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Abstract- Bangladesh is a densely populated country in the third world facing myriads of problems with the growth of population. The increased population leads to the growth of urban areas and slums which, in turn, generating a huge volume of waste. The huge generations of waste in different cities of Bangladesh like Khulna city increasing global anxiety day by day. In order to conduct the research, both primary and secondary data has been used. This paper highlights the status of waste generation and its management and a novel management process is proposed to increase the capacity. The waste generation rate of KCC is now 0.50 kg/cap/day producing around 950 tons of wastes, where about 36.84% being uncollected. The rubbishes, which remain uncollected, are dumped in open spaces, street and drains, clogging the drainage system, which create serious environmental degradation and treats to health. Moreover, the population growth rate is around 5% per year and waste generation rate will be about 1.7 times in 2025. Most of the urban local bodies are finding it difficult to keep pace with the demand for adequate solid waste management and conservancy services provided by the urban local bodies. So, both public and private sectors should take proper initiatives for effective solid waste management.

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Challenges of Waste Generation & Improvement of Existing Scenario in Commercial City of Bangladesh

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Abstract- Bangladesh is a densely populated country in the third world facing myriads of problems with the growth of population. The increased population leads to the growth of urban areas and slums which, in turn, generating a huge volume of waste. The huge generations of waste in different cities of Bangladesh like Khulna city increasing global anxiety day by day. In order to conduct the research, both primary and secondary data has been used. This paper highlights the status of waste generation and its management and a novel management process is proposed to increase the capacity. The waste generation rate of KCC is now 0.50 kg/cap/day producing around 950 tons of wastes, where about 36.84% being uncollected. The rubbishes, which remain uncollected, are dumped in open spaces, street and drains, clogging the drainage system, which create serious environmental degradation and treats to health. Moreover, the population growth rate is around 5% per year and waste generation rate will be about 1.7 times in 2025. Most of the urban local bodies are finding it difficult to keep pace with the demand for adequate solid waste management and conservancy services provided by the urban local bodies. So, both public and private sectors should take proper initiatives for effective solid waste management.

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I. INTRODUCTION

Due to rapid growth of population and unrestrained urban growth urban environment is debasing severely. For most of the cities in developing countries mass production and solid waste disposal is a palpable reason for the environmental degradation (Ashraf 1994). Due to swift urbanization two-thirds of the world's people living in cities by 2025 and urban populations in developing countries grow by more than 150,000 people every day (UNDESA 2005). The perpetually-increasing consumption of resources has resulted in enormous amounts of solid waste from industrial to domestic activities which can pose major threats to human health (Frosch 1996). The environment and human health face a severe impact due to the irrational disposal of solid waste (Rathi 2006). Municipal corporations of the developing nations are not capable to handle increasing amounts of waste and a significant portion of wastes are not properly

stored, collected or disposed in the proper places for ultimate disposal due to lack of enthusiasm, consciousness, loyalty, as well as money (Ahsan et. al 2005, Riyad et. Al 2013). There is a need to work towards a sustainable waste management scheme, which requires institutional, financial, environmental, economic and social sustainability. Maximum reported values of solid waste generation have been derived empirically with assumptions regarding population, number of transports available for transportation of wastes (Anon 2001, Rahman et. Al 2013). Human activities generate waste and the extreme human activities concentrate, such as in urban centers, appropriate and safe solid waste management. Typically one to two thirds of the solid waste generated is not collected by many municipalities (Rahman et. al 2013, World Research Institute 1996). Many of these waste materials can be reused (Kumar and Bhowmick, 1998) and thus may eventually become valuable resources if they are removed from the waste stream (World Bank 1999). Bangladesh is a densely populated country; country's population will be about 17 cores by 2020 (BBS, 2001, Bahauddin & Uddin 2012). Khulna is a medium size city in the context of Bangladesh, even though it has a population of about 2 million people and the population growth rate is around 5% per year. Khulna was declared as a Pouroshava/Municipal council in 1884 and promoted to a Municipal corporation in 1984 on the platinum jubilee of Khulna Pouroshava. In 1990 Khulna has been confirmed as a City Corporation (Wikipedia). Day by day the amounts of solid wastes are increasing with the rapid increasing of population especially in city area. So, solid waste creates an endangered situation for waste management in urban life and deteriorates the daily life of people with the loss of economy and environment. This study aimed at investigating ongoing solid waste management practice in the perspective of large cities in Bangladesh and finally a general physical model was proposed in consultation with the relevant stakeholders for its long-term sustainability.

II. METHODOLOGY

Khulna, the third largest city of Bangladesh (Fig. 1), is located in the southern part of the country and is situated below the tropic of cancer, around the

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intersection of latitude 22.49°N and longitude 89.34°E. The area of Khulna city is 47 square km (BBS, 2009) comprising 38 wards (LGED 2012). In Khulna City, a survey was conducted to find out the whole number of NGOs and CBOs, their goings-on MSW management activities, and the current scenarios of secondary disposal sites and roadside open dumping. A few meetings were organized with the conservancy department of the city corporation office to gather the data and information of MSW management. Secondary data, such as statistics and reports on the quantity of solid waste generated and its composition and management practices of Khulna has been collected by searching previous study, books and journals etc.

In majority of the urban areas, community bin system of waste collection is being practiced in Bangladesh. Recently, in some parts of Khulna city NGOs have introduced door-to-door collection of solid waste. But neither communal bin system coverage nor house-to-house waste collection system is adequate yet. KCC is liable for the operation and maintenance of municipal services, including solid waste management. Eight (8) functional departments and the conservancy department of Khulna City Corporation is liable for management, maintenance and monitoring of solid waste, street sweeping, public latrine and urinal, drain sludge, and street lighting. A total of 22 NGOs and CBOs are involved in MSW management in different wards of KCC in cooperation with the city authority and respective ward Commissioner. Prodiapan and PRISM (Project in Agriculture, Rural Industries, Science, and Medicine) Bangladesh are the two national NGOs initiated MSW management in Khulna city and provide financial support to other small NGOs and CBOs. Another NGO, Rural Unfortunates Safety Talisman Illumination Cottage (RUSTIC) established in 1993 and initiated community based MSW management project in March, 1997. RUSTIC has been collecting waste from households since June 1997 (Rustic 2003). Some other NGOs are also involved in waste management in Khulna city, namely, World Vision, Muktir Alo, Samaj Progoti Sangsta (SPS), Bangladesh Resource Improvement Center (BRIC), Rupayan, An Organization for Socio Economic Development (AOSED), Nabarun Shangsad, Proshanti and Center for Human Development CHD). Some CBOs are involved as well in waste collection services, namely, Protisruti, GOTI, (Ispahani Bananipara Community (IBC), SAMADAN, CLANSHIP, Nobo Jagoron, Ginna Para Community (GPC), Jubo Unnayan Sogngatan (JUS) and Commitment (AOSED 2003, BRIC 2003, Muktir Alo 2002, Nabarun Shangsad 2003, PRISM 2002, Rupayan 2003, RUSTIC 2003, SPS 2003). Table 2 depicts that different organizations involved in solid waste management in Khulna city of Bangladesh.

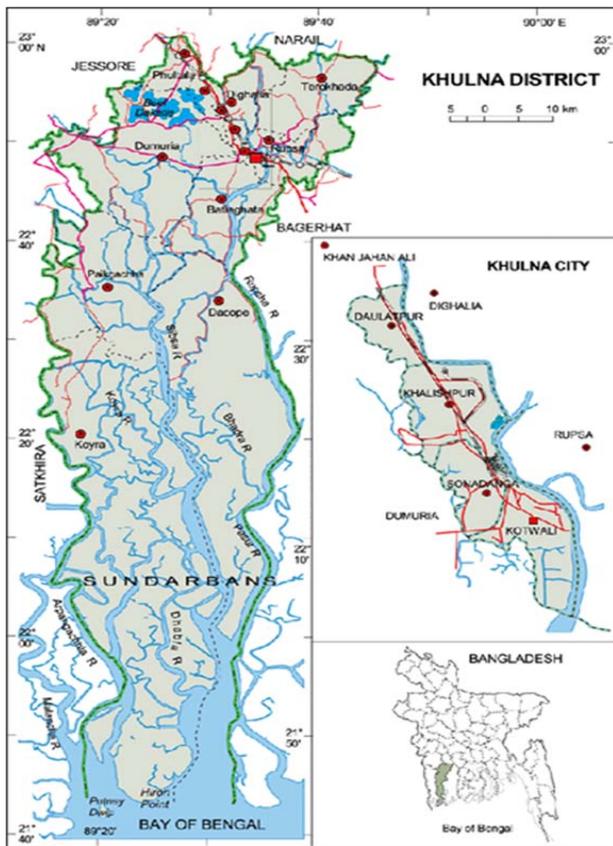


Figure 1 : Location of the study area

III. RESULTS & DISCUSSION

a) Present Scenario of Solid Waste Management

The major sources of solid wastes in Khulna are residences, whole and retail sale market places including shopping places, streets, hotels and restaurants, private clinics and hospitals, educational institutions, cinemas, railway, bus, and launch/steamer ghats, slaughter houses, etc. In a study by Ahmed (1991) in Bangladesh, it has been found that during wet season the waste generation rate increases by 15% to 50%. Table 1 depicts that solid waste generation in Khulna city is growing with the growth of population.

Table 1 : Solid waste generation in Khulna city

Year	Population (million)	Waste generation rate (kg /day/capita)	Total waste generation (tones/day)	Waste collection (tones/day)	Collection efficiency (%)
2008	1.50	0.35	525	275	52.38
2013	1.90	0.50	950	600	63.16

(Source : Conservancy section, KCC 2013)

Table 2 : Name of organizations involved in solid waste management

Name of organizations	Ward no.
Prism Bangladesh	3,31
Prodipan	6,12,24,27,28
Society Progress Association (SPS)	9,15,16
Muktir Alo	21,23
Rustic	17,18
Rupayan	19,20
AOSED	25,16
Shabolombi	10
Prosanti	30
Protisruti	22
Nabarun Sangsad	24 (part)
Goti	20,25 (part)
BRIC	4,5,7
Centre for Human Resources Development (CHD)	16 (part)
Commitment	11
World Vision	18
Khulna City Corporation (KCC)	22,29

(Source : Conservancy section, KCC 2013)

b) Yearly population and projected waste generation for next 12 years

Though the national population growth rate is 1.579% (Mundi 2013). Khulna city with its emerging

industrial and commercial activities population growth rate is higher than the national growth rate. Projected population is calculated by Exponential method of population projection which is expressed in Table 3.

Table 3 : Projection of population growth and attendant waste generation (2014-2025) of Khulna Statistical Metropolitan Area

Year	Waste/day/capita (kg)	Population (million)	Total waste/day (tones)	Total waste/year (tones)
2014	0.53	1.99	1055	385075
2015	0.56	2.09	1171	427415
2016	0.59	2.19	1292	471580
2017	0.62	2.30	1426	520490
2018	0.65	2.41	1567	571955
2019	0.68	2.53	1721	628165
2020	0.71	2.65	1882	686930
2021	0.74	2.78	2057	750805
2022	0.77	2.92	2249	820885
2023	0.80	3.06	2448	893520
2024	0.83	3.21	2664	972360
2025	0.86	3.37	2898	1057770

IV. PROPOSAL FOR SUSTAINABLE WASTE MANAGEMENT

Considering the present status of MSWM in the country, the researchers has summarized in a flow chart as depicted in Fig. 2. Every family and commercial institution should have separate bins to store separately the recyclable, non-recyclable and hazardous items of waste. Every house should have a

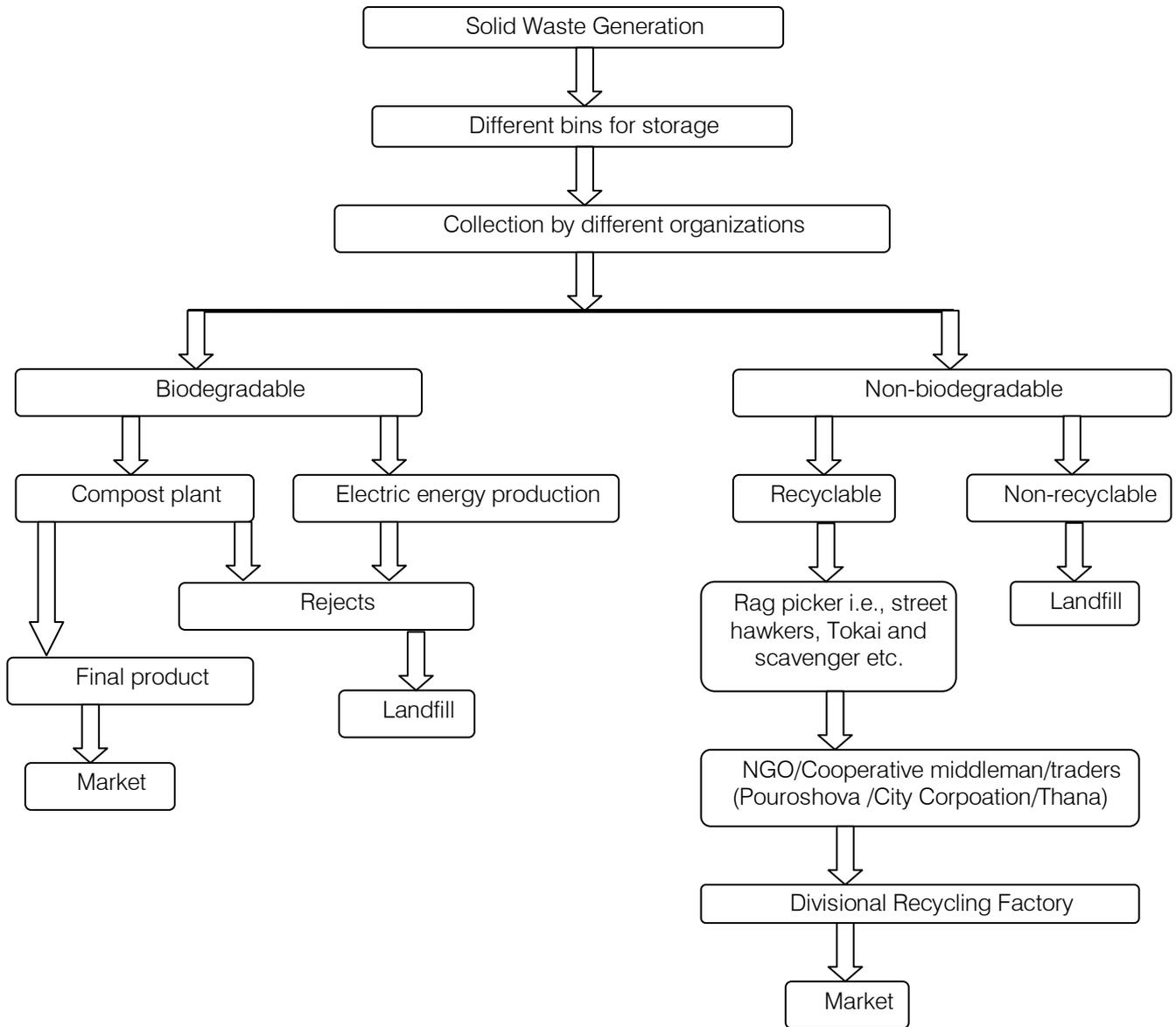


Figure 2 : Proposed management process of solid waste

common storage bin/container where all the families of the house should store the solid waste and KCC/different organizations should collect the waste from the common storage bin of the house by van. Wastes from households, commercial institutions, streets and drains should be carried to the primary collection bins by vans. A separate common bin should have for the hazardous items and organizations should carry and dispose it separately. Biodegradable items should be carried separately to the processing plant (compost or electric energy), the non-recyclable inorganic items should be carried and disposed separately and the recyclable waste should go to the recycling process. In medical, hazardous, non-hazardous, recyclable items should be stored in separate bin. Recyclable items should go to the recycling process by the own initiative of the

hospital/clinic/diagnostic lab. In this process, recycling factory should have one divisional factory in every district. Modern technology should be used in every step of SWM such as collection, transportation, recycling, disposal and other processes.

V. CONCLUSION

The outburst of world population is changing the nature of solid waste management from mainly a low priority, localized issue to an internationally pervasive social trouble. Solid waste management scenario in Khulna City Corporation area is being deteriorated day by day as the situation is very difficult to handle the colossal volume of waste in KCC due to the irrepressible migration of rural people to urban areas for better life. There is an adequate legal framework existing in the country to address MSWM, what is causing its

application. In spite of a strict legislation in place, open dumping is the most wide spread form of waste disposal. The possible causes for poor implementation could be a combination of technical, social, institutional and financial issues. Public awareness, political determination and public participation are essential for the successful implementation of the legal provisions and to have an integrated approach towards sustainable management of municipal solid wastes in the country. All the practices and efforts should reflect the better future but practically all the activities are not in planned manner and not to target oriented. As an emerging area, Khulna city should develop in a proper way to make beautiful, livable town in near future. Proper management and initiatives can lead organized and succeed outputs.

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