 2023}. The speakers contended that annual waste production of 50 million metric tonnes of waste is an opportunity to promote ^{sustainable} waste-to-resource conversion practices to kick start circular economy (Dawn, Circular Economy of Pakistan, Nov 2023).

Challenges for Solid Waste

Management in Pakistan

Pakistan is facing ^{challenges regarding} solid waste management in Pakistan which are as follows.

→ Weakness of Environmental Institutions of Pakistan

Pakistan has all environmental institutions for proper solid waste management system but it is weakness of these institutions that is posing challenge to solid waste management in Pakistan. An evidence that shows incompetence of these institutions is that Guddu barrage is full of poisonous wastes that is killing fish of this barrage. Moreover, due

to weakness of these institutions the total mass of plastic waste generated so far in Pakistan has become equal to size of two K-2 mountains (Dawn, Solid Wastes in Pakistan, July 2022).

→ Poor Governance Structure

Another challenge to solid waste management in Pakistan is poor governance structure of Pakistan that has failed to implement National Environmental Policy (NEP), EPA and other international commitments ^{regarding} conservation of environment. The government is not providing incentives to buy modern technologies in order to clean solid wastes. The Deputy Commissioner, Kashmir, Sindh explained this issue as, "Waste mostly ends up in water channels due to lack of necessary equipment" (Tribune, Lack of Technology for Solid Waste Management, Dec 2023).

→ Financial Constraints

Pakistan also faces financial constraints for solid waste management. According to study conducted by District Government of Karachi, 9000 tons of solid wastes is generated by the city daily. However, according to World Bank the financial cost of recycling and waste to energy incineration of one metric ton

Lack of financial resources is \$100. So, it is a major challenge that Pakistan faces for solid waste management in the country.

Conclusion

Solid waste management is a key aspect in environmental conservation. Pakistan has opportunities for effective solid waste management in the country. But still the country is suffering from various governance issues that create hurdles in adopting modern solid waste disposal techniques for the sake of environment. Thus, Pakistan needs to take efficient steps to overcome these hurdles to reduce solid wastes from the country.