DEVELOPING SUSTAINABLE SOLUTIONS FOR EFFICIENT SOLID WASTE MANAGEMENT

Aim: To minimize environmental impact, conserve resources, and protect human health by prioritizing waste reduction, reuse, and recycling while ensuring proper and safe disposal of remaining waste.

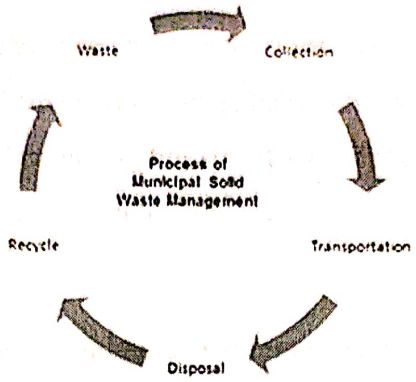
Learning Objectives:

1. To minimize pollution by properly disposing of and managing waste to prevent air, water and soil contamination.
2. To reduce health risks by ensuring proper collection, transportation and disposal of waste to prevent diseases and pest infestations.
3. To promote recycling, composting and waste to energy methods to reduce the depletion of natural resources.
4. To implement eco-friendly waste management practices to ensure long-term environmental sustainability.
5. To encourage waste minimization through awareness, education and the adoption of sustainable consumption habits.
6. To develop an effective system for collecting, transporting, treating and disposing of solid waste.

INTRODUCTION

Solid waste is a term that refers to a variety of waste materials that are discarded as unwanted and useless as a result of animal and human activity. Solid waste is generated in a given area by industrial, residential, and commercial activities and may be disposed of in various ways. As such, landfills are typically divided into sanitary, municipal, construction and demolition, and industrial waste sites. Waste is classified according to its composition, including plastic, paper, glass, metal, and organic waste. Additionally, wastes may be classified according to their hazard potential, such as radioactive, flammable, infectious, toxic, or non-toxic wastes. Solid waste management (SWM) is defined as the discipline associated with control of generation, storage, collection, transportation, processing and disposal of solid waste materials in a way that best

addresses the range of public health, conservation, economic, aesthetic, engineering, and other environmental considerations.



It is an integrated process comprising several collection methods, varied transportation equipment, storage, recovery mechanisms for recyclable material, reduction of waste volume, and quantity by methods such as composting; refuse derived fuel (RDF), waste-to-energy, and disposal in a designated engineered sanitary landfill. The selection of a suitable SWM process is driven by the source and quality of waste produced. Solid waste is generated from a number of sources which include households (kitchen and yard), commercial areas (shops, hotels and restaurants), industries (raw material and packaging), institutions (schools, hospitals and offices), construction and demolition sites, wild and domesticated animals (carcasses of dead animals, manure), parks (fallen branches, leaves from trees), and streets (sand, silt, clay, concrete, bricks, asphalt, residues from air deposition, and dust).

OBJECTIVES OF WASTE MANAGEMENT

❖ The primary goal of solid waste management is reducing and eliminating adverse impacts of waste materials on human health and the environment to support economic development and superior quality of life. This is to be done in the most efficient manner possible, to keep costs low and prevent waste buildup.

❖ To develop sustainable, efficient methods for managing solid waste that minimize environmental impact, reduce landfill usage, promote recycling and enhance resource recovery.

❖ Promoting re-use of different things who have fulfilled their purpose.

❖ Promote recovery of energy from waste materials.

IMPORTANCE OF SWM

➢ Solid waste management is a broad term that encompasses planning, administrative, financial, engineering, and legal functions. Complex inter-disciplinary relationships between fields such as public health, urban and regional planning, political science, geography, sociology, economics, communication and conservation, demography, engineering, and material sciences may be required to develop solutions.

➢ Residential and industrial producers, urban and rural areas, and developed and developing nations have unique solid waste management practices. Local government authorities are responsible for the management of non-hazardous waste in metropolitan areas.

➢ On the other hand, hazardous waste materials are typically managed by those who generate them according to local, national, and even international authorities.

➢ Environmental Protection: Proper waste management helps prevent pollution of air, water, and soil. It reduces the release of harmful substances into the environment, minimizing negative impacts on ecosystems, wildlife, and human health.

➢ Resource Conservation: It involves recycling and reusing materials, reducing the need for new raw materials. This conserves natural resources and energy, leading to more sustainable production processes.

➢ Energy Savings: Many waste management practices, such as recycling and waste-to energy technologies, generate renewable energy or recover energy from waste. This reduces the reliance on fossil fuels and helps combat climate change.

➢ Reduction of Greenhouse Gas Emissions: Proper waste management, including recycling and composting, reduces methane emissions from landfills and the need for energy-intensive production of new materials, thereby mitigating climate change.

➢ Health and Safety: It can lead to disease transmission, water contamination, and air pollution. It minimizes health risks for communities and workers in the waste industry.

➢ Aesthetic Improvement: Proper waste disposal and cleanliness contribute to visually appealing surroundings, enhancing the quality of life for residents and attracting tourism.

➢ Economic Benefits: It creates job opportunities in recycling, waste collection, processing, and related industries. It also reduces the costs of waste cleanup, disposal, and environmental remediation.

➢ Compliance with Regulations: Many countries and regions have strict regulations for waste management to protect the environment and public health. Proper waste management ensures compliance with these regulations, avoiding legal and financial penalties.

➢ Sustainable Development: Integrating waste management into sustainable development goals ensures the well-being of current and future generations by preserving resources and minimizing the environmental footprint.

➢ Promotion of Circular Economy: It contributes to the transition to a circular economy, where resources are used efficiently, products are designed for durability and recyclability, and waste is minimized.

TYPES OF SOLID WASTE MANAGEMENT

• **Landfill:** It involves burying the waste in vacant locations around the city. The dumping site should be covered with soil to prevent contamination. Benefits: A sanitary disposal method if managed effectively. Limitations: A reasonably large area is required.

• **Incineration:** It is the controlled oxidation (burning/thermal treatment) of mostly organic compounds at high temperatures to produce thermal energy, CO2, and water. Benefits: Burning significantly reduces the volume of combustible waste. Limitations: Smoke and fire hazards may exist.

• **Composting:** It is a natural process of recycling organic matter like leaves and food scraps into beneficial fertilizers that can benefit both soil and plants. Benefits: It is beneficial for crops and is an environment-friendly method.

Limitations: Requires high-skilled labour for large-scale operation.

• **Recycling:** It is a process of converting waste material into new material. Examples: wood recycling, paper recycling, and glass recycling. Benefits: It is environment-friendly.

Limitations: It is expensive to set up and not reliable in case of an emergency.

• **Vermicomposting:** Vermicomposting is a bio-conversion technique that is commonly used to handle solid waste. Earthworms feed on organic waste to reproduce and multiply in number, vermicompost, and vermiwash as products in this bio-conversion process. Benefits: It reduces the need for chemical fertilizers and enhances plant growth. Limitations: It is time-consuming, cost-ineffective, and requires extra care.

MUNICIPAL SOLID WASTE

• Every day goods such as product packaging, yard trimmings, furniture, clothing, bottles, cans, food, newspapers, appliances, electronics, and batteries make up the municipal solid waste.

• With rising urbanization and change in lifestyle, the amount of municipal waste is also rising.

• Municipal solid waste management is the need of the hour and is important for the safety of public health and better environmental quality.

HARMFUL EFFECTS OF SOLID WASTE

Accumulation of solid waste in open areas is an eyesore, diminishing real estate and property value, a breeding ground for insects, and other vectors (rats and mice, wild and domesticated animals). It also causes odour nuisance, reflects the unorganized nature of the community, and creates a poor environment for growing children. Improper and unorganized disposal of Municipal Solid Waste (MSW) in open areas and landfills have a negative impact on the living conditions of human beings as well as the overall environment. It results in spread of communicable and non-communicable diseases among human beings and animals, thus affecting the welfare, livelihood, and economic productivity. In addition, it causes contamination of soil, surface water, ground water and generation of toxic and greenhouse gases and effect on biodiversity. However, using adequate information, resources, and efficient management practices, one can turn solid waste into a useful resource.

CURRENT STATUS OF SWM IN INDIA

Management of Solid Wastes is of growing concern to the general public at large, local authorities and business communities in cities and towns across India. The problem is exacerbating in urban areas due to rapid strides in population growth, coupled with an economic boom that encourages the consumption of goods and, hence, wastes generation. In Census 2024, the urban population accounts for 36.6 percent of the total Indian population. The Local Governing Bodies (LGBs), viz. municipalities and municipal corporations, are responsible for providing SWM services in the urban areas. In most of the urban areas, insufficient funds, use of obsolete/ inefficient technologies, lack of public awareness/training, and improper infrastructure have resulted in a state of poor SWM.

INITIATIVES TO IMPROVE SWM IN INDIA

In recent years, the Government of India has taken several initiatives to improve existing SWM practices in the country. Some of the key initiatives and recommendations are given below:

❖ The Ministry of Environment and Forests (MoEF), Government of India, published "Municipal Solid Waste (Management and Handling) Rules 2016" (MSW Rules 2016). These rules were developed in conformance with Sections 3, 6 and 25 of the Environment Protection Act, 1986 and aim at standardization and enforcement of SWM practices in the urban sector. They dictate that, "Every municipal authority shall, within the territorial area of the municipality, be responsible for the implementation of the provisions of these rules and infrastructure development for collection, storage segregation, transportation, processing and disposal of municipal solid wastes". In addition, "the CPCB shall coordinate with State Pollution Control Boards (SPCBs) and Pollution Control Committees (PCCs) in the matters of MSW disposal and its management and handling".

❖ The Jawaharlal Nehru National Urban Renewal Mission (JNNURM) is a notable initiative undertaken by Government of India. JNNURM provides funding for urban infrastructure development in 67 cities and towns of the country. This mission was initiated in 2006 and is slated to continue until 2011.

❖ Urban Infrastructure Development Scheme for Small and Medium Towns, this scheme is to improve the urban infrastructure in towns and cities in a planned manner and to promote public–private partnership (PPP) in infrastructure development. This scheme was introduced in the year

2005-06 and will continue for seven years. This scheme is applicable to all cities/towns as per 2001 census, except the cities/towns covered under the JNNURM. One of the components of this scheme is to renew the old sewerage and solid waste disposal systems in inner (old) areas.

❖ Swachh Bharat Mission (SBM) was launched on 2nd of October, 2014 with a vision to achieve a clean India as a tribute to the father of the nation, Mahatma Gandhi, on his 150th birth anniversary, in 2019. SBM is being implemented by the Ministry of Urban Development (M/o UD) and by the Ministry of Drinking Water and Sanitation (M/o DWS) for urban and rural areas with a given set of guidelines for improved sanitary services and capacity building initiatives.

❖ Finance Commission Recommendations Constituted by the President of India, under Article 280 of the constitution, the Finance Commission is to recommend on distribution of central tax revenues between the Union and the States. Supporting Local bodies through grant, subsequent to the passage of the 73rd and 74th constitutional amendments were first time announced in the 10th Finance Commission for providing basic services at the grassroots level and strengthening decentralization.

❖ National Green Tribunal Recommendations CPCB has framed and notified the "Action Plan for Management of Municipal Solid Waste (MSW)" in compliance with the National Green Tribunal order dated 5th Feb-2015 in the matter of OA No. 199 of 2014.

COLLEGE PROFILE

SYTR Government Degree College, officially known as Sri Shanthamma Y.Thimmareddy Government Degree College, is located in Madakasira, Sri Sathya Sai District, Andhra Pradesh. Established in 1991, the college is affiliated with Sri Krishnadevaraya University, Ananthapur.

REASON FOR CHOOSING SWM PROJECT

Taking up project on solid waste management in our college can be justified for several reasons. The project promotes awareness about the harmful effects of improper waste disposal on the environment and emphasizes sustainable practices. It provides us with hands on experience in understanding waste generation, segregation and management process.

In our college, generate a significant amount of waste daily and this project allows the institution to set an example by managing waste responsibly within the campus.

We have a chance to explore ways to recycle and repurpose waste materials, thereby conserving resources. We usually develop skills such as teamwork, problem solving and research as they analyze waste management challenges and propose solutions.

Proper waste management reduces the risk of pollution and disease spread, ensuring healthier campus environment.

The project can serve as a model for surrounding communities, inspiring them to adopt better waste management practices. By understanding this project in our college, not only responsible but also encourages a culture of eco-consciousness among students.

METHOD FOLLOWED

The most feasible solid waste management method for to us to do project in our college is

1. Segregation
2. Composting

Segregation

Segregate waste into biodegradable, recyclable and non-recyclable categories is simple and cost-effective. For this, we labeled bin around the campus for paper, plastics, metals and organic waste and the segregated waste handover to the waste collecting municipality vehicle.

Learning Outcome:

We understand the importance of waste categorization and recycling process.

Composting

Generally, in our college offenly generate organic waste from categorizes, such as food serapes, plastics and garden waste which can be composted. For this, we built a composting pit and whatever the compost generated that should be used for further plantation.

Learning Outcome:

From this, we learn about biodegradation, soil enrichment and sustainable waste management.

CONCLUSION

The solid waste management project conducted at our college has highlighted the importance of sustainable practices in handling waste. Through this project, we were able to identify the primary sources of waste generated within the college, categorizes effectively and implement the segregation and composting method for proper disposal.