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SOLID WASTE MANAGEMENT THROUGH 13RS IN SYLHET CITY

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ABSTRACT

In the rush towards urbanization and industrialization as well as with emerging consumption, many developing countries have witnessed the overflow of waste and depletion of the inexhaustible natural resources at an alarming rate. The purpose of this study is to assess the existing management system in Sylhet city and review the types of solid waste that can be used for renewable sources, with an aim to maximizing resource recovery and minimizing landfilling by implementing 13Rs. The study involves a structured questionnaire and interview encompassing 150 households from different socioeconomic groups (low, lower middle, upper middle and high) for data collection. In Sylhet, Sylhet City Corporation (SCC) is the only responsible organization for the collection and disposal of the solid waste though some community-based organizations (CBOs), Non-Governmental Organizations (NGOs) and private sectors are also working. The waste generation rate here is 0.48 kg/cap/day as per estimation. About 200-250 tons of solid waste is disposed of every day in the low lying land and Hawor, situated in Lalmatia, Mogla bazar in an uncontrolled manner. This situation has contributed clogging of drains resulting in localized flooding and unhygienic condition. Again the uncollected wastes are disposed of locally which results in drainage congestion, water pollution and degradation of the overall environment. Shortage of land for landfill is also a physical constraint here. The overall condition necessitates proper solid waste management. Implementation of the 13Rs will have a profound impact on this combat with a view to protecting the environment.

Keywords: *Solid waste, SCC, environment, pollution, 13Rs.*

1. INTRODUCTION

Bangladesh is the world's 11th most populous country (United Nations, 2017) and one of the fastest urbanized countries in Asia (Anon, 2004). Because of the rapid growth of population, unplanned urbanization, industrialization and economic development, many developing countries are facing a colossal challenge of managing municipal solid waste (Damghani et al., 2008). It is estimated that approximately 13,1332 tons of waste is produced each day in the urban areas of Bangladesh, which is above 4.86 million tons annually. From the growth of population and increase in per capita waste generation, it is estimated that this amount will grow up to 47,000 tons/day and nearly 17.2 million tons per year by 2025 (Sujauddin et al., 2008). Although improper solid waste management (SWM) is one of the most burning and serious environmental problems in Bangladesh, solid waste disposal is a challenging issue for a fast-growing city like Sylhet.

Inadequate waste disposal causes environmental degradation which in turn can be provoked by the contamination of surface and groundwater through leachates, soil contamination through direct waste contact or leachates, air pollution by waste burning, spreading of diseases by different vectors like birds, insects and rodents or the uncontrolled release of methane by anaerobic waste decomposition (Zurbrugg C., 2002). Again the illegally dumped uncollected waste in open spaces, water bodies or even roadside burning is

ascending serious threat to the environment. Developing countries are facing several major problems with the generated solid waste such as-

- Health hazard from uncollected waste,
- Health hazard from collected but poorly disposed of waste,
- Economic burden of waste disposal in towns and cities.

(Pearce D,Turner R.,1994).

Uncontrolled disposal of solid waste causes degradation of urban environment which has manifested the necessity of solid waste management in Sylhet city. Again a total number of nine natural drainage channels (locally called Chara) (Chowdhury R.J., 2005) are being filled up by the wastes from most of the households (situated along or near the Chara) as well as the street sweeping, which eventually affects the natural drainage system and the environment. Treating waste as a resource is the first step towards waste management and conserving resources (C. Visvanathan et al, 2007). US EPA has given emphasis on using 4R (reduce, reuse, recycling, and recovery) for achieving low use of raw materials but Bangladesh stressed on 3R (reduce, reuse and recycle) in the National 3R workshop held in February 2007 for minimizing solid waste (Chowdhury M.A.I., 2013). Afterward, 3R or 4R, other Rs such as refuse, repair, return, remanufacture, replace, renew, refill, recharge, reconditioning, recovery can be utilized to alleviate the solid waste according to Chowdhury M.A.I. (2013). An approach to implementation of these 13 Rs will have an inferential efficiency in managing and lessening the waste hazard.

Solid waste management is a worldwide problem. Many journals, books, conference papers, reports have revealed about solid waste management and resource recovery. To gain further knowledge about to solid waste management through Rs some of the studies are emphasized here.

The technical and methodical issues of solid waste management, as well as the non-technical and specific management of solid waste, have been detailed in a book by Chowdhury M.A.I., (2013). Also, solid waste minimization through Rs and cost and financial aspects of solid waste management are highlighted in this book. A study on the amount of recovery and recycling of wastes in Chittagong city was conducted and recommendation of promoting 3R strategy was made by R.B.Chowdhury et al., (2013).

The Department of Environment (DoE), Bangladesh has adopted a project on Reduce, Reuse and Recycle (3Rs) at some selected locations of both Dhaka and Chittagong city, where source segregation is a major issue (Nishita Ivy et al., 2013). A study of F. A. Samiul Islam (2016) stated that recycling can solve the unemployment problem offering an admirable environment. Moghadam et al, (2009) revealed in a study that, about 60% of MSW is transferred to the composting plant for recycling, rendering only 40% to be transferred to the dumping station. In India, various recyclable items which are readily marketable (paper, cardboard, plastics, glass and metal scraps etc.) are collected by the itinerant collectors, while the rag pickers and scavengers collect these items from the waste enclosures, platforms or the open dumps and earn their livelihood by selling them (Visvanathan, C. and Trankler, J., 2003). A recommendation of solid waste management system was made by a study of Esra Tınmaz and Ibrahim Demir (2005). Also, the comparison between the operating cost of the recommended management system and the market price of the recyclable materials was conducted in that study.

1.1 Problem Statement

In Sylhet, SCC has taken initiatives to manage solid waste by collecting, transporting and disposing of. But these practices are being challenged due to the uncontrolled collection system, inadequate space and increasing value of land. All the solid wastes are disposed of together without segregation. This is ultimately emerging a threat to the environment as well as to human health.

In the existing Solid Waste Management (SWM) system undertaken by SCC, some notified problems are:

- Inadequate service coverage,
- Operational inefficiency of services,
- Improper management of clinical (hazardous) waste.

The roadside collection system as shown in figure 1 creates nuisance to the pedestrian.

Figure 1: Roadside waste collection by SCC

Again the Lalmatia landfill is going to be completely filled up requiring new landfill sites, which is so uncertain due to the NIMBY (not in my backyard), BANANA (build absolutely nothing anywhere near anything), LULU (locally unacceptable land use) and NOTE (not over there either) syndrome (A.J. Morrissey, J. Browne, 2004) in the local community. Indigent management of solid waste results in intense urban, sanitary and environmental problems such as clogging of drains, emission of greenhouse gases, contamination of surface water, soil quality deterioration, deployment of infectious diseases, risk of explosion in landfill areas, groundwater contamination through leachate percolation, unpleasant odors as well as aesthetic aggravation (Pokhrel, D. and Viraraghavan, T., 2005). Reduction in waste before it is generated reduces the municipal and commercial cost involved in waste collection and disposal and also helps in protecting the local environment (NEERI, 1983). So, this study intends to develop the concept of 13Rs in order to solve the existing problems of solid waste management in Sylhet city like the requirement of sites for landfill, the overburden of increased amount of solid waste, cost of management, health and hygiene and finally detrimental environmental and sanitary conditions. In addition, it will also help to solve the unemployment problem by involving the poor people in resource recovery operations.

1.2 Study area, Sylhet city

Sylhet is a city in eastern Bangladesh, on the Surma River. It is one of the largest cities in Bangladesh. During the colonial period, Sylhet experienced rapid growth and expansion of the city. Sylhet was changed to a city corporation from a municipal board in 2001 and currently, the city is administrated by the Sylhet City Corporation. The latitude of the city is 24˚ 54'' North and the longitude is 91˚ 52'' East. It covers an area of 26.50 km^2 with a population of about 800,000 (Bangladesh Bureau of Statistics, 2015). Figure 2 shows the study area

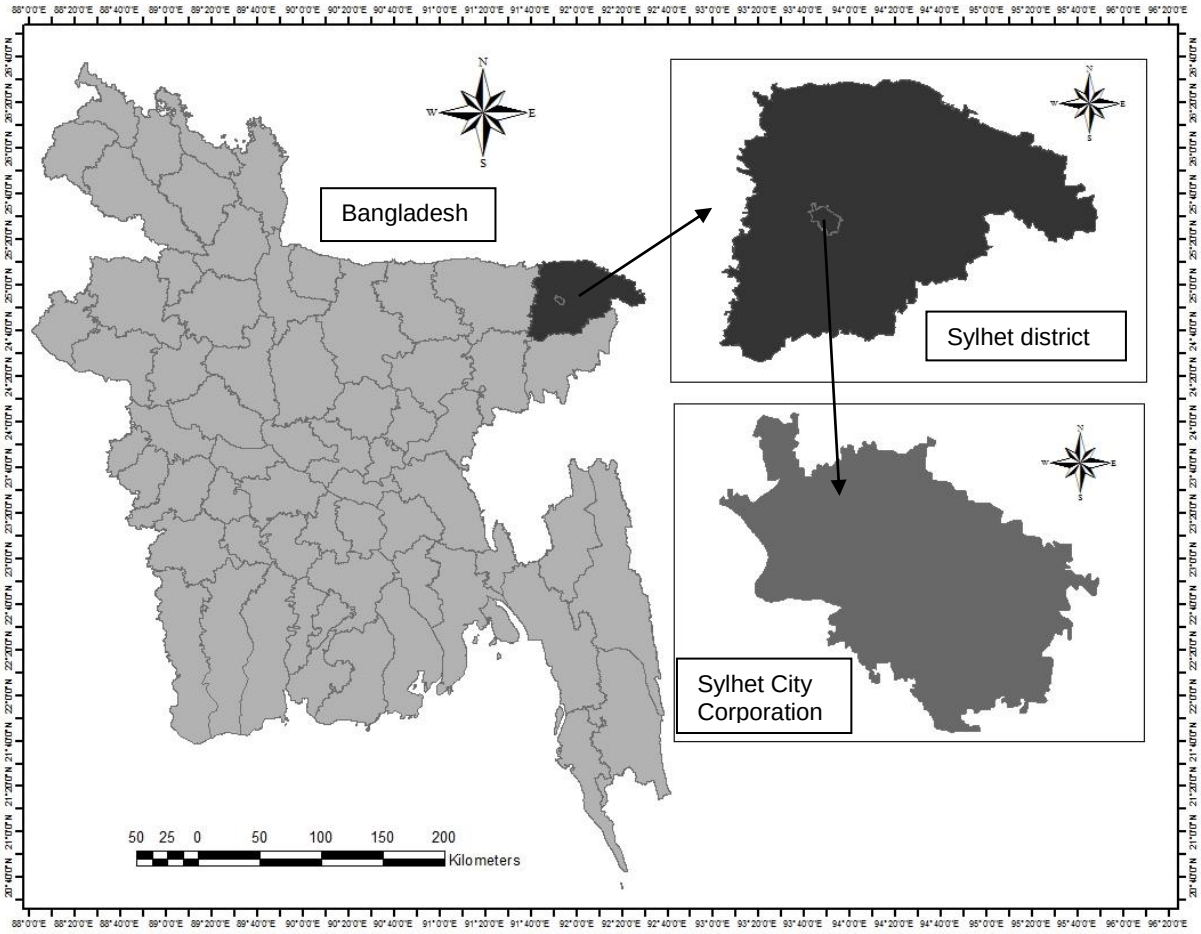

Figure 2: Study Area

1.3 Objectives of the study

General objective:

- To minimize the solid waste through 13 Rs.

Specific objectives:

- To investigate the waste generation rate and composition of wastes in Sylhet city,
- To assess the existing solid waste management system in Sylhet city,
- To evaluate the current practice of Rs in minimizing waste.

2. MATERIALS AND METHOD

2.1 Materials

A structured questionnaire with open-ended and close-ended questions has been designed, tested and modified to the final shape to collect data. The questionnaires were served, and information was collected correspondingly though in some cases face-to-face interviews were taken to get information.

2.2 Method

The study involves both primary and secondary data collection. Data were collected in order to estimate the waste generation rate and to investigate the composition of the generated wastes. By the time, the existing management system of solid waste and practice of using Rs are also assessed to meet the aim of this study by recording the views of the respondents. Then data was analyzed, and findings have been made.

2.2.1 Primary data collection

Primary data collection means practical field observation and field-based data collection. This includes Pilot study and Field study.

2.2.1.1 Pilot study:

To determine statistically sound household sample and to derive the socioeconomic information needed for the research, a pilot study of 150 households from 27 wards in SCC has been conducted. It is done to categorize the waste producers into groups viz. Low, lower middle, upper middle and high based on their income.

2.2.1.2 Field study:

The field study has been conducted from April 2017 to June 2017, using cluster sampling method representing four socioeconomic group of the pilot study, including low, lower middle, upper middle and high-income categories. A survey by questionnaire has been conducted to collect required data. Also, formal and informal interviews have been taken along with identification of problems, efficiency, and limitation of the existing management system. The field observation is depicted in figure 3 together with some existing waste segregation practice in figure 4.

2.2.2 Secondary data collection

Secondary data has been collected from SCC conservancy wings, related NGOs, CBOs and published papers.

2.3 Data analysis

The collected data has been overviewed and classified according to the contents. Amount of the generated waste and waste composition has been recorded. A representative sample of 100kg waste was taken and then each type of materials in the waste content was weighed to determine by implementing which R(s) it can be managed. Also, the percentage of waste can be processed through Rs has been determined.

Figure 3: Data collection

Figure 4: Existing practice of waste segregation (locally)

The study method is shown in figure 5.

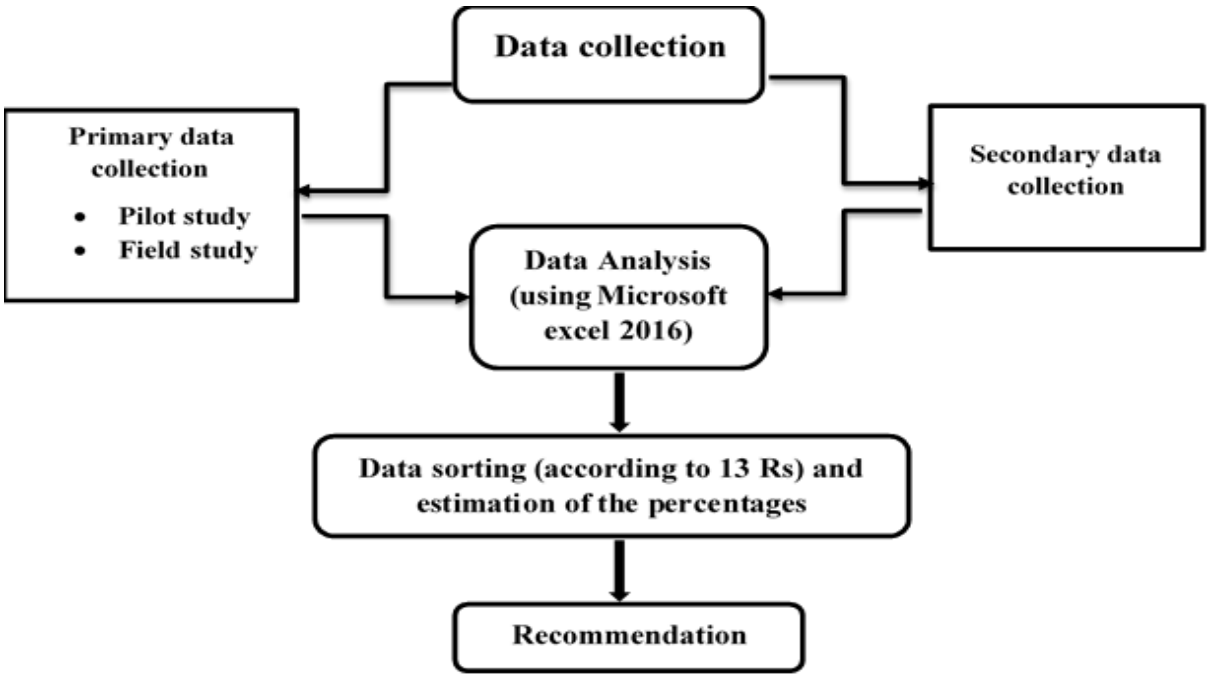

Figure 5: Flowchart of study method.

2.4 Concept of 13 Rs

13 Rs are nothing but the ways we can follow with a view to maximizing resource recovery and minimizing landfilling. These are refuse, reduce, reuse, repair, replace, remanufacture, reconditioning, recovery, refill, return, renew, recharge and recycle. By following these Rs, waste stream following landfill can be reduced to a great extent. Figure 6 shows the 13 Rs and those Rs are explained in table 1.

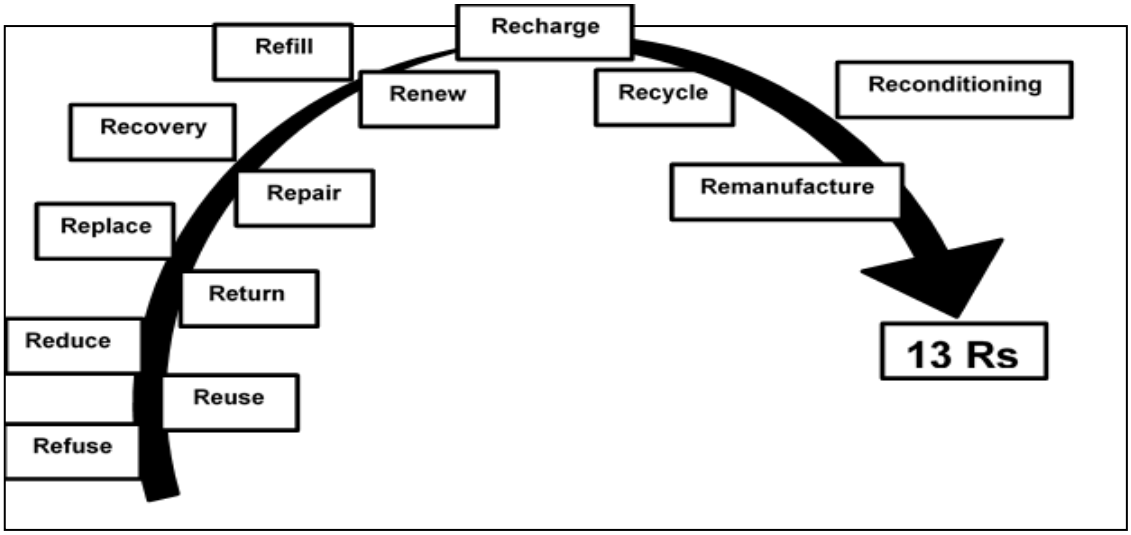

Figure 6: 13 Rs

Table 1: Explanation of 13 Rs

R type	Explanation
Refuse	Avoiding the practice of buying or using anything that becomes misuse. It is the first way to avoid the production of waste.
Reduce	Decreasing the amount of waste when mixed, of resources when sorted, and of materials when an action is applied. It minimizes the amount of waste to a great extent.
Reuse	Giving things or products a second chance by using them for their original or a different purpose more than once.
Repair	Minor renovation of the part or parts of any inactive industrial or utility plants. Repair makes a broken thing operational again.
Replace	Changing of non-working faulty parts of a plant, machine or equipment with the same parts from some type of another source.
Remanufacture	The practice of taking end-of-life goods and re-engineering them back to as-new or better condition.
Reconditioning	Second time or third-time use of anything by changing or altering the original or previous condition whatever it is deteriorated or destroyed by the use of first time.
Recovery	The process of retrieving and regaining products components and materials.
Refill	Replenishing or filling up anything to make it usable again.
Return	Returning used products to suppliers.
Renew	Conversion of waste to energy as an alternative waste management option
Recharge	Reviving or refreshing anything to get its full power for an extended period
Recycle	Reprocessing/s of used materials of an item converting into new product/s or a new raw material/s for use in a new product/s through a number of conversion/s.

3. RESULTS AND DISCUSSION

The main purpose of this study is to find out a feasible approach to solve the existing problems related to solid waste in Sylhet City. The main two parameters here are the waste generation rate per day and the percentage of wastes that can be managed by using one or more Rs. According to SCC conservancy wing, about 250 tons of wastes are collected every day from the 27 wards which are disposed of directly in Lalmatia landfill without any type of segregation. In this study, it is found that the waste generation rate is 0.48 kg/cap/day. In accordance with the finding, about 72.46 % i.e. 181.15 tons of wastes can be minimized by implementing 13 Rs. As a result, each day only 27.54 % i.e. 68.85 tons of wastes will need to be dumped in the landfill.

3.1 Existing waste management system

According to SCC, each of the 27 words has 2 collection vans which collect domestic waste from door to door. Again some CBOs have their own collection vans. All these vans collect waste from their assigned area and take them to the solid waste transfer station in Rikabi Bazar. There the wastes are filled in the trucks provided by SCC and directly taken to Lalmatia landfill without any segregation. It is worth mentioning that, there is a separate space in Lalmatia landfill for the dumping of medical waste and some of the wastes are segregated by the workers. Another noticeable thing is that in this landfill wastes are openly burnt either partially or completely to reduce the volume which is very detrimental to the environment. The overall existing system is shown in figure 7.

Figure 7: Existing system of waste management

3.2 Waste generation rate

Being not an industrial city, most of the generated wastes in Sylhet are of domestic, commercial and clinical types. The estimated waste generation rate here is 0.48 kg/cap/day including all types of wastes. The major portion of the daily generated wastes consists of 42% food waste, 11% metals, 6% paper and paper products, 5.7% plastic products, 5.5% glass, 4.2% tires and rubber, 3.8% e-wastes, 3.5% ceramics and tiles etc. as per estimation. The percentages of the generated waste with the composition are shown in figure 8.

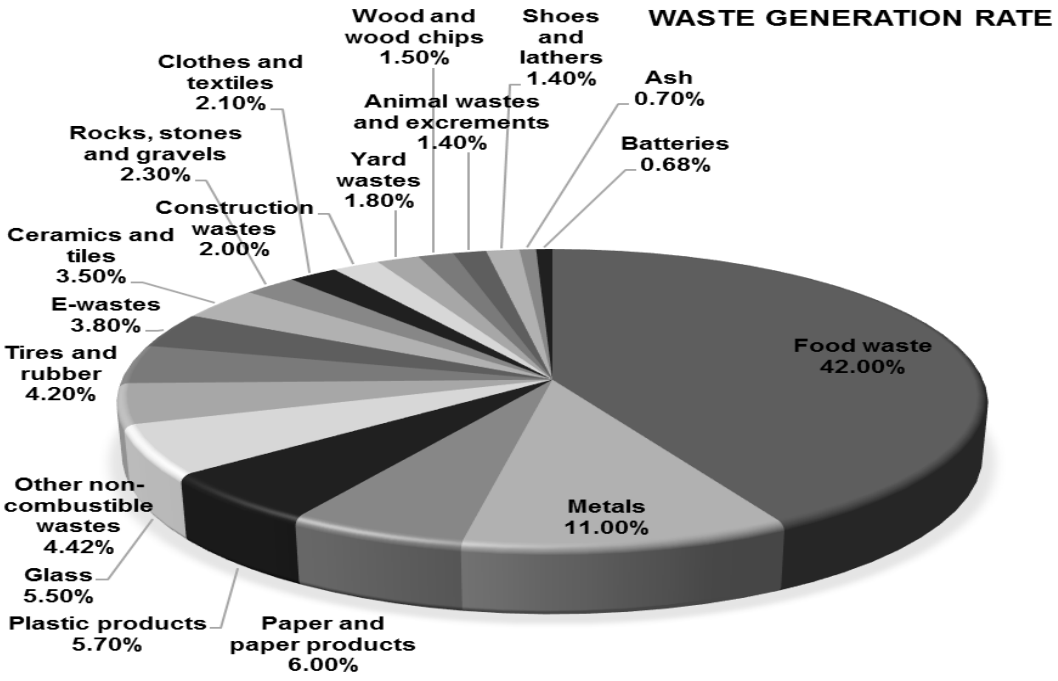

Figure 8: Waste generation rate per day

3.3 Waste minimization rate through 13 Rs

In the existing management system undertaken by the SCC, there is no systematic use of Rs. In fact, there is hardly any initiative to adopt the concept of Rs. But it is evident that, if this situation is continued, within a few years, a new landfill site will be required which is very difficult to find due to the increasing cost of land and public views towards the landfill. Though local hawkers collect wastes (paper, plastic, metal etc.) from door to door which is re-processed by some of the Rs, this percentage is not significant enough. In this study, it is estimated that 72.46% of the waste can be processed by using Rs, which will be very effective to meet the challenge of managing solid waste. The implementation of Rs in total manageable wastes is shown in figure 9.

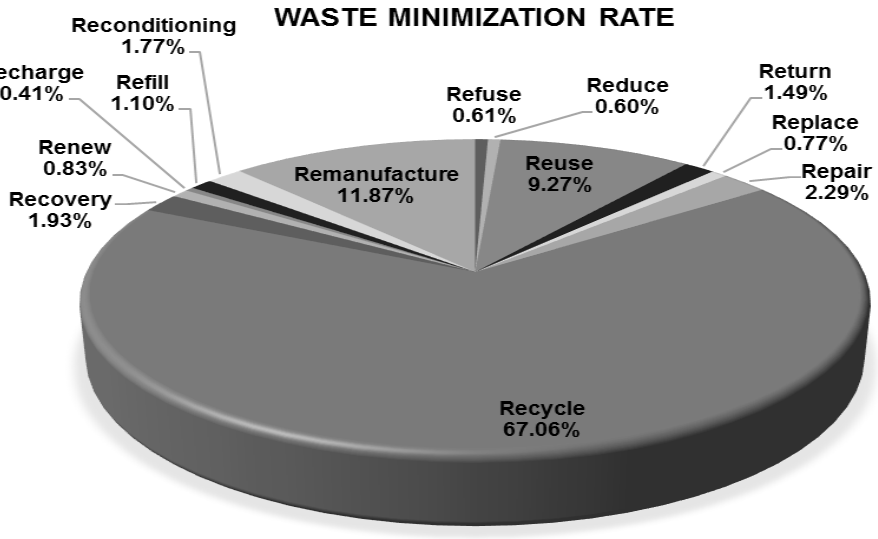

Figure 9: Waste minimization rate through 13 Rs.

3.4 Recommendation

Based on the findings here, some recommendations are made-

- As people are seemed to be reluctant to separate the wastes at source, it is tenacious to minimize the waste hazard. So, raising public awareness and ensuring public participation is the first action to achieve the goal.
- The uncollected wastes should be taken under collection scheme.
- SCC should undertake proper initiatives to implement the Rs.
- Study on financial viability and economic feasibility for cost-effectiveness of implementing the Rs is to be conducted.
- The success of adopting the concept of 13 Rs also depends on the marketing opportunity of the re-processed things. To improve the use of reusable materials, authorized people, as well as the entrepreneurs, should be encouraged to use the re-processed materials as raw material. Also, they must be informed about where and how they can find those materials.

4. CONCLUSIONS

The increasing rate of solid waste has a hostile effect on the environment as well as the social and professional life of the city dwellers, urban planners, developers and other concerned stakeholders. The waste generation rate here is 0.48 kg/cap/day as estimated which has increased than before. The study indicates that the existing waste management system in Sylhet city is not sufficient enough to manage the generated wastes. The reduction in the percentage of solid waste for disposal in landfill attained by segregating the waste contents and implementing the concept of 13 Rs is 72.46% (i.e. only 27.54% will be dumped in landfill). This will, in turn, reduce the volume of landfill required. With the technology available, the operating cost of implementing 13 Rs is less than the market price of the re-processed products which will add revenue. Some locally arrangements are made to segregate the wastes which can be enhanced to ensure the implementation of 13 Rs. Moreover, employment opportunity can be made by engaging the local folk in waste management through Rs which will solve the unemployment problem.

The result warranted that if the strategy of 13 Rs is accomplished, the problems regarding solid waste will be lessened to a great extent and the environment will be benefited a lot.

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