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Abstract

The damps caused by solid waste are having a devastating impact on the conditions in disadvantaged countries. It is easy to see that improper disposal of solid waste has a negative impact on the ecology in any nation that is experiencing economic growth. Since there is insufficient proper planning and funding, the situation regarding the management of solid waste is deteriorating at an alarming rate. a problem in the management of solid waste as a result of rapid industrialization, growing urbanisation, and a limited budget. Because of the incorrect disposal of solid waste, infectious diseases are spreading across the study area. According to the findings of the research, inefficient solid waste management systems may be linked back to a number of issues. These problems include rapid population growth, increases in the formation rate of solid waste, management defects, a lack of legislative implementation, and inadequate funding. The unintentional invasion of the city, harsh weather conditions, lack of social awareness or community participation, inappropriate resources, particularly inappropriate equipment, and a lack of money are the key causes of inadequate municipal solid waste management systems. A municipal solid waste management system that is inefficient may be the cause of serious environmental issues, including the spread of infectious diseases, the contamination of land and water, the clogging of sewers, and the reduction of biodiversity.

Keywords: solid waste management, environmental impacts, land pollution.

Introduction

In metropolitan regions struggling to keep up with the rapid pace of population increase and rubbish production, solid waste management (SWM) remains a primary socioeconomic and governance concern. Many worldwide development agendas, charters, and visions highlight

the significance of SWM in realising sustainable development. The United Nations' Sustainable Development Goals (SDG) include providing access to clean water and sanitation (SDG6), developing sustainable cities and communities (SDG11), reducing greenhouse gas emissions (SDG13), safeguarding terrestrial ecosystems (SDG15), and promoting sustainable consumption and production (SDG12) (https://sdgs.un.org/goals, accessed on September 26, 2022). It supports a circular urban economy by lessening reliance on nonrenewable resources and increasing the reuse and recycling of materials for the purposes of eliminating waste, decreasing pollution, cutting costs, and fostering green development.

The world's population is projected to reach 8 billion by 2025 and 9.3 billion by 2050, with roughly 70% of that total residing in urban areas [1,2]. This growth in population, along with an improved standard of living and increased consumerism, will continue to pose a formidable challenge to SWM in cities around the globe. Spending 20–50% of their budgets on garbage collection and transportation accounts for 80%–95% of the total cost of waste management in poor nations [3,4]. Increased rates of diarrhoea and acute respiratory infections, especially among children, are just two of the public health risks associated with living near garbage dumps [5]. This is especially true in many low-income countries, which collect as little as 10% of garbage generated in suburban areas. Lack of knowledge, technology, funds, and good governance [6,7,8] are all barriers to efficient municipal SWM.

In some cities in developing nations, the emphasis of municipal SWM has been the removal of rubbish from households and businesses without more attention to what was then carried out with it [9]. In most third world nations, municipal waste is sent to landfills or dumpsites, the majority of which are expected to be full within a decade. At one time, it was considered acceptable to dispose of rubbish by dumping it or burning it in an open area, often in low-income neighbourhoods on the outskirts of cities, or by dumping it into bodies of water. In a similar vein, a number of urban areas continue to rely on antiquated or badly maintained infrastructure, as well as unregulated dumping and open-air rubbish burning. In the vicinity of waste dumps, these actions can have a disproportionate impact on already vulnerable populations [10]. However, there are a number of long-term issues with this strategy, such as loss of resources, environmental degradation, and the spread of infectious illnesses.

Environmental and public health problems associated with unsustainable SWM methods were previously not widely recognised, but this has changed significantly with the birth of the environmental movement in the 1960s. Throughout the 1970s and later, SWM was seen as a technological problem that could be handled by the use of technology; as a result, resources were prioritised and spent on trash collection vehicles and systems [5]. Although it's true that advances in technology have allowed for a major decrease in harmful material emissions, this perspective shifted in the 1990s when towns realised they couldn't safely evacuate residents or properly dispose of trash without the help of those they served [5]. Under pressure from financial institutions and other donor agencies, the public sector in the global South was unable to make enough improvements in SWM, prompting the adoption of privatisation policies at the decade's close. Yet, the current worldwide perspective on how to manage municipal SWM issues is shifting as a result of privatization's failure to offer municipal SWM services to low-income and disadvantaged areas.

Instead of relying on conventional methods like landfilling, open dumping, and open incineration [11,12,13], a more sustainable waste management strategy places a premium on

minimising trash generation and sorting it into appropriate streams for reuse, recycling, and energy recovery. This method, which is still in its infancy but is gaining traction in the Global South, is more inclusive and eco-friendly than conventional methods and has a less detrimental effect on human health and the environment [14,15,16]. Since that 90% of projected urban expansion by 2050 will occur in the Global South, it is important to evaluate the state of SWM there and its effects on the environment and human health. The effects of SWM on human health and the environment have been the subject of very few investigations to far.

Solid Waste Management: An Introduction

Management of solid wastes includes its collection, processing, and ultimate disposal. The term "waste management" refers to the process of collecting, transporting, treating, analysing, and finally disposing of wastes from a variety of sources.

It's a major issue on a global scale since it contaminates both water and the air. It demonstrates how it contributes directly to people's health, the economy, and environmental destruction. It may cause ecological damage and the spread of illness transmitted by vectors (diseases spread by rodents and insects).

Garbage from households and factories both fall under the category of solid waste, which is defined as any non-liquid, insoluble material that may or may not include harmful chemicals. Waste from homes, public facilities, businesses, institutions, restaurants, grocery stores, farmers markets, as well as garbage from laboratories and hospitals also falls under this category, as do biomedical waste and electronic waste.

Every day, many tonnes of trash are forgotten on the streets of most emerging markets. It's a haven for disease-spreading bugs, which in turn clog sewers and create other infrastructure problems.

Due to 'rapid urbanisation, population expansion, and economic development,' India's annual solid waste production is expected to rise to 387.8 million tonnes in 2030 and 543.3 million tonnes by 2050.

Types of Solid Waste Management

1. Landfill:

This entails burying rubbish in unoccupied lots across the city. To avoid pollution, the dumping site should be covered with dirt.

Benefits: If properly handled, it may be a hygienic disposal technique.

Limitations: A reasonable amount of space is necessary.

2. Incineration:

The controlled oxidation (burning/thermal treatment) of primarily organic molecules at high temperatures in order to create thermal energy, CO2, and water.

Benefits: Burning decreases the amount of combustible trash greatly.

Limitations: There may be smoke and fire dangers.

3. Composting

It is a natural process that converts organic materials such as leaves and food scraps into useful nutrients that benefit both soil and plants.

Benefits: It is helpful to crops and is an environmentally friendly strategy. **Limitations:** Large-scale operation need highly specialised labour.

4. Recycling

It is the process of transforming trash into fresh material. Wood recycling, paper recycling, and glass recycling are a few examples.

Benefits: It is environmentally friendly.

Limitations: It is costly to put up and unreliable in an emergency.

5. Vermicomposting

It is a bio-conversion method that is often used to treat solid waste. Earthworms grow and proliferate by eating organic waste, producing vermicompost and vermiwash as byproducts of the bio-conversion process.

Benefits: It eliminates the demand for artificial fertilisers while also promoting plant development.

Limitations: It is time-consuming, inefficient, and needs special attention.

Municipal Solid Waste

- Municipal solid trash consists of everyday items such as product packaging, yard trimmings, furniture, clothes, bottles, cans, food, newspapers, appliances,.
- As cities grow and people's lifestyles change, so does the volume of municipal trash.
- As cities grow and people's lifestyles change, so does the volume of municipal trash.
- It is broadly divided into five categories:
 - 1. Recyclable Material: Glasses, bottles, cans, paper, metals, etc.
 - 2. Composite Wastes: Tetra packs, toys.
 - 3. Biodegradable Wastes: Kitchen waste, flowers, vegetables, fruits, and leaves.
 - 4. Inert Waste: Rocks, debris, construction material.
 - 5. Domestic Hazardous and Toxic Waste: E-waste, medication, light bulbs, etc.
- 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

- Bad odour of waste
- Production of toxic gases
- Degradation of natural beauty
- Air pollution
- Water pollution
- Soil pollution
- Spread of diseases
- Effect on biodiversity

Important Points About Solid Waste Management

• The growing urbanisation, industrialization, and population growth in India will make solid waste management a top priority for state and local governments in the 21st century.

- The well-being of urban residents depends on effective garbage management.
- The urban poor are at a higher risk since they tend to reside in squatter areas that aren't serviced by solid waste collection services and are often situated close to unregulated dumps.
- To address these problems, the "Swachh Bharat Abhiyan" was launched to educate the public on how to properly dispose of solid garbage. The idea of trash management has gained traction since the beginning of this ad.

How Improper Waste Disposal Affects the Environment



Fig. 1. Improper Waste Disposal Affects the Environment

Recycling and trash removal are two of the most vital economic sectors. The vast industrial industries swiftly harm the environment if they do not have access to garbage disposal. When thinking about how inappropriate trash disposal impacts nature, this becomes immediately clear. Here is a quick glance at the consequences of poor garbage disposal if you want to know more about the significance of waste disposal.

1. Land Pollution

Land contamination occurs when trash is dumped on unusable land. Because of decay or time, the contents of this trash pile leak into the ground surrounding it. As a result, the soil and everything in its immediate vicinity becomes toxic as a result of the pollution.

2. Water Pollution

Whenever trash can't be properly disposed of, it eventually winds up in the next body of water. It eventually decomposes in the ocean, where it contaminates the water and eventually kills out the marine life there. This procedure increases the water's toxicity, making both freshwater and any body of water hazardous for human consumption and swimming. Pollutants stay behind and may taint other water supplies since water is mobile and a powerful solvent.

3. Air Pollution

Understanding the connection between inappropriate garbage disposal and air pollution is crucial in light of the global nature of the problem. Greenhouse gases accumulate in the atmosphere and produce significant global climate change; this is a well-established fact about air pollution. Problems associated with excessive gas emissions into the atmosphere have their roots in careless trash disposal. Decomposition of garbage produces greenhouse gases like methane, which contributes significantly to climate change on a worldwide scale.

4. Climate Change

The role and influence of pollution on the global climate is a major concern. The ozone layer is depleted in part due to the gases produced by waste. As the ice caps melt, the sea level rises, destroying natural ecosystems and flooding the homes of billions of people.

5. Extreme Weather

As a result of climate change, we have also seen a rise in the occurrence of severe weather and natural catastrophes. The frequency with which natural catastrophes like tornadoes and floods occur has increased dramatically as a result of climate change. Hurricanes, too, have grown more common as a result of global warming.

6. Disease

Major illnesses may thrive in untreated garbage piles. Contaminated water and garbage dumps are both ideal breeding grounds for the spread of illness. Illnesses caused by incorrectly handled garbage may impact humans, animals, and vegetation.

7. Plant Death

Most plants cannot survive on soil that has been contaminated by air or water pollutants. Toxic rain may damage plants even if there are no toxins in the soil.

8. Animal and Marine Death

Animals on land and in the water also succumb to the effects of littering. Plastic pollution in the ocean kills sea turtles and fish, and wildlife is put at risk when it eats trash that contains toxins. As a result, poor waste disposal is a leading cause of extinction across a wide range of species every day, and it has long-lasting negative effects on ecosystems all around the world.

9. Loss of Habitats

The habitats in which different species of animals may thrive are wide. This explains why some species are restricted to certain regions. To make matters worse, trash adds to global warming, which in turn reduces the available space for animals' natural homes. The demise of

animals like polar bears is a direct result of the shrinking size of their habitats, which prevents them from being able to migrate to safer locations.

10. Lower Biodiversity

When species go extinct and farms fail, global biodiversity gradually declines. Loss of biodiversity is harmful to ecosystems because it raises the probability of extinction in the face of a catastrophic event. Fewer species means fewer species that can adapt to new environments as illnesses spread more easily from population to population.

11. Worsening Infrastructure

The effects of waste on the environment and society extend far beyond the impacts on the global climate; the waste problem even affects the world's infrastructure. Drains will become clogged and drinking water tainted if trash like plastics and other garbage is dumped into our water supplies. Rats and other rodents, which thrive in unsanitary conditions, can multiply rapidly in polluted landscapes.

12. Radiation and Hazardous Materials

Regulations have made the public mostly oblivious to the risks posed by radioactive waste, but incorrect disposal may cause radiation sickness in the surrounding region. If businesses don't use a specialised industrial disposal service, hazardous pollutants and even even more benign substances might make their way into residential regions.

13. "Dead" Zones

Our culture has a tendency to overlook the fact that landfills are essentially "dead" spaces. These landfills expand in size and population as more garbage is dumped into them. They make possible the formation of useless wastelands, as the resulting spaces may be used for no other purpose than to store trash.

14. Human Impact

It's simple to understand how this affects everyone, what with the illnesses and climate change that bad garbage processing causes. Mishandling of garbage is contributing to environmental degradation, therefore eliminating activities that create unnecessary waste would save lives and help maintain a livable planet.

For many, the effort required to reduce waste and commit to good waste management is overwhelming. There are many who think it's already too late and it's pointless to try. Yet, even if just a few individuals make a shift and begin properly disposing of garbage, it is a step in the right direction. It also improves the odds that a radical solution will emerge and be implemented. Make sure you're helping with trash management rather than hastening the planet's demise at all times.

Preventive Measures for Reduction of Environmental impacts of improper solid waste management

Environmental Impacts of Improper Solid Waste Management

Air, soil, and water contamination may all result from improper solid waste management. The contamination of surface and ground water systems is a direct result of the careless disposal of garbage. A major cause of flooding and bug breeding in urban areas is the accumulation of trash in drains. Urban air pollution is exacerbated by careless waste management practises like incineration and open burning. Decomposing organic waste in landfills releases greenhouse gases, and untreated leachate pollutes the soil and water nearby. These negative

effects on the environment are solely due to solid waste disposal, and do not include the significant environmental degradation caused by material extraction and processing at the beginning of the product life cycle.

1. Regulations

- Garbage from Cities (Management and Handling Rules) Regulations from the year 2000 stress the need of enlisting the help of local residents in sorting trash, forbidding littering, mandating secure waste storage, and mandating the most effective means of transporting trash to facilities where it can be processed and disposed of.

Regulations for the Control, Storage, and Disposal of Hazardous Waste (1989): To implement a reliable system for controlling the creation, accumulation, transportation, processing, and disposal of both domestic and foreign hazardous wastes.

To dispose of solid and hazardous waste, the principal legislation in the United States are found in the Resource Conservation and Recovery Act (RCRA). Date of death October 21, 1976. In 1984, Congress passed the Hazardous and Solid Waste Amendments to RCRA.

The Bio-Medical Waste (Management and Handling) Regulations of 1998 were enacted and made public with the intention of putting a stop to the careless dumping of hospital waste/BMW and guaranteeing that such trash is managed in a way that doesn't endanger people's health or the environment.

Notified in 1999 with an update in 2003, these regulations govern the production and application of recycled plastics. The purpose of the regulation is to guarantee appropriate plastic trash collection, sorting, transportation, and disposal.

2. Waste Processing Techniques

• Non-technical methods of disposal

As far as garbage disposal goes, this is the norm. Open, unmanaged, and poorly managed dumping are commonplace in many Indian cities, leading to severe environmental deterioration. In most urban areas, almost 90% of trash ends up being dumped on the ground.

• Environmentally Safe Landscaping

A sanitary landfill is a landfill that has been meticulously designed to minimise the environmental impacts of garbage disposal by spreading, compacting, and covering the material. Since landfilling seems to be the most generally used approach in India in the next years, some changes will need to be done to guarantee the sanitary landfilling, as it separates the refuse, decreasing the quantity of surface water flowing into and gas leaving from the trash.

• Composting

Composting is a biological process of decomposition that converts the organic element of solid waste into humus-like material by the action of organisms in the trash itself and the surrounding environment. Cities like Bangalore, Baroda, Bombay, Kolkata, Delhi, Jaipur,

and Kanpur all have large-scale compost facilities with capacity of 150 to 300 tonnes per day (Sharholy et al. 2008). In modern times, composting accounts for roughly 9 percent of garbage management.

• Incineration

To dispose of combustible garbage, incineration burns it at high enough temperatures (900–10000C) to completely consume it, leaving behind only ash and noncombustible waste. Burning garbage may cut trash by 75%-95% under optimum circumstances. Most municipal incineration in Indian cities only deals with medical and other types of biological garbage. Other theories put the blame on the low calorific value (800-1100 Kcal/Kg) and high organic material (40-60%) found in garbage. Pollution abatement is a costly task, however newer incinerators have mechanisms installed in their smokestacks to reduce emissions.

• Pyrolysis

Certain organic wastes may have their chemical contents and chemical energy recovered by pyrolysis, which involves the destructive distillation of the solid waste to extract those elements and that energy. It's a method of incineration wherein organic materials are broken down chemically by heat and pressure in the absence of oxygen. Gases, minor amounts of liquid, and a solid residue comprising carbon and ash are produced from organic materials.

Material recovery and recycling

Reusing old materials to make something new is called recycling. Reusing cans is an efficient way to save costs. Trees may be saved by paper recycling. Reusing metals will cut down on the need to mine for new supplies. Just approximately 10 to 15 percent of plastic trash gets recycled in Western countries, while that number is closer to 80 to 90 percent in India. Nonetheless, just 14% of paper waste was recycled, when the worldwide average was 37%.

3. The Policy of 4R's

Refuse -

Don't waste money on new containers when you can reuse old ones around the home. Don't give in to the temptation to replace what you currently have with something new just because you believe it's beautiful.

Reuse -

Don't toss those empty soda and beer containers; instead, cover them with some handmade paper or paint and use them as pencil holders or little flower pots.

Recycle -

Carry your purchases home in reusable cloth or jute bags. Waste has to be separated so that recyclables may be collected and transported.

Reduce -

Minimize your impact on the environment by bringing a reusable bag to the store with you and loading up on groceries that way.

Conclusions

The creation of solid trash has greatly expanded as a result of increasing economic activity and fast urbanisation. The current yearly MSW production in India is 42 MT. Growing populations make solid waste management, once a regional concern, become a global challenge. The dangers that vast amounts of trash pose to human health and the natural world in major cities can no longer be ignored. There is a problem with municipal solid trash in India right now, and everyone in the country has some responsibility for it. Poor public education and awareness contribute to a lack of community sensitivity. At the individual level, there is no system in place for the separation of organic, inorganic, and recyclable garbage. SWM is addressed by a system of laws that is sufficient for the nation. The article provides a concise overview of the current state of solid waste management and the available processing methods for addressing the issue. A number of restrictions have been put in place by the government, and a number of awareness programmes are also in place to help with the problem of improper solid waste disposal.

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