Sustainable Management of Household Solid Waste of Urban Area: A Case Study on Kushtia Municipality in Bangladesh

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Abstract

Household solid waste management is a problematic issue in the urban area. Urbanization, improper management approach, and limited funding are the main barrier for achieving these difficulties. The main objectives of this is to examine the types and current amount of wastes generated, assessment of existing solid waste management system and finally suggested a sustainable management system of household solid waste for municipal area. Total 100 respondent answers were collected randomly from 10 wards in the kushtia municipal area through a defined questionnaire. Filed observation and informal discussions also conducted municipality worker, authority and others for knowing the existing management system. Qualitative field data represent that about 31% households produced 4-5kg waste per day and the majority percentages were organic waste (55%). Owing to unawareness about 79% households was not segregated their waste at home and 56% households performed their waste collection activates due to lack of municipal worker facilities. Though 63% wastes were stored in the municipal dust bin, but 25% waste was thrown on the road side and 12% were anywhere. Sixty six percentage wastes were transported by Small open pick up. Open dumping (87%) were common as a result various types of problems (odor problem 54%, unhygienic condition (23%), the insect problem (13%) and footpath blockage 10%) were faced by urban dwellers. Results drawn from this research and suggested a sustainable management system will be useful for a municipal authority and planners, for proper management of solid waste and environmental sound city management.

Keywords: Household, Solid waste, Existing Solid Waste Management, Sustainable Management, Kushtia Municipality.

Introduction

Solid wastes include various types of wastes which area produced from our daily activities. In the Residential area household wastes production are depend on following factors such as, family size, behaviors and food growing season, and living style[1,2]. Urban population and mechanization have been increasing rapidly and these are creates large amount of municipal solid waste which have an adverse effect on environment, daily life of urban peoples, and other stakeholders[3], which is a big challenge for sustainable urban development[4].

In the Bangladesh solid waste generation during the last decade of the previous century has been increased enormously[5], per capita solid waste generation is about 0.5 kg /day whereas only 0.2 kg/day of them is carried to the final disposal and rest is disposed-off locally[6] due to lack of inspiration, awareness, lack of manpower, insufficient materials and support, on the other hand about 40-60% of wastes are not properly stored, collected or disposed[7,8]. This result is uncollected waste on roads, canals, river and other public places[9]. It responsible for our environmental degradation (fire hazards, odor nuisance, atmospheric and water pollution, aesthetic nuisance losses), health problems and economic losses[10]. So it has become a more challenging issue for the future days. Now, sustainable Solid waste management system is necessary to ensure environmental safety and sustainable development in the urban area[11]. The main objective of this study is to examine the types and current amount of wastes generated, assessment of existing solid waste management system and finally suggested a sustainable management system of household solid waste disposal for municipal area.

Methodology

Study Area: Kushtia municipality located in kushtia sadar upazilla[1] (23.9000°N, 89.1333°E) under Kushtia district[2] of Bangladesh (Figure-1). Detail information about the study area (Kushtia municipality[3]) is presented in Table-1.

Research Methodology: In this study combination methodology such questionnaire survey, informal discussion and field observation were used In order to accomplish the research's objectives. Observation was done by field walk in order to know the sources of wastes generation, types of wastes and dumping sites. Photographs were taken during the observation. Informal discussions were conducted with municipality worker, authority, non-government organization and the inhabitants living adjacent to the dumping sites in order to know the existing waste management system and its limitation.
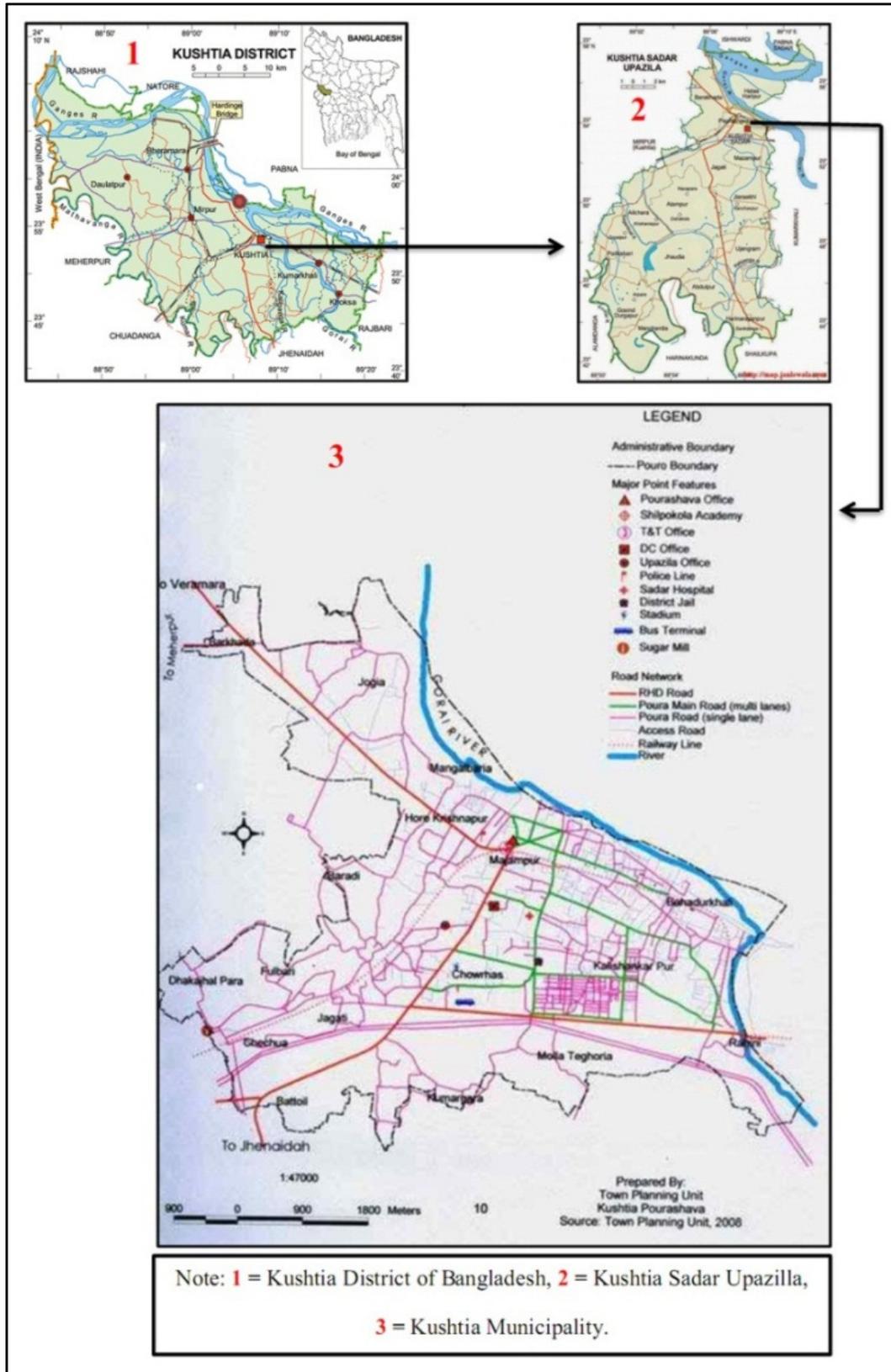
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Figure-1
Map of the Study Area

Table-1
General information about Kushtia municipality source[12]

Basic Information		Solid Waste Management	
Established	1st April, 1869	Solid waste production	25-30 tonnes/day
Total area(sq. km)	27.75	Municipality managed waste	18-22 tonnes/day
No. of wards	15	No. of Garbase Truck	08
Total population	2,38,065	Area of Dumping Ground	3 acre
No. of Household	54,765	No. of Transfer Station	03
Average Household size	4.5	No. of Dustbin	60
Population Density (per sq.km)	6,644 (8,308 with extension area)	Solid waste disposal site	2
Rainfall in kushtia (mm)	1467	Number of NGOs involve in SWM	1

Data were collected randomly from 100 households among 10 wards through structured and open-ended questionnaires. The key part of the questionnaire was waste generation status with existing management approach. The study was conducted from January 2014 to June 2014. Data about study area were collected from municipality office.

Results and Discussions

Waste generation and types: The total quantity of solids waste generation depends on various factors such as geographic location, season of the year, population characteristics, legislation, peoples attitude and it also change over time and with development, in the study area, it has been found 32% and 30% household produce respectively 3-4 kg and 4-5 kg waste per day and rest of produced 1-2 kg (27% households) and more than 5 kg (12% households) per day (Figure-2). In urban Bangladesh majority percentage of solid waste are originated from residential houses theses are includes food wastes, metal or non-metal waste etc.
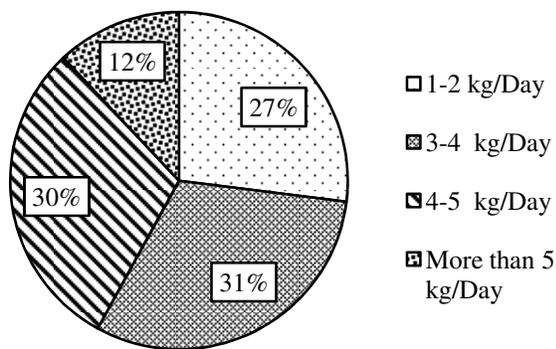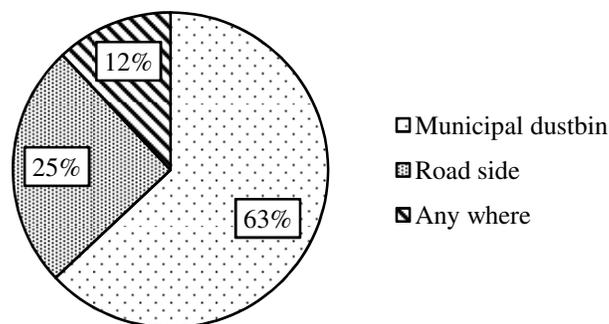

Figure-3
Waste Disposal Site in the Study Area

Study results revealed that 55% food waste, 17% plastic waste, 13% paper, 9% Metal, non-metal waste and paper products, 6% others waste produced in the study area (Table-2).

Existing system of household waste management in Kushtia Municipality: In the municipal area waste collection consists of two parts, in part one household dweller collect their home produced waste, then transfer in the municipality dustbin (temporary storage place) by own willingness. Another part is done by municipality authority such as door-to-door collection and transport the waste to dustbins/containers, by rickshaw vans. These solid wastes are collected for removing from the dustbins/containers and transported by open truck then these wastes are disposed in open dumping site (Figure-4).

Figure-2
Solid Waste generation in the study area

Table-2
Household Solid waste category in Kushtia municipality

Household solid waste category	Percentage (%)
Food Waste	55
Paper	13
Plastic, cloth, Elastic, Leather	17
Metallic, Non-metallic	9
Others	6

On site handling, segregation and storage: On site handling and storage is an important element of solid waste management. On site handing defined as activities associated with the handling of solid waste until they are placed in containers for storage before collection during on site handling different types of waste are separated by the waste producer. Separation at source has obvious advantages both in terms of costs and resource recovery. In the municipal area about 79% household never segregate their household waste (Figure-5) which not only a problem of waste management but also increase waste management cost and reduce the resource recovery rate.

On site storage of solid waste, facilitates the collection process, collection cost and ensures the maximum collection of solid wastes generated and discourages thrown of waste indiscriminately in the streets. About 68% household used plastic bin, 23% used small container and 9% used others (plastic bag, basket, etc.) for home produced solid waste storage at home (Figure-6).
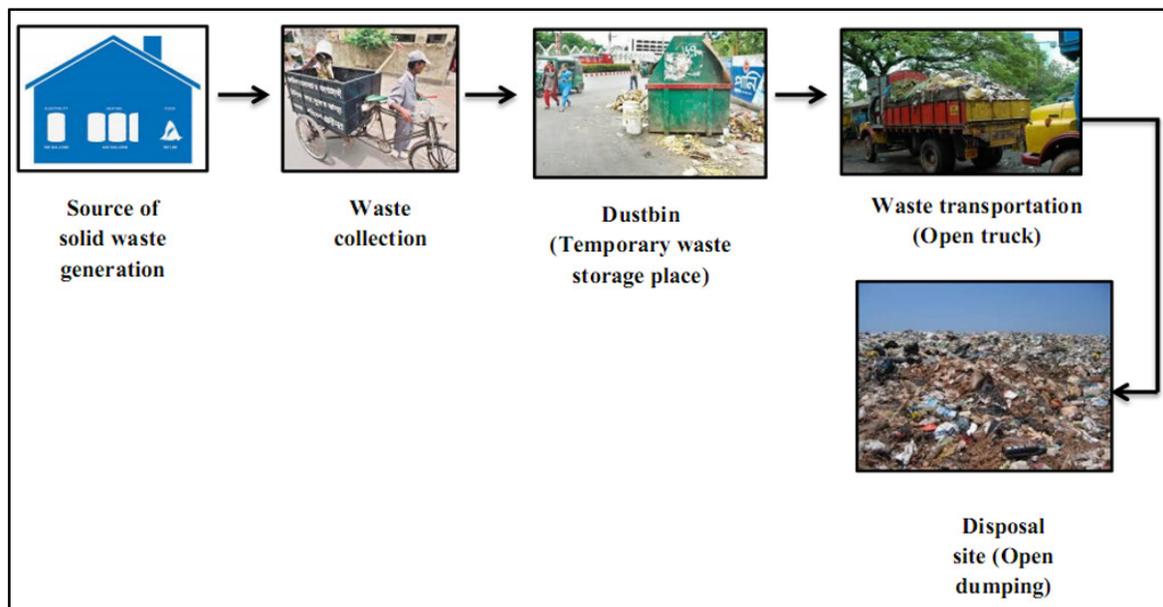

Figure-4
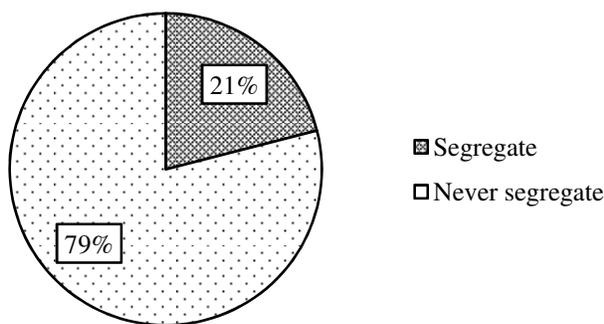**Pictures of various stages of waste Handling and Disposal**

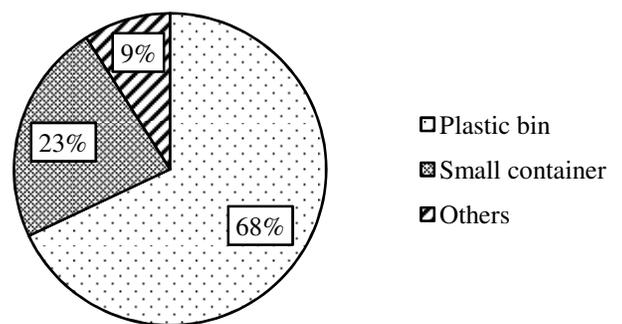**Figure-5**
Waste Segregation Percentage

Figure-6
Waste Storage systems

Collection and storage of solid waste: Collection of solid waste in urban area is very difficult and complex task because. In Kushtia municipality waste are collected by two steps, in first step households (56%) bring their garbage to the nearby public bins/containers located on the road side. Second part is municipality authorities collect waste (44%) from door-to-door[4] (100%) (Figure-7). The primary reason is that the generation of solid waste is a diffuse process that occurs in a variety of places, including individual homes, multi-storied apartment buildings, etc. With the increase of the quantity of solid waste the collection task becomes even more critical because of the high cost of fuel and labour. It is estimated that 60-80% of the total cost of solid waste management is spend on the collection phase alone on the other hand municipality authority has lower budgets for waste management projects. The For temporary waste storage 63% used municipal dustbin, 25% used road side and 12% to throw waste anywhere (Figure-3). In case of final transformation of waste from temporary storage to disposal site municipality authority suffers various problems.

Transportation of solid waste: Various types of vehicle are used for waste collection. Mainly open trucks are used for waste transportation from temporary storage place to dumping site. In the study area, it has been found that 66% small pickup, 12% compactor truck, 16% open tipping truck and 6% farm tractor and trailer for waste transportation (Table-3) but all of the

Table-3
Types of vehicles used for solid waste transportation

Transportation vehicles	Percentage of used
Small open pick up	66
Compactor truck	12
Open tipping truck	16
Farm tractor and trailer	6

vehicle remains open during transportation which is not an appropriate system for waste transportations.

Final Disposal: In urban area, for integrating solid waste system disposal site is an important factor and these sites should be safe, reliable for long-term disposal of solid wastes[5]. Mainly low-lying lands areas are filled by urban wastes which are selected by the municipality authority. In the study area 87% waste is dumped in the lowland open space (Figure-8). This disposal site does not follow the principle of sanitary landfills. Waste spreads all over the site during the blooming of wind its leads to soil pollution, water pollution and air pollution[13].
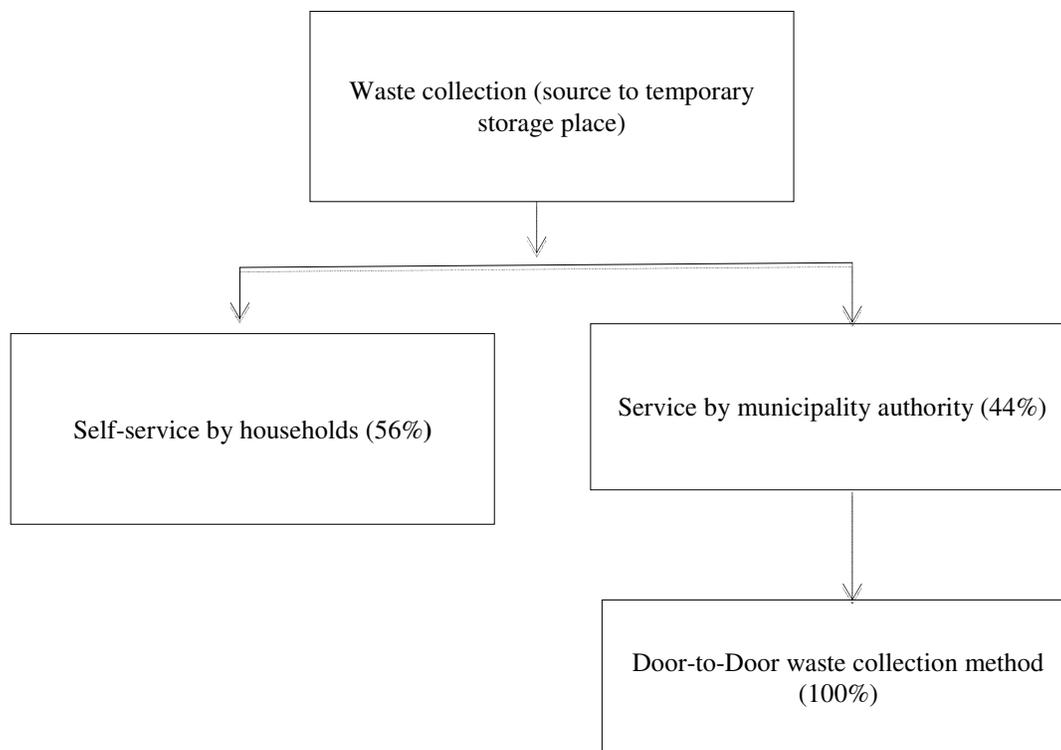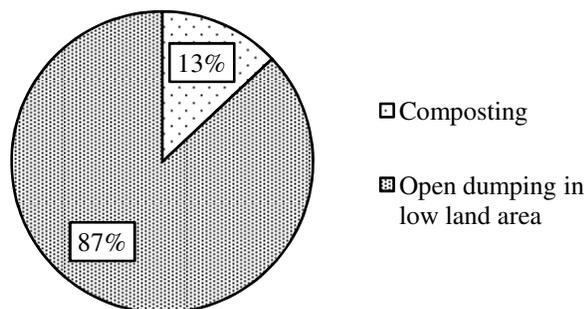
Figure-7
Waste Collection to Storage System

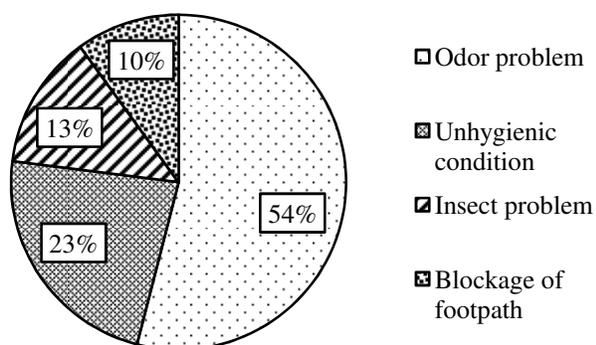**Figure-8**
Use of Waste in the Study Area

Figure-9
Problems Associated with Unplanned Disposal

Problems of solid waste management in the study area: Improper solid waste management has a big threat on kushtia city. The Majority percentage of respondents said that they suffer from the odor problem (54%) and unhygienic condition (23%), the insect problem (13%) and footpath blockage (10%) (See figure 9). The possible causes are uncontrolled dumping of waste on the road side, drains, open spaces and lower capacity of dustbin storage[14], on the other hands unpleasant odor also released near the disposal site due to lower Compaction, non-leveling of waste and rarely used final earth cover. Leachate, bad odor, dust, insect problems etc. are the most common environmental problems in the existing sites. Uncontrolled waste dumping also blocks the drainage system as result serious problems occurred during rainy season.

Existing Limitations of Kushtia municipality for solid waste management: Though municipal authority is trying to give their full efforts for the solid management system, but there are some problems associated with the current management system of solid wastes in the city. The municipal authority has no experience town planner, solid waste management specialist. The inability of waste management is poor institutional structure, inefficient manpower and equipment, unscientific and inefficient collection practices, lack of awareness among citizens, limited involvement of non-government organization, inefficient management of landfill, shortage of land for waste disposal and lack of sufficient budge make the management system more vulnerable.

Proposed sustainable Waste management system for Kushtia Municipality: Sustainable solid waste management (SSWM) system includes the generation of waste, storage, collection, transportation, processing and final disposal. This system will be Social sustainability, Environmental sustainability, Economic sustainability. The proposed waste management system also followed above criteria that are discussed in Table-4. The proposed new waste management system for kushtia municipality are present in Figure-10.

Conclusion

Municipal household's solid waste management is a major challenge in developing country especially urban areas. In the study area about 31% households produced 4-5 kg waste per day and majority percentages were organic waste (55%). The present management system in the study area was not satisfactory; about 79% wastes dump in open space. It has a long term negative impact on the environment; already peoples faced various types of problems (odor problem 54%, unhygienic condition 23%). Mainly gradually growing volume of wastes for population growth, an inappropriate waste-management system and lower residences awareness were responsible for this situation.

This study has been developed a sustainable waste management system for Kushtia municipality authority by considering of waste generated, the availability of resources, and the environmental conditions. It will be help for reduction of waste management cost, improvement of environmental quality, resource and energy recovery and finally will improve city living standards. It is essential to conduct a long-term consciousness rising programme, campaigning and training programme in the area between municipality worker and residences about the sustainable waste management system and its benefit. This programme will be successful when municipality authority, Non-government organization and residential community will be working together, as a result they will get a clean and better city for habitant.

Table-4
Description of Proposed sustainable Waste management system for Kushtia Municipality

Step numbers	Name of steps	Description of steps
01	Waste generation	These activates in which materials will be known as no longer being of value and will be either thrown away or gathered together for disposal.
02	On site segregation, storage and processing	In this step activity will be associated with the segregation and processing of solid waste at or near the point of generation. For this purpose two types of storage bin will be used….. I. Biodegradable waste storage bin II. Non- biodegradable waste storage bin
03	Collection	In this step two types of collection method will be applied I. Door-to-Door collection by municipality worker II. Self-service by respective household N.B.: One thing should be mind that, two types of waster will be never mixed together during waste collection and bearing.
04	Storage (Temporary storage of collecting waste in a dustbin)	After collection of waste, it will be stored in two separate dustbins. I. Biodegradable waste storage dustbin. II. Non- biodegradable waste storage dustbin. For avoiding waste mixing
05	Processing and Recovery	Different types of technique, equipment and facilities will be applied for recovering of usable materials, conversion product. This will be sold in market for processing of industrial raw material.
06	Disposal	In final step waste will be disposed on the basis of its nature I. Biodegradable waste will be transferred in composting site or biogas plant area. II. Non- biodegradable waste will be transferred in low land areas for sanitary landfilling.

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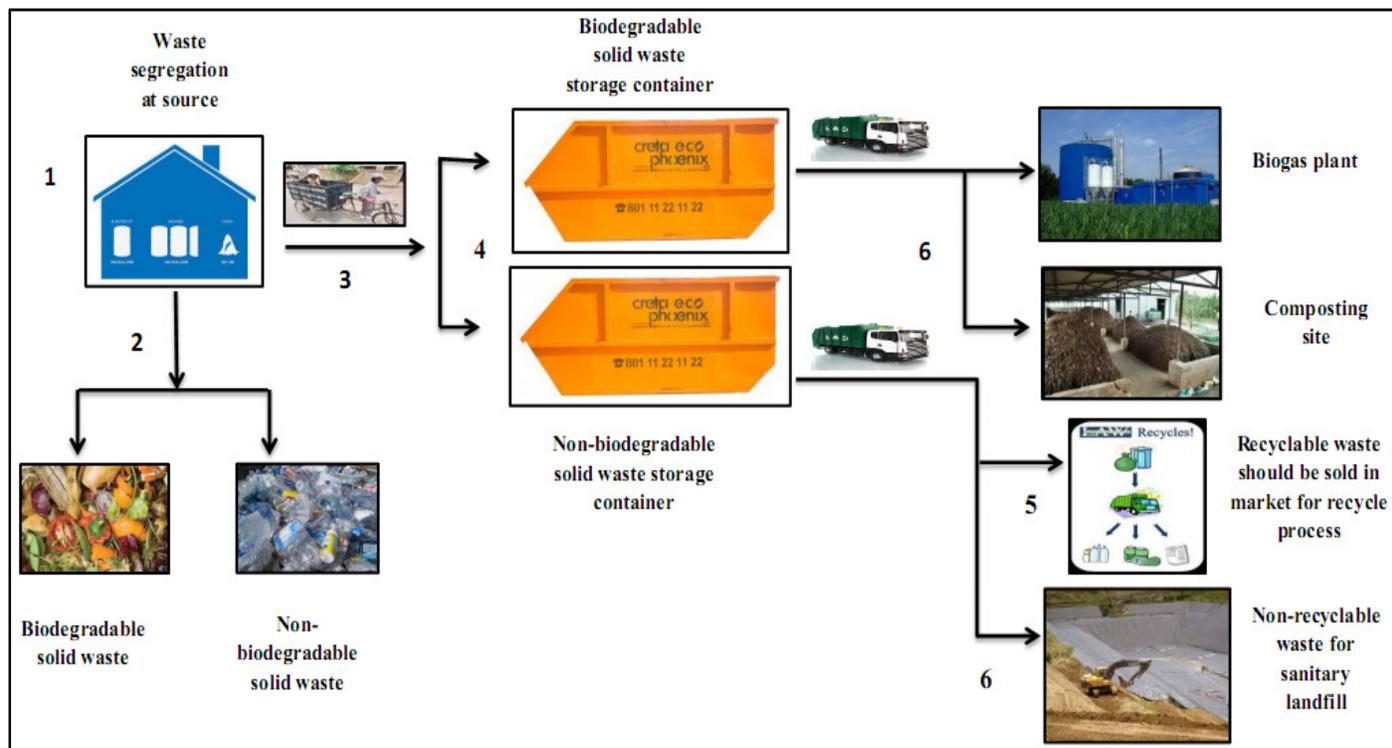
Figure-10
Proposed sustainable Waste management system for Kushtia Municipality

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