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# RESEARCHING WASTE MANAGEMENT TECHNOLOGIES

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**Abstract.** One of the best ways to mitigate the environmental impact of municipal solid waste is to introduce smarter, more tech-focused solutions to the waste management industry. These innovative processes help to streamline collections, monitor waste levels and make it easier for individuals and businesses to up their rates of recycling and help the environment. A number of innovative companies are working on exciting new waste management systems and technologies that are specifically designed to build a more sustainable waste management industry. These technologies come in a variety of different forms and address a number of different issues affecting the waste management industry. One thing they all have in common is a desire to reduce pollution, streamline the waste collection system and protect our environment.

**Key words:** waste management, global positioning system, waste vehicle, solid waste management, total collected waste,

**Introduction.** Many of the new technologies making waves in the world of solid waste management are aimed at businesses. This is because companies generally produce more waste than individual households. Helping businesses to make sustainable waste management easier and more cost-effective will encourage more to recycle. With an estimated 75% of all the waste we produce thought to be recyclable, this could have a real impact on pollution, landfills levels and climate change. As urban areas grow and become more densely populated, traditional waste disposal and collection systems become less practical. One of the best tech solutions to this problem is the pneumatic waste pipe. Pneumatic pipes can be installed below public waste containers to transport waste straight to processing centers without the need for a trash pickup. This system has two main benefits. The first is that it can dramatically reduce the number of garbage trucks on the roads. This can help to cut harmful emissions and minimize the number of vehicles clogging up our cities. Secondly, sending waste direct from dumpsters to waste management centers can help to avoid full containers overflowing [1]. As well as being unsightly, overflowing dumpsters can cause an environmental health hazard and contribute to the pollution of the local area. The more waste a trash truck can carry, the more it can collect on each round and the fewer trips it has to make. Solar-powered trash compactors compress trash as it accumulates inside a dumpster to increase capacity. This allows these smart containers to hold up to five times more than traditional trash bins. As well as compressing waste, solar-powered trash compactors have built in waste level sensors. These sensors transmit data on the capacity of the bins, allowing users to schedule pickups and streamlining the collection process. Technology has a huge amount to contribute to waste management and recycling. Used well, it can help us to reuse old electronics, recycle ever more of our plastics and reduce the number of vehicles on our roads. In the future, tech advancements are likely to have an even greater impact on recycling rates and efficiency, leading to a greener, healthier planet for all of us.

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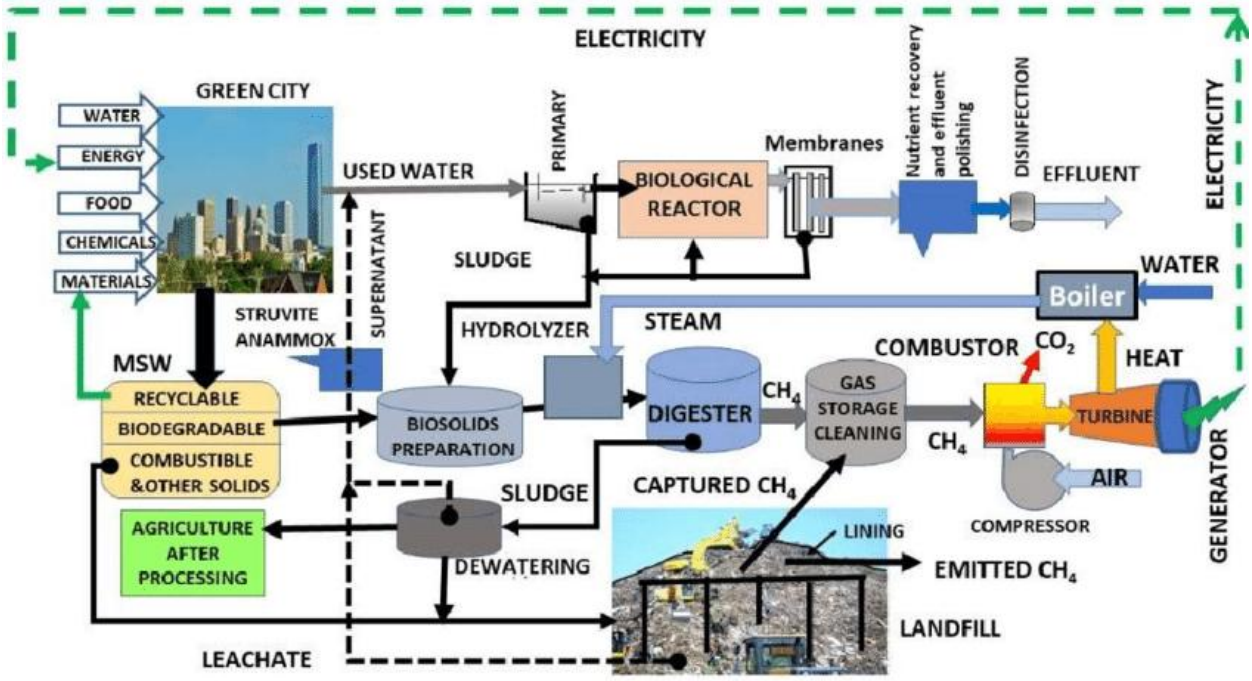


Figure 1. Solid waste processing lines using current technologies

A combination of technologies and other upstream and downstream solutions can help these communities effectively manage plastic waste, safeguarding their valuable ecosystems and livelihoods. New innovative technologies to treat plastic waste only work effectively in very specific island contexts - viability of these technologies can be impacted by many different aspects including the volume and type of plastic waste, existing solid waste management systems (organization, legal, finance), infrastructure, and community awareness [2]. Any treatment technologies should be considered alongside other solutions such as reducing the plastic input to islands upstream, before it becomes plastic waste, as well as sorting and then transporting plastic waste to a viable recycling market. Many waste processing technologies are available and in practice world-wide. However, efficiency of a particular technology depends upon the criteria for which it is designed and planned.

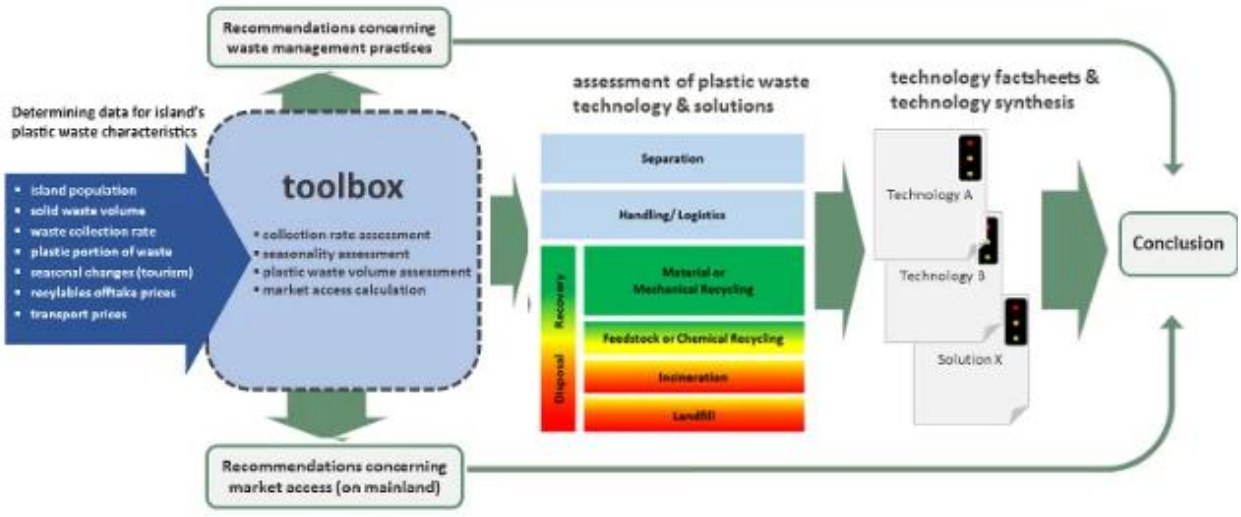


Figure 2. Technologies and solutions to manage plastic waste

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The major criteria considered for selection of technologies are the waste quantity, waste characteristics, physical properties and composition of wastes, availability of land, social factors, capital investment, duration of treatment, products market. The thermal process of treatment is applied to destroy the harmful potential of wastes together with energy recovery. In this process, the waste components are incinerated in controlled oxygen supply so that maximum heat energy can be recovered without causing the air pollution. During incineration, the waste undergoes chemical changes to release gaseous byproduct, water vapour along with heat energy. The heat energy can be utilized for generating electricity through boiler. The efficiency of heat recovery depends upon the calorific value of incinerated waste [3]. For planning and designing of a waste management plan, some preliminary survey is required to be obtained from the city/town and accordingly selection of waste processing technologies can be done for the city/town. In case of waste quantity is found less than requirement, a regional plan may be prepared for clusters of towns to achieve the desired quantity of waste. In case of excessive generation of waste, the waste can be reduced by adopting decentralized treatment process (vermin-composting/Biogas) in pockets – within garden premises, large residential complex, etc.

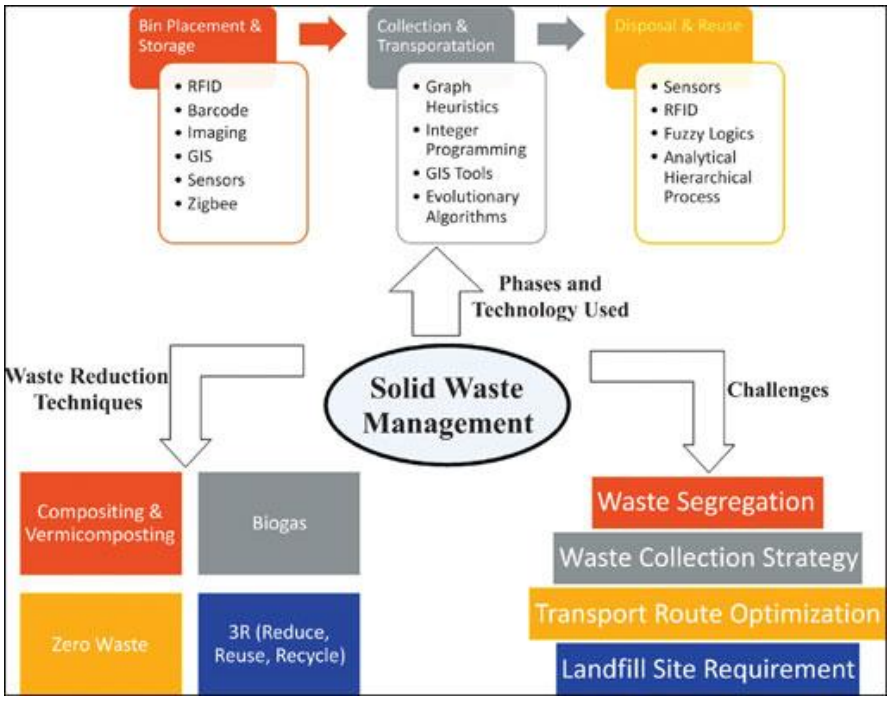


Figure 3. Role of Technology in Solid Waste Management

However, Integrated waste processing plants are capable of processing both organic and incinerable wastes. Incineration and composting are traditional approaches to treating solid waste. However, new designs can lead to more widely applicable, safer, and more efficient versions of these treatments. For example, gasification and ash melting technology are being applied to incineration of solid waste to deal with the ash that remains and thereby reduce the potential for dioxin pollution. Meanwhile, treatment of hazardous solid wastes, including toxic wastes, is important to render them harmless and stop widespread environmental contamination. The amount of solid waste dealt with by recycling or incineration has increased in the United States. Recycling begins with separating out recyclable materials from solid waste [4]. Recycled material can be processed to produce another version of the same object. For instance, aluminum cans are made into more aluminum cans. Recycled material can also be processed to make something completely different, such as tires that are made into road surfacing material. Highlights must be given to the massive avoided burdens in

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the incineration process unit, mostly due to the electricity production and also to the utilization of waste as fuel, since this represents a noxious asset for nature and, this way, it is converted into a useful feedstock instead of deposited. In what concerns the electricity production, it must be stressed that this contribution is an approach, once this is not an established process in the plan, rather constituting an output of the incineration process. Therefore, it is important to choose and apply a proper technology to solve waste problem considering waste treatment and disposal system as an integrated one. Composting is the other main method of treating solid waste. Composting involves using microbial action to turn waste with an organic content, such as kitchen and garden waste, into a nutrient-rich addition to soil. Through an analysis of conventional and innovative waste treatment methods, it becomes evident that embracing recycling, resource recovery, and responsible waste disposal are essential steps in building a sustainable future. Collaborative efforts between governments, businesses, and communities, combined with technological advancements and public awareness, are crucial for implementing effective waste treatment systems globally. Composting can be accomplished by an individual household or on a larger scale. Compost itself does not have a high market value, but the composting process also produces methane, which can be captured and sold as fuel in an advanced composting facility. The main environmental benefit of the project is the recycling of accumulated and newly generated waste. It helps to prevent the accumulated environmental damage and prevent damage to the environment. The technical efficiency of the pyrolysis technology in the first place depends on the morphological composition of municipal solid waste, which is determined by several organizational and social factors: the level of living standards, waste collection and transportation system as well as other factors to be examined. It can be applied, in an abbreviated form, to the evaluation of individual equipment choices or, in very detailed form, to the design of an entire treatment facility [5]. Industrial waste contains pollutants that may preclude the use of excess activated sludge, derived from industrial waste treatment, as an agricultural fertilizer. Recent legislative changes have considerably reduced the options available for the disposal of solid waste from biological treatment plants. Consequently, it is now more economically favorable to recycle organic wastes to land. Heavy metals may gain entry into waste streams from a variety of sources. The presence of metals in some dyestuffs is well known, but these contaminants may also be present on the raw materials and as a contaminant of other process auxiliary chemicals, where it has been involved in the compound's synthesis. Though payback period of this investment is large enough, we can confidently talk about the need to invest in the future in terms of achievements of the current and deferred environmental impact for the future generations. An increasing number of new technologies is being applied to solid waste treatment. For instance, the thermal conversion process applies heat and high pressure to a mixture of manure, tires, plastics, and sewage sludge, converting it by a complex series of chemical reactions into gasoline, oil, and methane [6]. This technique uses the energy from the waste to treat the ash and reduce its dioxin content to harmless levels in a system that is readily adaptable to municipal incinerators. If waste is seen as a scientific and technical challenge, then its safe disposal and recovery of valuable materials are more likely. A phase-wise discussion of the activities involved in solid waste management cycle is provided along with the current methods in practice for each activity. The paper further provides a technical review of technology used for improving the waste management scenario. A brief discussion of the methods for reducing waste generation and increasing reuse is also presented. Finally, the paper identifies a list of challenges related to the waste management process and provides suitable suggestions for addressing the identified challenges.

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