

INTEGRATED SOLID WASTE MANAGEMENT BASED ON 3R's

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Abstract: Waste generation and its management are being widely debated across the globe and in recent years, it has become a niche spot. Both the developed and developing countries are trying to find out new ways for climate change mitigation and adoption options respectively. A large proportion of the waste is not properly managed and dumped in unplanned sites that are creating severe environmental hazards. The significance of integrated solid waste management systems in recent years increased due to the growing number of populations and problems of waste management issues affecting the daily lives of people and the impact on the environment. Implementation of the 3R's will have a profound socioeconomic impact, also modern 3R's (Reduce, Reuse and Recycle) strategy acts as a sustainable and socioeconomic option for solid waste management. 3R's (Reduce, Reuse, and Recycle) system were proposed with priority on source minimization, intermediate treatment then final disposal and enlighten the waste generators to practice 3R's as a substantial measure to reduce, reuse and recycle the generated solid waste there all day.

Keywords: Environment protection, Reduce, Recycle, Reuse, Solid waste

INTRODUCTION

Solid waste management is one of the major environmental encumbrances in many Asian countries. World population growth, urbanization, rising living standards and rapid technological development as well as modern lifestyles and consumption patterns contribute to the increase in solid waste and the changes in its composition have contributed to an increase both in the quantity and variety of solid wastes generated by industrial, mining, domestic and agricultural activities [1],[8]. Our world is facing severe problem of population. People are using various kinds of products, which are produced from household, industries, hospitals, public place, etc from which solid waste is generated in large quantities. Due to which pollution is generated [6].

Solid waste means any garbage, refuse, sludge from a wastewater treatment plant, water supply treatment plant, or air pollution control facility and other discarded materials including solid, liquid, semi-solid, or contained gaseous material, resulting from industrial, commercial, mining and agricultural operations, and from community activities. In simple words Solid wastes are any discarded or abandoned materials [10].

The major quantity of wastes generated from agricultural sources include sugarcane baggase, paddy and wheat straw and husk, wastes of vegetables, food products, tea, oil production, jute fibre, groundnut shell, wooden mill waste, coconut husk, cotton stalk etc. The major industrial non-hazardous inorganic solid wastes are coal combustion residues, bauxite red mud, tailings from aluminum, iron, copper and zinc primary extraction processes. Mining/Mineral waste include Coal washeries waste, mining overburden waste tailing from iron, copper, zinc, gold, aluminum industries Non hazardous other process waste include Waste gypsum, lime sludge, lime stone waste, marble processing residues, broken glass and ceramics, kiln dust. Hazardous Waste includes Metallurgical residues, galvanizing waste, Tannery waste [7].

Wastes are materials which are discarded after use at the end of their intended life-span. Waste management is a collective activity involving segregation, collection, transportation, re-processing, recycling and disposal of various types of wastes. Sustainable waste management involves managing waste in an environmentally sound, socially satisfactory and a techno-economically viable manner. The significance of integrated solid waste management systems in recent years increased due to the growing number of populations and problems of waste management issues affecting the daily lives of people and the impact on the environment. Implementation of the 3R's will have a profound socioeconomic impact, also modern 3R's (Reduce, Reuse and Recycle) strategy acts as a sustainable and socioeconomic option for solid waste management. 3R's (Reduce, Reuse, and Recycle) system were proposed with priority on source minimization, intermediate treatment then final disposal and enlighten the waste generators to practice 3R's as a substantial measure to reduce, reuse and recycle the generated solid waste there all day.

WASTE MANAGEMENT STRATEGY-3R'S: REDUCE, REUSE AND RECYCLE

The 3R's - reduce, reuse and recycle - all help to cut down on the amount of waste we throw away. They conserve natural resources, landfill space and energy. Plus, the 3R's save land and money communities must use to dispose of waste in landfills. Sifting a new landfill has become difficult and more expensive due to environmental regulations and public opposition. The 3R's are concerned with better resource efficiency in accordance with the following principles:

- **Reduce** – Eliminating the generation of waste, where possible by stopping it coming on to site in the first place
- **Reuse** – Making use of materials in their original state on the same site or at other sites
- **Recycle** – Turning materials into new products for other purposes.

Thus the principle of reducing waste, reusing and recycling resources and products is often called the "3R's." Waste minimization can be achieved in an efficient way by focusing primarily on the first of the 3R's, "reduce," followed by "reuse" and then "recycle." The waste hierarchy refers to the "3R's" i.e., reduce, reuse and recycle, which classify waste management strategies according to their desirability. The 3R's are meant to be a hierarchy, in order of importance. The waste hierarchy has taken many forms over the past decade, but the basic concept has remained the cornerstone of most waste minimization strategies. The aim of

the waste hierarchy is to extract the maximum practical benefits from products and to generate the minimum amount of waste.

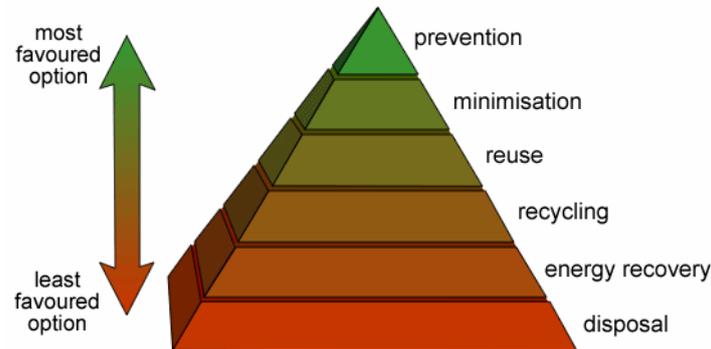


Figure 1: Waste Hierarchy

Source: [9]

The concept of minimizing waste impacts in terms of quantity or ill-effects, by reducing quantity of wastes, reusing the waste products with simple treatments and recycling the wastes by using it as resources to produce same or modified products is usually referred to as “3R’s”. Purchasing and using resources with care can reduce the pace of consumption of resources and further connected energy and resources. Ultimately reducing wastes multi fold for waste streams. When long lasting goods are reused time and again, it offsets harvesting of new similar or same products. This saves fresh resources exploitation and waste generation quantity. Some waste products can be consumed as resources for production of different goods or the same product, meaning recycling the same resource. This too saves fresh resources and offsets waste generation. All in all, the 3R’s individually or collectively saves fresh resources exploitation, add value to the already exploited resources and very importantly minimizes the waste quantity and its ill effects. Waste minimization efficiency is stated to be better achieved applying 3R’s in a hierarchical order- Reduce Reuse and Recycle [9].

REDUCE:

The best way to manage waste is to not produce it. The first and most important step in cutting the amount of waste you eventually send to landfill is reducing the quantity that you actually produce in the first place.

Reducing the amount you buy is the most significant of all the options to manage waste. The key is to only purchase goods that we need and in the right amount. If we never generate products in the first place, we do not have to extract raw resources, manufacture goods from scratch, come up with shipping materials, utilize additional resources for shipping, and then devise ways to dispose of them [4].

- Avoid over-packaged goods, especially ones packed with several materials such as foil, paper, and plastic. They are difficult to recycle, plus you pay more for the package.
- Avoid disposable goods, such as paper plates, cups, napkins, razors, and lighters. Throwaways contribute to the problem, and cost more because they must be replaced again and again.
- Buy durable goods - ones that are well-built or that carry good warranties. They will last longer, save money in the long run and save landfill space.

- At work, make two-sided copies whenever possible, Use electronic mail or main bulletin board, Use cloth napkins instead of paper napkins, Use a dish cloth instead of paper towels.

REUSE:

The idea of being wasteful makes many people uncomfortable. Yet most of us continue to waste because we can't think of anything better to do with last year's phone book, draperies that are too short, or a closet a favourite pet. We are conditioned to think of things that are old, empty, worn, broken, ugly, or marred as useless, so we throw them away without much thought about the consequences. Most Americans buy far more than they can use effectively, as evidenced by bulging attics and garages.

The process of reusing starts with the assumption that the used materials that flow through our lives can be a resource rather than refuse. Waste, after all, is in the eye of the beholder. One person's trash is another person's treasure. If we really look at things we are throwing away, we can learn to see them as materials that can be reused to solve everyday problems and satisfy everyday needs. Most of us, however, haven't even begun to exploit the resources in our trash. Once you have made up your mind to use trash for positive uses, you can begin to brainstorm and generate ideas. Reusing saves money, conserves resources, and satisfies the human urge to be creative [4].

- Reuse products for the same purpose. Save paper and plastic bags, and repair broken appliances, furniture and toys.
- Reuse products in different ways. Use a coffee can to pack a lunch; use plastic microwave dinner trays as picnic dishes.
- Sell old clothes, appliances, toys, and furniture in garage sales or ads, or donate them to charities.
- Use re-sealable containers rather than plastic wrap.
- Use a ceramic coffee mug instead of paper cups.
- Reuse grocery bags or bring your own cloth bags to the store. Do not take a bag from the store unless you need one.

RECYCLE:

Recycling is a series of steps that takes a used material and processes, remanufactures, and sells it as a new product. Begin recycling at home and at work

- Buy products made from recycled material. The recycling symbol means one of two things - either the product is made of recycled material, or the item can be recycled. For instance, many plastic containers have a recycling symbol with a numbered code the identifies what type of plastic resin it is made from. However, just because the container has this code does not mean it can be easily recycled locally.
- Check collection centres and curbside pickup services to see what they accept, and begin collecting those materials. These can include metal cans, newspapers, paper products, glass, plastics and oil.
- Consider purchasing recycled materials at work when purchasing material for office supply, office equipment or manufacturing.
- Buy products made from material that is collected for recycling in your community.
- Use recycled paper for letterhead, copier paper and newsletters.

SOME STUDY OF LITERATURE

Jibril Dan azimiJibril, Ibrahim Bin Sipan, MaimunahSapri at el (2012),Thousands of solid waste tonnage is generated daily in Higher Educational Institutions (HEI's). The significance of integrated solid waste management systems in recent years increased due to the growing number of populations within HEI's and problems of waste management issues affecting the daily lives of people and the impact on the environment. Several promising approaches have been developed in the past few years; one of them is the 3R's system in Integrated Solid Waste Management Hierarchy. 3r's (Reduce, Reuse, and Recycle) system were proposed with priority on source minimization, intermediate treatment then final disposal and enlighten the waste generators to practice 3r s as a substantial measure to reduce, reuse and recycle the generated solid waste there all day. This paper critically analyses the 3R's strategic approach for the awareness amongst the waste generators within HEI's to minimize the solid waste generated within HEI's and reduce the running cost of the system, for effective and efficient waste management in HEI's.

Dr. AhmedulHyeChowdhury, Niaz Mohammad, Md at el (2014),Waste generation and its management are being widely debated across the globe and in recent years, it has become a niche spot. Both the developed and developing countries are trying to find out new ways for climate change mitigation and adoption options respectively. Global climate change is a burning issue and presently Bangladesh is facing grave situations. A large proportion of the waste is not properly managed and dumped in unplanned sites that are creating severe environmental hazards. Gradually, it can be replicated in each urban and rural centre and growth points of Bangladesh can play a vital role in climate change mitigation. Implementation of the 3Rs will have a profound socioeconomic impact, also modern 3Rs (Reduce, Reuse and Recycle) strategy acts as a sustainable and socioeconomic option for climate change mitigation by reducing green house gas (GHG) emission from the municipal solid waste.

N. E Ali, H. C Sion (2014), the amount of solid-waste generated in Asian countries has increased tremendously, mainly due to the improvement in living standards, rapid developments in technology, growth in economy and population in the cities. Solid waste management is a global issue and major challenge facing Asian countries and neglecting its management may have negative consequences on the environment. Waste composition data proves the developed countries to have generated more recyclable materials while developing countries produce more organic and less recyclable waste such as paper, plastic and aluminium. In this regard, increase in number of landfills and disposal sites, will have an impact on GHG (greenhouse gas) emissions and pollutants to air and water. Alternative methods should therefore be taken to reduce the volume of waste. Most Asian countries have adopted the 3R's (reduce, reuse, and recycle) concepts in order to reduce solid waste and their governments have implemented laws and regulations in order to support this. Implementation of 3R's is the major contributor to the solid waste minimization and it can improve the quality of environmental sustainability and reduction of carbon dioxide emission in to the atmosphere. Based on our review, most of the countries practicing the 3R's concept in tandem with laws and regulations perform better than those that just practice the 3R's concept without any laws and regulations. The paper suggests that every country must focus on the laws and regulations relating to solid waste minimization so that it could be easily implemented as outlined.

CONCLUDING REMARKS

According to the brief study of the literature for integrated solid waste management (3R's) the following conclusion can be observed and the benefits are reviewed as follows:

- Minimize waste that needs to be disposed in centralized landfills, thus extending existing landfill capacity and reduce the environmental impact of disposal sites.
- Prevent pollution created by manufacturing new products or products made from virgin materials.
- Save energy in manufacturing, transportation, and disposal of products.
- Decrease greenhouse gas emissions, which contribute to global climate change.
- Conserve natural resources such as timber, water, metals, and fossil fuels.
- Reduce the need for land filling and incineration, which are expensive to operate and maintain.

Help sustain the environment for future generations.

REFERENCES

- [01] Asokan Pappu, Mohini Saxena, Shyam R. Asolekar, "Solid wastes generation in India and their recycling potential in building materials", Pg no 2311-2320
- [02] Bundela P.S, Gautam S.P, Pandey A.K, Awasthi M.K, Sarsaiya S, "Municipal solid waste management in Indian cities – A review", International Journal of Environmental Sciences, ISSN 0976 – 4402, 2010, Volume 1, No 4
- [03] Dr. Ahmedul Hye Chowdhury, Niaz Mohammad, Md. Rajibul Haque and Dr. Tafazzal Hossain, "Developing 3Rs (Reduce, Reuse And Recycle) Strategy for Waste Management in the Urban Areas of Bangladesh: Socioeconomic and Climate Adoption Mitigation Option", IOSR Journal of Environmental Science, Toxicology and Food Technology, 2014, Volume 8, Issue 5, PP 09-18
- [04] Fahzy Abdul-Rahman, "Reduce, Reuse, Recycle: Alternatives for Waste Management"
- [05] Jibril Dan azimi Jibril, Ibrahim Bin Sipan, Maimunah Sapri, Suleiman Aliyu Shik, Mona & Shahabudin Abdullah, "3R s Critical Success Factor in Solid Waste Management System for Higher Educational Institutions", Social and Behavioral Sciences, 2012 , Vol 65 PP 626 – 631
- [06] Kanthe V.N, Chavan P.G, " Solid Waste Used As Construction Material", IOSR Journal of Engineering (IOSRJEN) ISSN: 2250-3021 , PP 75-77
- [07] Md. Safiuddin, Mohd Zamin Jumaat, M. A. Salam, M. S. Islam and R. Hashim, "Utilization of solid wastes in construction materials", ISSN 1992 – 1950, International Journal of the Physical Sciences Vol. 5(13), pp. 1952-1963, 18 October, 2010
- [08] N. E Ali, H. C Sion, "Solid waste management in Asian countries: a review of solid waste minimisation (3r) towards low carbon", Earth and Environmental Science, 2014, Vol18
- [09] "National 3R Strategy for Waste Management", Department of Environment Ministry of Environment and Forests Government of the People's Republic of Bangladesh November 2009
- [10] <http://www.dec.ny.gov/chemical/8732.html>