

Sustainable Management Scheme for Academic Institutional Solid Waste: A Case Study in Khulna Metropolitan City, Bangladesh

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ABSTRACT

Of all environmental problems that have come into focus in Khulna, academic institutional solid waste management has been the slowest to develop either direction or regulatory mechanisms. The study was conducted at different educational institution in Khulna, Bangladesh to determine the generation rates and identify the current situation of academic institutional solid waste management (ISWM) which finally motivated to take a sustainable decision of the management of the Academic institutional solid waste. It has been found that the organic food waste dominates in the University, such as the College, the Technical College and secondary and primary schools and the paper and cardboard category is prominent in the academic institutions. The results of the study would provide us important insight into the growing concern of academic institutional solid waste and would help us to find a better alternative of existing solution of the management of Academic institutional solid waste in Khulna city.

Keywords

Academic institution, effective management, waste generation, sustainable decision, environmental problem, Khulna.

1. INTRODUCTION

Improper solid waste management (SWM) is considered to be one of the most burning and serious environmental problems in developing countries like Bangladesh [2]. The generation of solid waste is increasing with the competition to the growing rate of population in Bangladesh as well as round the world [13]. Due to rapid 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 [18]. The ever-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 [8]. Ongoing advancements in science and technology have also contributed significantly to the increased volume and toxicity of waste generation [15]. Khulna city, as being one of the fast growing towns of the country, has increasing solid waste generation. The average per capita rate, according to KCC, a person generates 0.50 Kg/day solid waste [10]. Khulna has many prestigious educational institutions. There are 5 universities, beside these there are 17 schools, 7 UCEP schools: 1 technical school and 6 IGV (Integrated General and Vocational) schools. 12

colleges, 03 Polytechnic Institutions and 03 medical colleges [20]. Schools, colleges and universities generate hazardous wastes from laboratories, metal workshops and repair workshops located on their premises. These institutions also handle large quantities of foodstuffs and equipment. The disposal of food tins, bottles and plastic wrappings poses serious threats to human health and the environment when it is not done properly. This study aimed at investigating ongoing academic institutional solid waste generation rate 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.

2. METHODOLOGY

Khulna, the third largest city of Bangladesh is located in the southern part of the country and is situated below the tropic of cancer, around the intersection of latitude 22.49⁰N and longitude 89.34⁰E. The area of Khulna city is 47 square km [3] comprising 38 wards [12]. With regards to investigating the solid waste generation, a field survey was conducted in the Khulna city area. The selected study sites for SRM in Khulna city were: Khalishpur, Daulatpur, Power House and other places (OPs) which cover Moilapota (MP), Gollamari and the Lobonchora area (Fig 1). To determine the total generation of academic institutional solid waste, total 14 academic institutions have been surveyed from which solid waste was measured regularly. Eight buckets was supplied to academic institution to store their waste in the bucket.

3. RESULTS & DISCUSSION

A study in 2005 shows solid waste generation rate in different wards of Bangladesh shown in Table 1 [19]. Solid waste generation in Khulna city is increasing day by day. All of generated waste organic waste is prominent is shown in Fig 2 [22]. Solid waste generated in the academic and training institutions is dominated by organic waste as shown in Fig 3. The organic food waste dominates in the University, such as the College, the Technical College and secondary and primary schools. The waste stream in schools is characterized by higher amounts of paper and cardboard, compared to food wastes. The paper and cardboard category is prominent in the academic institutions, reflecting the large amounts of stationery used in the learning process. Paper is also used in the packaging of various types of items used in the academic and training institutions.

Table 1. Basic information of six city corporations of Bangladesh

City corporation	City area (sq. km)	Population (million)	No. of wards	Wastes generation rate (kg/cap/day)	Total generation (tons/day)	Ultimate disposal site
Dhaka	360	11.00	90	0.40-0.55	5000-5500	2
Chittagong	156	3.65	45	0.30-0.45	1200-1400	2
Khulna	47	1.50	31	0.30-0.40	420-520	1
Rajshahi	48	0.45	30	0.25-0.35	160-210	1
Barisal	45	0.40	30	0.20-0.25	100-140	1
Sylhet	26.5	0.50	27	0.35-0.45	200-240	1

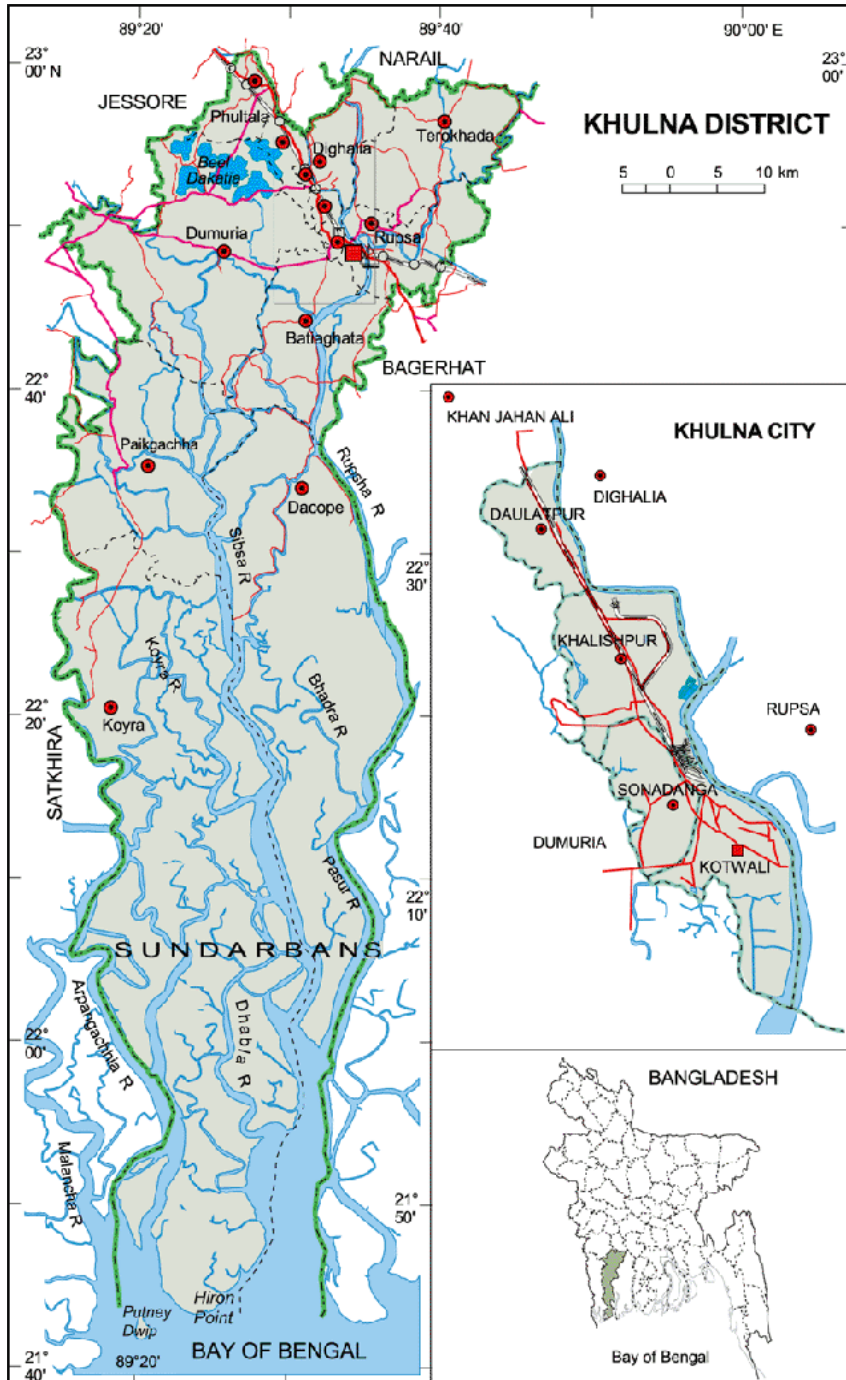


Fig 1: Location of study areas in Khulna city of Bangladesh

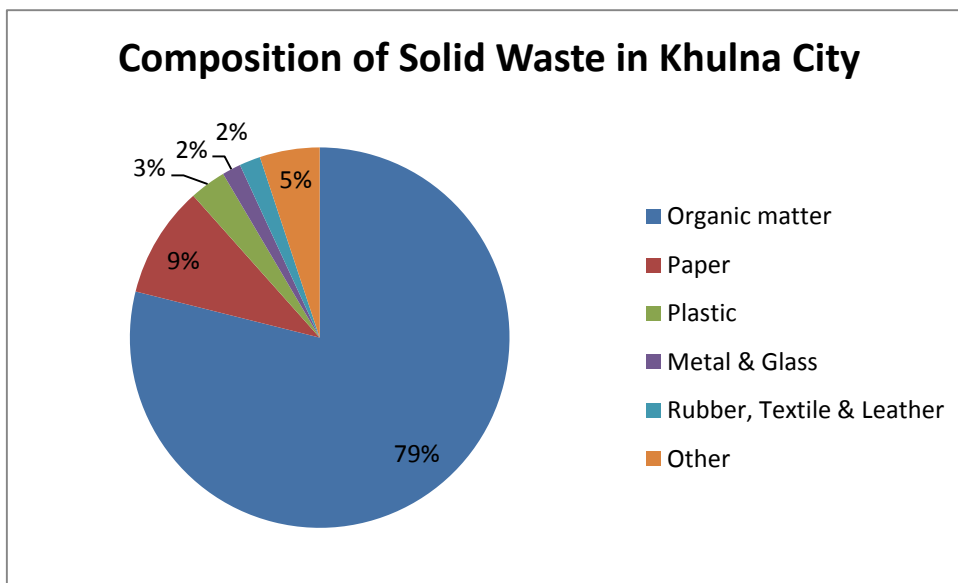


Fig 2: Location of study areas in Khulna city of Bangladesh

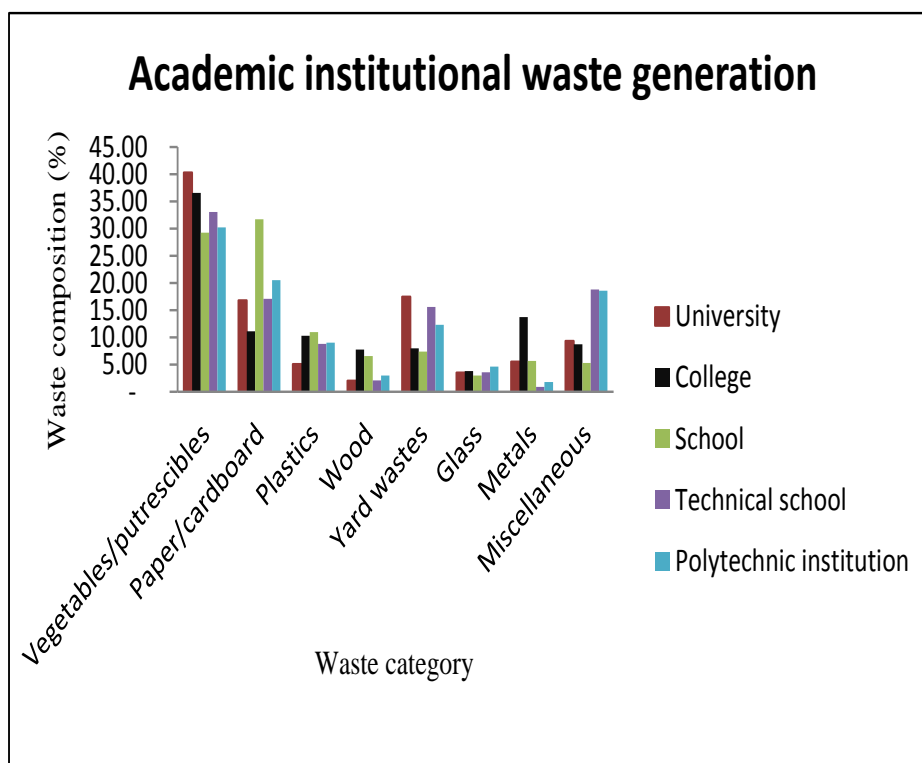


Fig 3:Waste Composition, by type of academic institution

In Khulna city, there are several shops for reusable material (SRM). Most of the SRM for old books were found in close proximity to Power House and Railway market area. Usually, those SRM had been dealing with all kinds of books. Their buying capacity varied in the range of TK 600–1200 per day, while sales ranged from around Tk 800 to 1800 per day. Most of the good looking books were bought by students and other books by different shopkeepers for packaging purposes. The world has a huge appetite for paper, even in these days of the so-called ‘paperless’ office. Global paper consumption is currently running at more than 350 million tons per year and rapidly approaching an unsustainable one million tons per day [6]. There is one paper-recycling industry in Khulna. They consume scrap paper to reprocess the paper product. The

paper materials are second highest by the weight (9.5%) of the total waste components generated in the city. Grocer reuses one portion of discarded paper by making packets. Paper mills have always recycled damaged product and scrap from converters. Paper mills purchase additional post-consumer waste paper based on fiber strength, fiber yield and brightness according to the type of product produced. Different medical colleges in Khulna city area produce hospital solid waste which is more hazardous due to the disposal in open [Fig 3]. The rapid increase in the number of clinics and hospitals in the country has proportionately increased the generation of hospital wastes [Fig4& 5]. Medical waste has been considered as one of the major health and environmental management

issues in Bangladesh over the last three decades. Poor management, lack



Fig 4: Disposal of hospital in open



Fig 5: Different Types of Medical Wastes

of handling knowledge and unscientific disposal of various health-care wastes pose serious direct and indirect public health threats to health-care personnel, nurses, technicians, waste workers, hospital visitors, patients, surrounding communities and the environment as well [21]. Study shows that the generation rate varies from 0.70 to 1.2 kg/bed/day and the percentage of hazardous portion varies 10 to 30% [5, 7, 11, 14, and 16]. It is a common observation in mega cities of Bangladesh that poor scavengers, women and children collect some of the medical wastes (e.g. syringe-needles, saline bags, blood bags etc.) for reselling despite the deadly health risks. It has been reported that the re-use of syringes can even cause the spread of infections such as AIDS and hepatitis [1, 17]. One estimate shows that some 5.2 million people (including 4 million children) die each year from waste related diseases in Bangladesh. The amount of municipal waste globally is predicted to be double by the year 2000 and quadruple by 2025 [9]. On average 641 kg waste is generated per day in the tertiary hospitals in Bangladesh. On average 1 kg waste was generated per day per bed out of which 79 percent consisted of general waste, 8 percent were infectious waste, 3 percent were sharp and 10 percent were recyclable waste. The generation of medical waste per day ranges from 0.76 kg to 1.16 kg per bed. The Dhaka Medical College Hospital generated the highest quantity of total waste with 1.16 kg/day/bed of which general waste was 0.96 kg/day, infectious waste was 0.11 kg/day/bed; sharp was .04 kg/day/bed and recyclable waste was 0.12 kg/day/bed. The study reported that Bajitpur Medical College generated the lowest quantity of waste [4].

Considering the present status of MSWM in the country, the researchers has summarized in a flow chart as depicted in Fig6. Authorities need to create awareness through education programs (i.e. reducing, reusing and recycling) for students focusing on minimizing incidences of littering, illegal dumping practices and waste going to landfill. It has been observed that, the universities are trying to come up with the education but it should also be notified that not all the students of our country can reach to the university level. So this education should be incorporated at the primary and secondary level at a full phase so that everyone can have the minimum knowledge of solid waste management. Solid waste management knowledge can be improved by different activities such as songs, games, and quiz about solid waste management. Proper training is needed for the students to take sustainable decision about solid waste management. Besides, competition between students, group works and field works by the students can be more helpful for better understanding and implementation. Class monitors can also encourage his/her classmates for proper solid waste management. Several awareness training program, seminar/symposium for the teachers and also several meeting with parents and experts of solid waste would help them to find a better solution.

4. CONCLUSION

Compared to residential and industrial areas, academic institutions generate relatively small amounts of solid waste. Developing integrated solutions for waste management problems requires public involvement. Proposed model is one of the best ways to inculcate proper solid waste management and recycling behavior in the minds of the students; and through the students, the message of segregation of waste, proper solid waste disposal and recycling would reach the community. Also today's students are members of tomorrow's community; therefore when students inculcate the practice of segregation and recycling at academic institution, it will be reflected in the future community when the students became grown member of the society.

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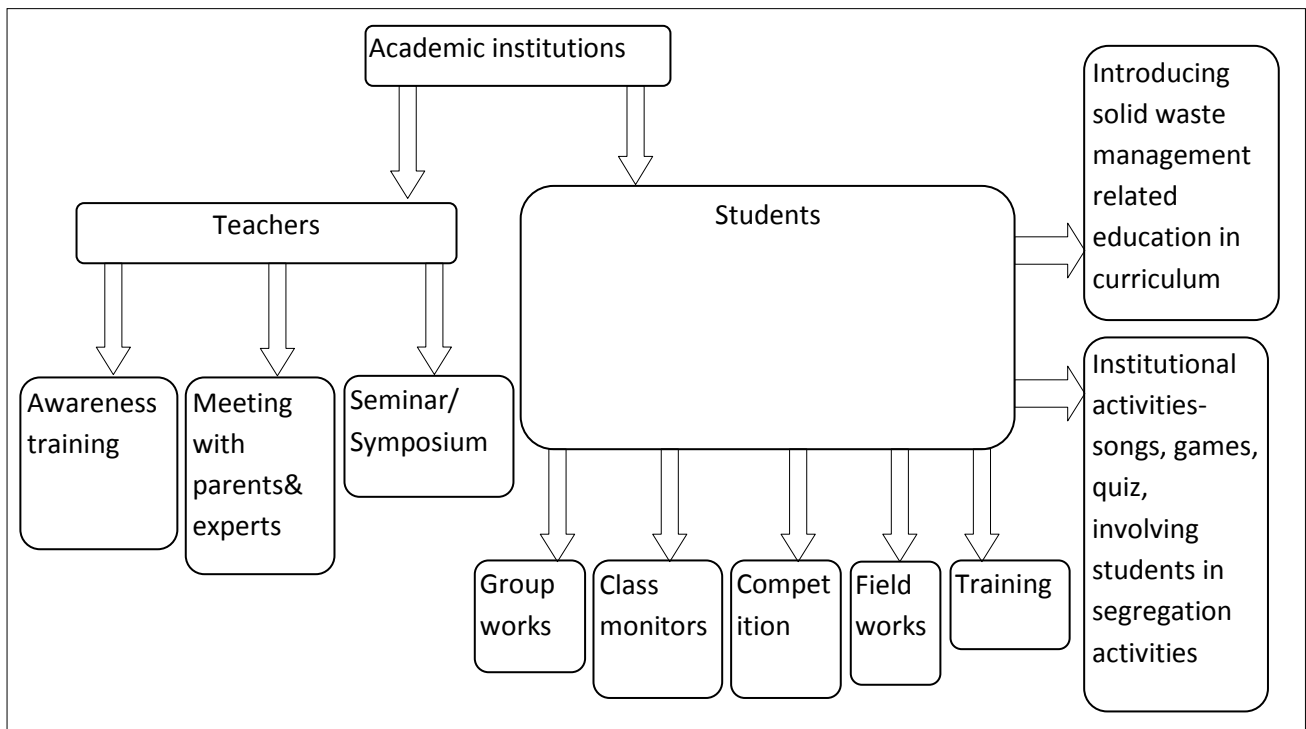


Fig 6: Proposed model for sustainable waste management in educational institutions

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