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PEOPLE'S PERCEPTION ON USING WASTE BINS IN REDUCE, REUSE AND RECYCLE (3R_s) PROCESS FOR SOLID WASTE MANAGEMENT (SWM) IN CHITTAGONG, BANGLADESH

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ABSTRACT

The concept of 3R_s has recently been adopted by the Department of Environment (DoE), Bangladesh under the “Climate Change Trust Fund” for reducing emission of Green House Gases (GHG_s) from unhygienic dumping of solid waste in Chittagong, Bangladesh. A purposive sampling method was used to select the study areas and the data were collected using a simple random sampling method wherein two different questionnaires were administered to the local households and waste dealers respectively. The household's survey was conducted to explore people's perception on adopting 3Rs concept for Solid Waste Management (SWM) in three selected areas of Mohammadpur, Suganda and Alfalah Gali of Chittagong city in 2012. Three types of 61,200 waste bins had been distributed among 20,400 families in 22 project areas, in which 40%, 55% and 35% respondents were interested to separate their waste as source segregation at three sampled areas respectively. 55%, 65% and 45% respondents were positive towards reducing waste in the same areas respectively, whereas 65%, 75% and 60% respondents were found positive on reusing waste in the areas respectively. 75%, 85% and 70% respondents showed positive response in recycling of waste. The collection of scrap iron, and its percentage, by local shop-keepers was maximum (1500 kg/day and 60%) as a recyclable material followed by paper (450 kg/day and 30%) and plastic (250 kg/day and 10%). Paper showed highest profit (28.57%) as a recyclable material followed by plastic bottle (18.75%), aluminium and scrap iron (14.29%). Proper practice of 3Rs concept in the urban areas could be the way of sustainable SWM, reducing the emission of GHG_s which is responsible for global climate change.

Keywords: Green-Yellow-Red colored waste bins, 3Rs, perception, SWM, GHG_s

INTRODUCTION

Solid Waste Management (SWM) is one of the most immediate and serious issues of greatest concern especially in the developing world. This is due to rapid urbanization taking place on an enormous scale in the cities of Asia, Africa and Latin America and also, cities currently account for two third of population growth in developing world [1]. With the unplanned urbanizations and rapid growth of middle class families with changing lifestyle, most of the Asian countries face great challenge of managing waste [2]. In Municipal Solid Waste Management (MSWM) of developing countries, five typical problem areas can be identified: i) inadequate service

coverage, ii) operational inefficiencies of services, iii) limited utilization of recycling activities, iv) inadequate management of non industrial hazardous waste, and v) inadequate landfill disposal [3]. Improper solid waste management is considered to be one of the most burning and serious environmental problems in Bangladesh [4]. Solid waste is irreparably degrading the urban environment and placing a serious threat to the natural resources [5]. The environmental degradation caused by inadequate waste disposal can be aggravated 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 [3].

Bangladesh is the world's seventh highest populated country and one of fastest urbanized countries [6]. But with the conventional system of collection, transportation and crude dumping of solid waste, municipal areas of Bangladesh are generally facing rapid deterioration of environmental and sanitary condition. Municipal services in most cities and towns are already over-burdened, and simply cannot meet the growing demand for municipal services resulting from unhygienic in the neighborhoods [7]. It is estimated that approximately 13,332 tons of waste is produced per day in the urban areas of Bangladesh, which is over 4.86 million tons annually. It is projected that this amount will grow up to 47,000 tons/day and close to 17.2 million tons per year by 2025, due to growth both in population and the increase in per capita waste generation [10]. But waste collection rate ranges from 44.30% to 76.47% in major cities [8]. Chittagong city is the second largest and commercial capital city in Bangladesh. The average generation of solid waste in the urban areas of Chittagong is about 0.5kg/person/day and 1550 tons per day [9]. The solid waste generation of the urban areas in Chittagong city is increasing proportionately with the growth of its population, which is posing serious threat to the management and disposal systems [10]. The above mentioned problem can be remedied and waste can be turned into resource if it is handled and managed in an appropriate and proper way. It is evident that only a strategy, Reduce, Reuse and Recycle (3Rs), could play a major role in terms

of managing waste and conserving natural resources [2]. The 3Rs have been considered to be a significant issue for waste management and a way of promoting ecological balance through conscious behavior and choices for solid waste management [11]. The concept 3Rs can solve the existing problems of solid waste management like requirement of sites for landfill, overburden of increased amount of solid waste and detrimental environmental conditions.

In this regard, these three options of waste management should be followed in a proper way with cooperative involvement of government bodies, City Corporations, Non Government Organizations (NGOs), Community Based Organizations (CBOs) and local people. 120,000 urban poor from the informal sector are involved in the recycling trade chain of Dhaka city and 15% of the total generated waste in Dhaka (mainly inorganic) which amounts to 475 tons/day are recycled daily [8]. Recently, the government of Bangladesh has been implementing a project commonly known as 3Rs pilot project in two main cities- Dhaka and Chittagong. The purpose of implementation of the project is to tackle climate change by reducing green house gas emissions from solid waste. If the project is successfully implemented, then it will set a great example for proper management of solid waste. The present study was undertaken to find out the people's perception on using three types of waste bins (Green color for bio-degradable waste, yellow color for recyclable waste and red color for hazardous waste) in Reduce, Reuse and Recycle (3Rs) process for solid waste management of port city, Chittagong, Bangladesh.

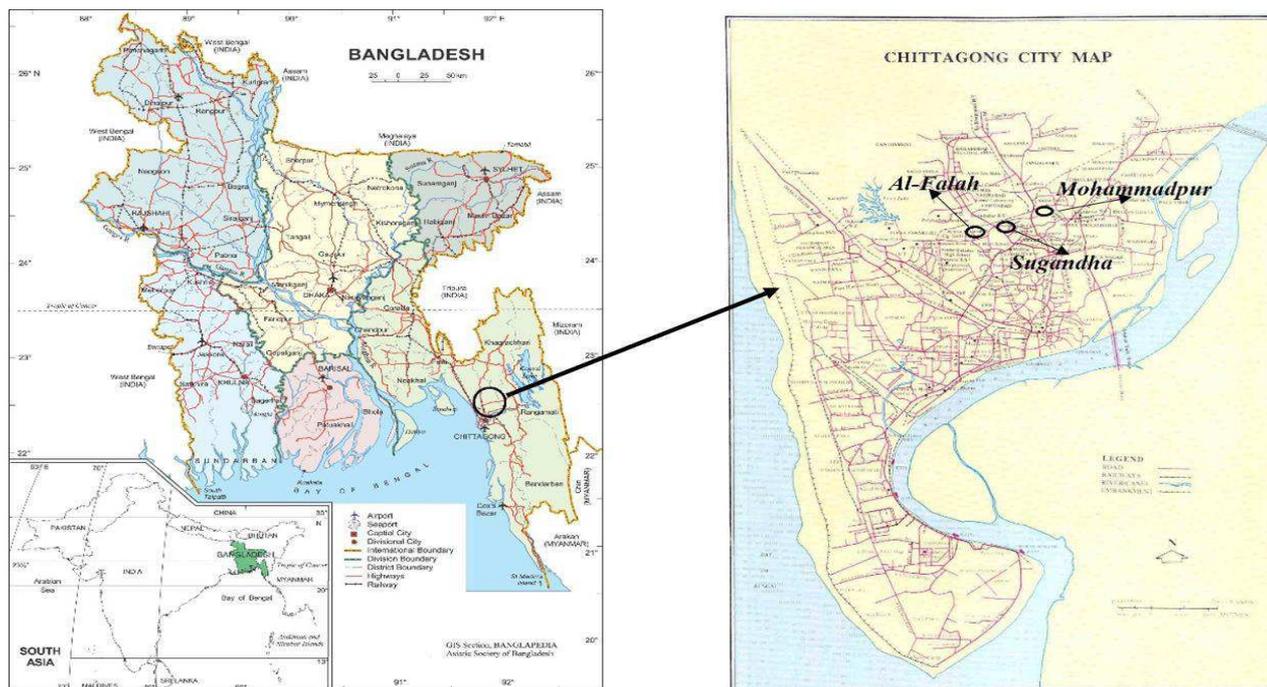


Figure 1: Map of Chittagong showing study area under 3Rs pilot project

STUDY APPROACH

Chittagong is the port city and commercial capital of Bangladesh which is located in between 22.3636° N latitude and 91.8033° E longitudes. The primary data from two different sources were utilized in the research study: questionnaires for household survey and waste dealers involved in recycling. A purposive sampling method was used to select the study area and the data were collected using a simple random sampling method wherein two different questionnaires were administered to the local households and waste dealers (shop-keepers) respectively. After sampling design, the study was conducted in three selected areas of Chittagong city namely Mohammadpur, Suganda and Alfalah Gali from 22 project areas under the Reduce, Reuse and Recycle (3Rs) pilot project by Department of Environment (DoE), Bangladesh (Figure 1).

Two different questionnaires were designed, tested and modified to collect data on the use of three colored waste bins (Green for biodegradable waste, yellow for recyclable waste and red for

hazardous waste) for assessing households' attitudes toward reduce and reuse of waste, and to assess recycling done by informal sector. Moreover, the questionnaires included socio-economic and daily solid waste traits, households' attributes to use waste bins for source segregation, supplied by Department of Environment (DoE), Bangladesh. A total of 60 households containing 20 households from each sampled area were surveyed randomly. 15 shops (waste dealers) have purposively been selected and surveyed from Mohammadpur area only to know the status of recyclable materials supplied from the households. Before collecting primary data, project activities under the 3Rs initiative involving distribution of three types of waste bins for the source segregation of solid waste was examined and relevant information and secondary data were obtained from the Department of Environment (DoE), Chittagong divisional office, Bangladesh. The collected data were then sorted and analyzed by computer software of MS Excel and SPSS.

RESULTS

Distribution of waste bins to the residents

For the purpose of source separation of waste, three types of waste bins (Green, Yellow and Red) have been distributed among 20,400 families of 22 project areas in Chittagong City Corporation (Figure 2). Among the 20,400 families involved in the 3Rs project, a total of 61,200 waste bins have been distributed by the NGOs (Non Government Organizations) with the supervision of Department of Environment (DoE), Bangladesh (Figure 3). Each family received three waste bins to keep three types of wastes- biodegradable (Green), recyclable (Yellow) and hazardous waste (Red). The residents of Mohammadpur (2,695 families) received maximum number of waste bins (8,085 waste bins), whereas residents of Sanonda residential area (255 families) received minimum number of bins (765 waste bins) (Figure 2 and 3).

Perception of the respondents on using waste bins at source

The households of the respondent were surveyed asking their perception to the use of waste bins for the purpose of source separation of waste. The respondents of Suganda residential area were found more positive towards source separation than other two sampled areas. Almost 55% of the respondents in Suganda residential area separate their waste in the three different bins distributed by DoE, whereas 40% of the respondents in Mohammadpur area and 35% of the respondents in Alfalah Gali area constitute those that use the waste bins to separate their waste. On the other hand, respondents of Alfalah Gali were found more negative towards source separation than the other two areas. 65% of respondents in Alfalah Gali area do not separate their waste, whereas 60% of respondents in Mohammadpur area and 45% of respondents in Suganda do not separate waste at source of origin (Figure 4).

Respondents' perception on Reduce, Reuse and Recycle

The household's opinion on reduce, reuse and recycle were recorded from the respondents of Mohammadpur, Suganda and Alfalah Gali area. The respondents of Suganda were found more positive about 3Rs (Figure 5). The respondents of Suganda (65%) showed highest positive attitude towards reducing waste followed by Mohammadpur (55%) and Alfalah Gali (45%) respectively, whereas 75% of the respondents in Suganda showed positive attitude towards reusing the waste followed by Mohammadpur (65%) and Alfalah Gali (60%) respectively. In case of recycling, the respondents of Suganda (85%) showed positive attitude followed by Mohammadpur (75%) and Alfalah Gali (70%) respectively (Figure 5).

Estimation of average quantity and composition of recyclable waste in sampled shops

Among the recyclable materials, the average quantity of scrap iron collected and its percentage (1500 kg/day and 60%) were found maximum in comparison to paper (450 kg/day; 30%), plastic (250 kg/day; 10%), aluminum (55 kg/day; 2.20%) and copper (12 kg/day; 0.50%) respectively (Figure 6). On the other hand, profit from the selling of paper was more (28.57%) than plastic (18.75%), scrap iron and aluminium (14.29%), and copper (9.89%) respectively (Figure 7).

Analysis of 3Rs approaches adopted by Department of Environment (DoE)

The Department of Environment (DoE), Bangladesh has adopted a project on Reduce, Reuse and Recycle (3Rs) where source segregation is a major issue (Figure 8). The DoE has taken initiatives to distribute three types of waste bins among the households for separating the waste as biodegradable, recyclable and toxic substances (Figure 8). The approach of 3Rs

adopted by DoE is in operation at some selected locations of both Dhaka and Chittagong city where the respondents showed positive attitudes towards the use of the three types of waste bins as source segregation.

DISCUSSION

It was found that 45%, 35% and 55% people are not interested in reducing the waste in Mohammadpur, Suganda and Alfalah Gali areas respectively. Regarding the reuse of waste, almost 35%, 25% and 40% respondents were found negative in these three areas respectively. In case of recycling, almost 25%, 15% and 30% respondents were found negative in Mohammadpur, Suganda and Alfalah Gali respectively. Considering profits from recycling found from shops surveyed, the materials which are more profitable (scrap iron, paper, aluminium and plastic) should be recycled in more quantities. For that purpose, recycling center near source of waste can be introduced under the 3Rs project. Human waste, municipal solid waste and industrial waste are the three major sources of environmental pollution in Bangladesh where the most serious concern is the crude open dumping of solid wastes in low lying areas leading to potential surface and groundwater contamination [12]. If a proper plan for solid waste management is not taken for the growing megacities of Dhaka and Chittagong, severe pollution problems and degradation of the urban environment appears to be the inevitable outcomes [13]. The qualities of refuse characteristics vary not only from city to city, but within the city itself and also seasonally [14]. The per capita solid waste production in cities like Bombay, Calcutta, Madras and Delhi ranges from 0.45 to 0.6 kg/day, however it is least in qualities when compared to American cities [15] where reducing the waste before it is generated is a logical way to save cost as well as natural resources. It reduces the municipal and commercial cost involved in waste collection, disposal and helps in protecting the local environment where source reduction is a part of community waste management plan [15]. In case of recycling, source reduction protects human health and the environment by removing the harmful substances from the waste stream, it also

conserves natural resources by reducing the demand for raw materials [15]. Paper and paperboard form the second largest component of domestic solid waste and contribute more than 13% of the total which is one of the most profitable activities [16]. The average component of metals in the solid waste stream is around 2%; ferrous metals like irons, steel and nonferrous metal like aluminium, copper, zinc, lead and silver, etc exist in the waste stream [16]. In the USA, 30.1% of the municipal solid waste is recovered and recycled or composted, 14.5% is burned and the remaining 55.3% is disposed off in landfills [14]. The per capita garbage production in the USA is 680 kg/person in the year 1996, which is two to three times more than in most of the developed countries and many times than in developing countries like Bangladesh [17, 18]. In 2000, recyclable materials found in the USA are batteries (96.4%), paper and paper board (45.4%), and yard trimming (56.9%) [14]. By the year 2012, the collected recyclables potential was about 1.2 million tons per month in Brazil which could avail opportunities to 733,594 waste collectors or alternatively create 1.8 million family grants [19]. The Plastic Solid Waste (PSW) presented the challenges and opportunities to societies regardless of their sustainability awareness and technological advances [20]. In 1990, each individual in the world produced an average of 250 kg of Municipal Solid Waste (MSW) generating in total, 1.3×10^9 tons of MSW, and ten years later, this amount almost doubled approximately at 2.3×10^9 tons [21]. Solid waste management is a challenge for the cities' authorities in developing countries mainly due to the increasing generation of waste, the burden posed on the municipal budget as a result of the high costs associated to its management, the lack of understanding over a diversity of factors that affect the different stages of waste management and linkages necessary to enable the entire handling system functioning [22]. Increase in population, booming economy, rapid urbanization and the rise in community living standards have greatly accelerated the municipal solid waste generation rate in developing countries [23]. In 2009, the residential waste

generation rate was 0.28Kg/person/day and the average household waste generation was 1.48 kg/day in Chittagong City of Bangladesh where the household solid waste comprised of nine categories of wastes with vegetable and food waste being the largest component (72%) [24].

The commercial solid waste generation rate was found to be 0.44kg/person/day and the average commercial unit generated 3.61 kg of waste per day where vegetable and food waste was the highest (35%) followed by packaging material (14%) and plastic, polythene, rubber (13%) [25].

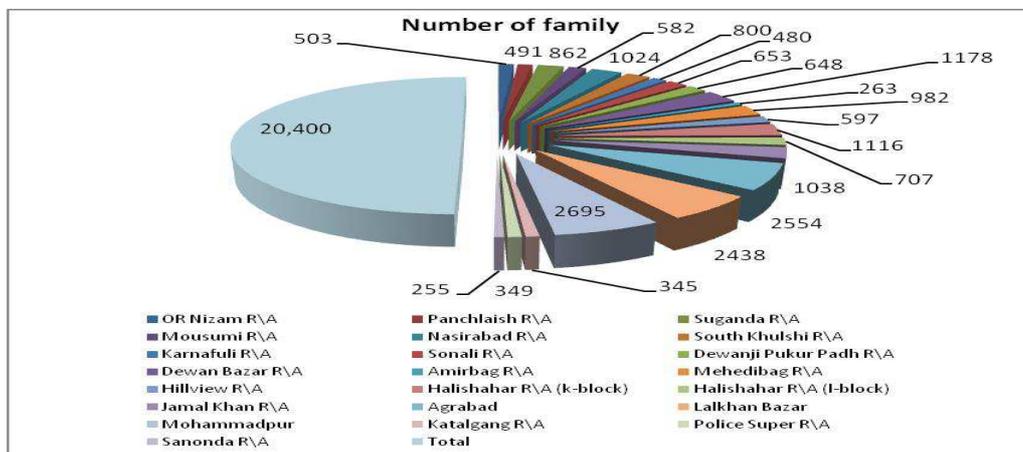


Figure 2: Number of families that received waste bins for source separation of household wastes

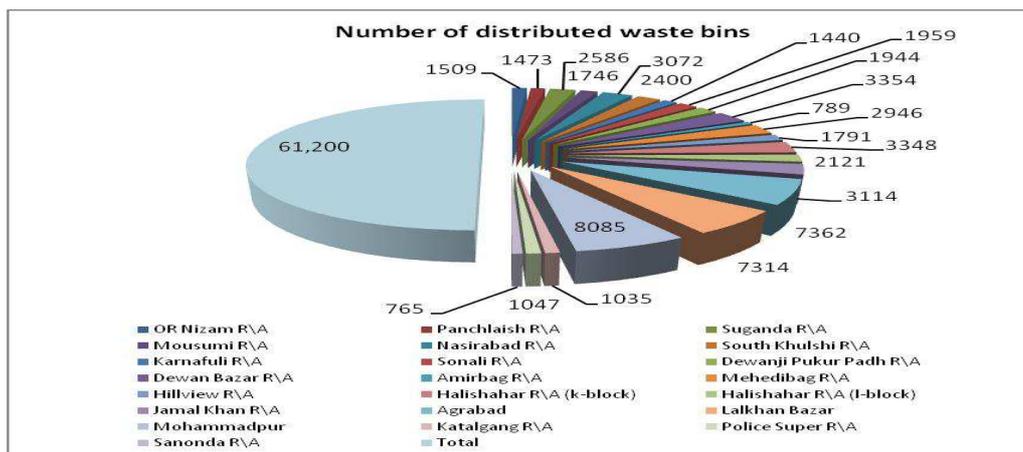


Figure 3: Distributed waste bins among families in the project areas

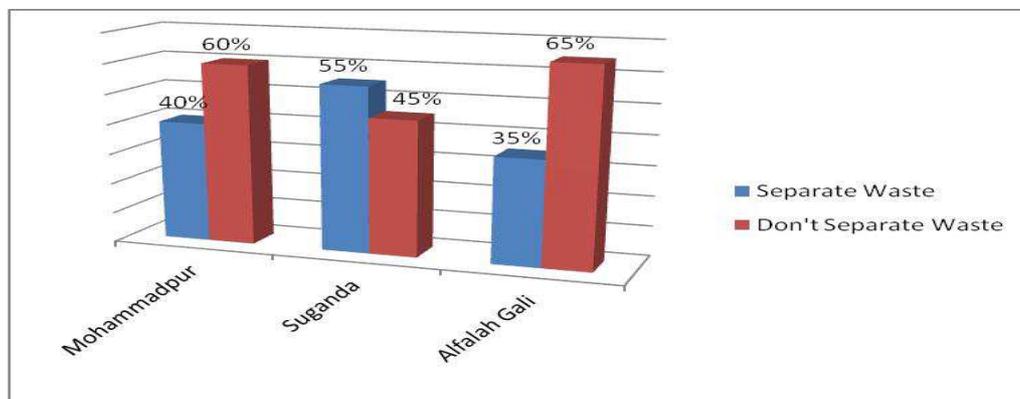


Figure 4: Respondents' opinion on the use of waste bins for source separation in sampled area

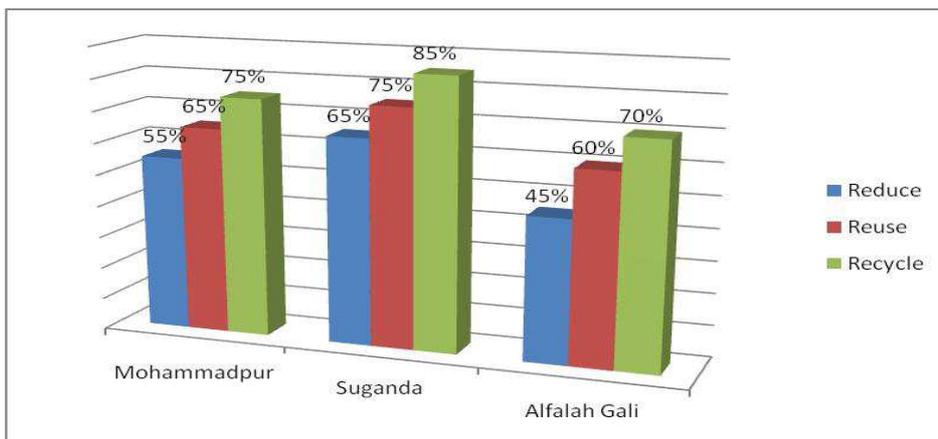


Figure 5: Households' opinion on reduce, reuse and recycle of household waste in sampled area

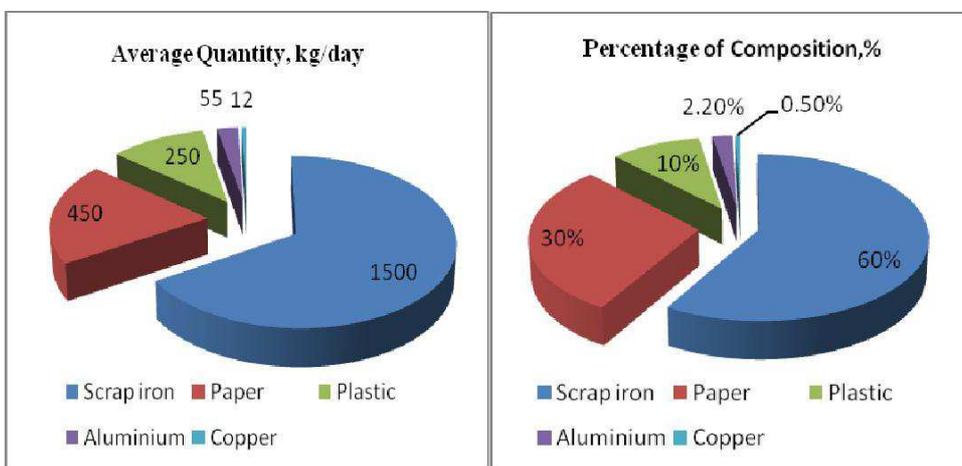


Figure 6: Average quantity and percentage of recyclable waste from the sampled area

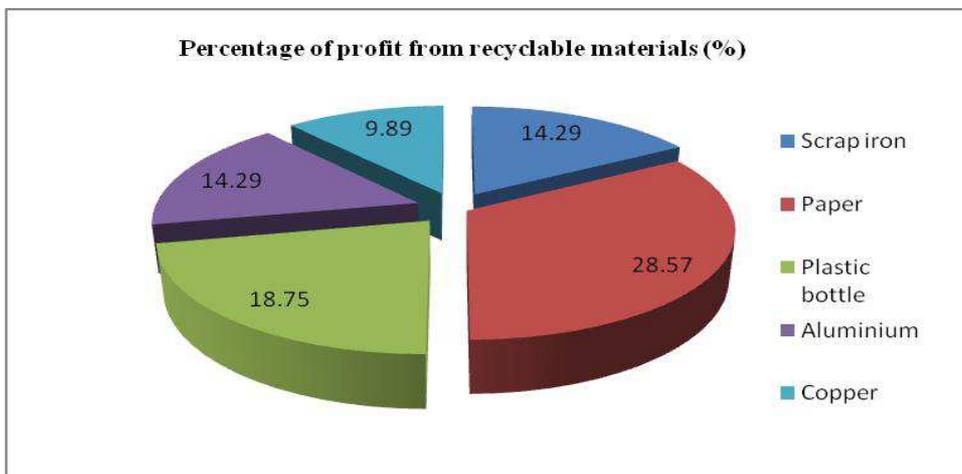


Figure 7: Profit obtained from recyclable materials

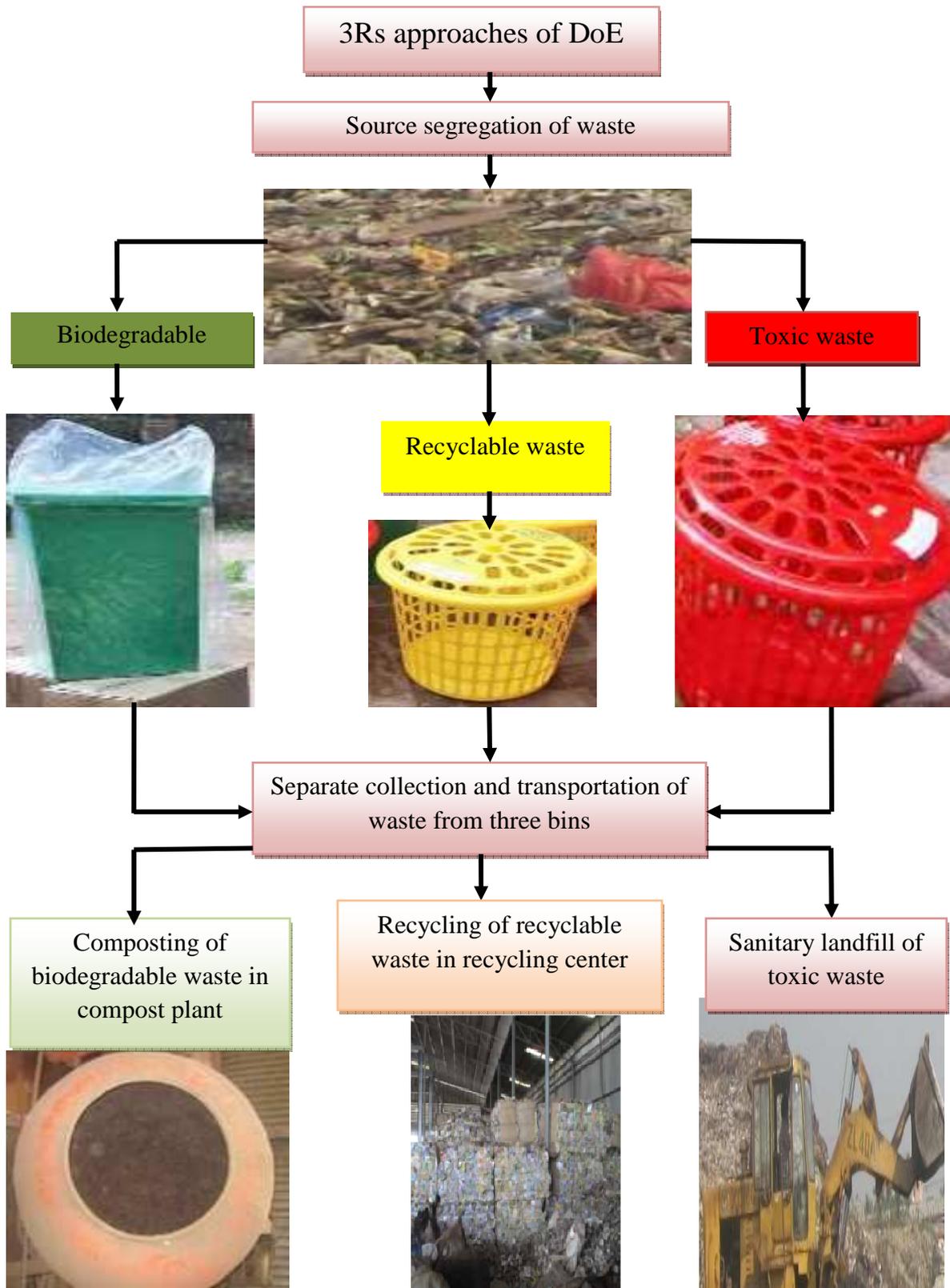


Figure 8: Flow diagram of 3Rs approaches of waste management adopted by Department of Environment, Bangladesh

CONCLUSION

In Bangladesh, the unhealthy condition of solid waste is more severe. The condition will turn into a more serious issue with the increase in urban population, if proper initiatives on solid waste management are not taken soon. It is very difficult to handle the large volume of waste in different cities and town without proper concern and maintenance by the government bodies, local bodies and NGOs involved in waste management. Moreover, the involvement of local people and communities is also important. Therefore, proper waste management is possible where 3Rs process is important in turning wastes into resources. The 3Rs project conducted by Department of Environment (DoE) has communication gaps lacking and inadequate co-ordination among City Corporation, local bodies and communities. Moreover, awareness build up between communities is also necessary. If these gaps and inadequacies can be overcome, then the initiative will be a good example of solid waste management. The households who receive waste bins should be motivated properly to keep waste separately in three colored bins (Green for biodegradable waste, yellow for recyclable waste and red for hazardous waste). It is also a matter of great concern to focus on separation, collection and distribution of wastes from the bins through the encouragement of individuals, local organizations, committees and City Corporation. For that purpose, distribution of waste bins and maintenance of these three types of bins in every household should also be monitored by the Department of Environment (DoE), Bangladesh, to ensure sustainable solid waste management and hence, reducing the emissions of green house gases.

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