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A STUDY ON MODERN AND SMART TECHNOLOGIES FOR EFFICIENT WASTE DISPOSAL MANAGEMENT

Nandhini Devi. E[1], Aarthi. M[2]

Department of Business Administrarion,

Idhaya College for Women, Kumbakonam

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ABSTRACT

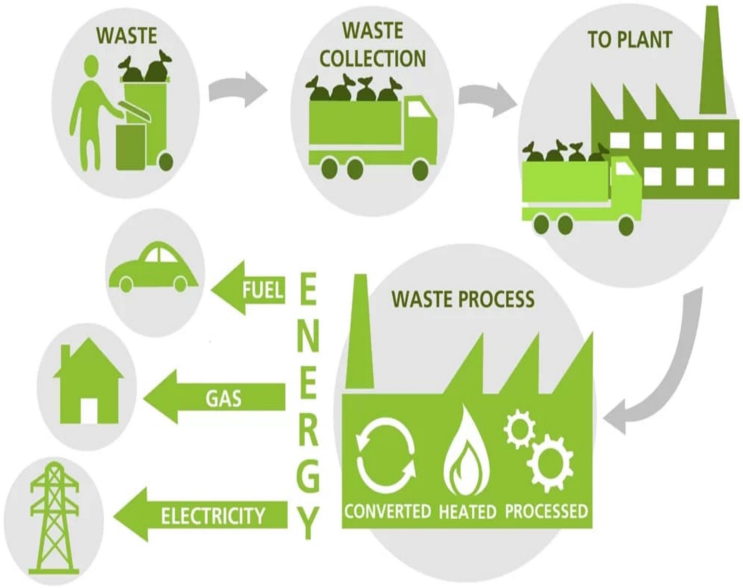
This study is based on the waste management.in the current scenario, the world waste management holds much important in every individual's life. The proper analyze waste disposal, recycling, and composting these are all the main process of the waster disposal management. (for example: in 1994, varberg introduced a weight-basedbilling system for household waste charging 1kg waste and at the same time recycling centers were set up and a "green shopping" was launched.) Population and the generation of vast waste quantities no proper waste management process have become one of humanities biggest threats. This has led to the degradation of abiotic and biotic components of these nations' ecological systems. These have seriously contributed to environment pollution and ecological deterioration. This study highlighted the use of simple, yet efficient waste disposal techniques and recommends the adequate supply and optimal utilization of trashcan and rubbish drums in private and public places; the consistent and wide use of recyclable materials and recycling equipment; information flow and training of all on the use of new techniques and methods and the need for the production and/or introduction of other appropriate technology and policy to enhance the implementation and execution of proper waste management schemes that will contribute to a cleaner and safer environment in developing countries. In the realm of municipal operations, the effective

management of municipal solid waste (MSW) stands out as a pivotal undertaking. It necessitates substantial allocations of fixed and variable resources and financial investments.

INTRODUCTION

Pollution of air, water, and the soil is already very evident, but now the roots of pollution have spread much further with radioactive and hazardous waste (Fernando, 2019). As a result of all these, many solid, liquid, and even gaseous waste are generated. The most significant danger arises when these are directly released into the environment without proper treatment methods and disposal procedures. This paper focuses on producing a short review of various innovative ways for appropriate waste disposal and efficient waste management.

The concept of biodegradable plastics indeed holds promise for mitigating the environmental impact of conventional plastics. Starch-based biodegradable plastics, in particular, have garnered attention due to their eco-friendly nature and lack of stabilization chemicals that can impede decomposition. These plastics offer a potential solution to the persistent problem of plastic pollution, as they are designed to degrade and disintegrate over time without leaving harmful residues in the



environment.

Additionally, recycling initiatives such as the remanufacturing of broken glass pieces can contribute to sustainability efforts by reducing the demand for virgin materials and minimizing waste

generation. By melting cullet (recycled glass), it's possible to create new glass products, thereby closing the loop in the glass manufacturing process and conserving resources.

On the operational side, effective waste management is crucial for municipalities to minimize costs and optimize resource allocation. Research focusing on Disposal Location Arc Routing Problems (LARP) with considerations for waste segregation and vehicle capacity limitations aims to enhance waste collection efficiency and reduce operational expenses. By identifying optimal locations for depots and waste disposal sites, such models can provide valuable insights for municipal authorities tasked with managing solid waste.

Moreover, incorporating triangular fuzzy parameters to represent demand adds a layer of complexity to waste management models, allowing for a more nuanced understanding of the variability inherent in waste generation. Real-world case studies, such as the one conducted in the UK, provide practical insights into the applicability and effectiveness of waste management optimization models. Sensitivity analyses further enhance the utility of these models by identifying key factors that influence their performance under varying conditions, thereby informing decision-making processes for municipal waste management authorities.

Overall, advancements in biodegradable plastics and recycling technologies, coupled with sophisticated waste management optimization models, offer promising avenues for building a more sustainable and resilient waste management infrastructure.

1. **Incineration**:
    - Incineration involves burning waste materials, which results in the generation of ash residue and air emissions.
    - Contrary to eliminating waste, incineration transforms waste into different forms such as air emissions, ash, and liquid discharge.
    - The resulting forms are often more challenging to manage compared to the original waste materials.
2. **Landfilling**:
    - Landfills are designated areas where waste is deposited onto or into the land.

- The primary aim is to prevent contact between the waste and the surrounding environment, particularly groundwater.
- Landfills can be categorized into open dumps (common in developing countries), semi-controlled or operated landfills, and sanitary landfills.

3. **Composting**:
    - Composting involves the controlled decomposition of organic matter using biological processes, leading to the production of nutrient-rich humus.
    - It utilizes a mixture of organic materials such as vegetable residue, animal matter, soil, and water to create compost.
    - In developing countries, a significant portion (80–85%) of waste is compostable.

Each method has its advantages and challenges, and the choice of waste management technique often depends on factors such as available infrastructure, environmental concerns, and resource availability.

Different types in waste disposal management

- **Municipal Solid Waste (MSW) Utilization:** MSW contains significant organic and combustible content, making it a potential energy source. High calorific value of MSW suggests its suitability as a replacement for coal, especially in industries like cement production.
- **Swedish Model for Waste Management**: Sweden has achieved remarkable success in waste recycling, with around 99% of locally produced waste recycled. Recycling is deeply ingrained in Swedish culture, with emphasis on waste separation and reuse by citizens.
- **Microbial Fuel Cells (MFC)**: MFC is a clean method for generating electricity from liquid waste, particularly wastewater, using bacteria and oxygen through anaerobic digestion. Special spiral spacers enhance energy production by creating a helical flow.
- **Smart Waste Bin Approach**: Integrates Internet of Things (IoT) and wireless sensor network technologies for efficient waste management. Smart bins equipped with IoT devices, RFID tags, ultrasonic sensors, and weight sensors streamline waste collection and monitoring.
- **Bio-refineries**: Utilize various waste materials, including biomass, lignocellulosic materials, and crop residues, to produce liquid biofuels such as biodiesel and bio-ethanol. Offer cleaner and safer alternatives to fossil fuels, contributing to sustainable energy production.

- **Biological Reprocessing**: Involves recycling and reusing organic materials through digestion processes and biological composting to minimize waste production. Various organic waste materials like paper products, food scraps, and plant materials are easily recycled.

Scope of waste disposal management

The scope of waste disposal management encompasses the collection, transportation, treatment, and disposal of various types of waste, including solid waste, liquid waste, and hazardous waste, in an environmentally sustainable and socially responsible manner. This includes strategies for waste reduction, recycling, composting, and proper disposal methods such as landfilling or incineration, while also considering factors such as pollution prevention, public health, regulatory compliance, and community engagement. Additionally, waste disposal management often involves technological innovations, policy development, and public education to address the challenges of waste management effectively.

Environmental Benefits of Waste Management

The environmental benefits of waste management are also many and varied.

1. Reduce Waste in Landfills Perhaps most importantly, it helps to reduce the amount of waste that is sent to landfill sites. They hold many different types of waste that are potentially harmful to the environment. So, landfills should be our last resort for waste disposal.

2. Reduce Greenhouse Gases With proper waste disposal, we reduce the greenhouse gas emissions associated with the decomposition of organic waste.

3. Reduce Pollution In addition, waste management can help to reduce the pollution caused by leachate. It is a hazardous liquid that can seep out of landfill sites and contaminate local water supplies. Furthermore, by recycling and reusing materials, waste management reduces the need for virgin resources, saving energy and reducing pollution associated with their extraction and processing. Ultimately, waste management is an essential tool in protecting the environment and safeguarding human health.

Conclusion

Waste management stands as a cornerstone of our society, offering multifaceted advantages. Through proper disposal and recycling practices, it safeguards the environment, conserves valuable resources, and fosters sustainable development. Effective waste management diminishes pollution, mitigates health hazards, and cultivates cleaner and healthier living conditions for forthcoming generations. Embracing responsible waste management not only enhances environmental resilience but also contributes significantly to public health, energy efficiency, and economic prosperity. Thus, it is imperative to recognize and prioritize the vital role of waste management in shaping a more sustainable and thriving future.

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