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Kitchen Market Waste Management System and Opportunities: A Case Study on New Market Bonolata and Mirpur-1 Kitchen Market

Abu Zubair^{*} Farhana Akther^{**}

Abstract: A huge amount of wastes are generated from the kitchen markets every day and these are not properly managed. Most of the kitchen market wastes are organic wastes and there is huge opportunity of converting these organic wastes into resources like composting of waste, producing biogas and electricity generation. At present wastes are just dumped in landfills which require huge land. There is no intermediary systems in practiced like recycling, incineration, composting, converting into other resources. Countries like Bangladesh with a small land and huge population have to suffer for the issue of waste management. This study is conducted on Kitchen Market Waste Management in Dhaka City Corporation and the study areas were Bonolota (New Market) kitchen market and Mirpur 1 kitchen market. This study tries to show the present waste management system of kitchen markets based on case study and also tries to provide some waste management systems that can be used to manage kitchen market wastes.

Introduction

Waste is a result of human activities which tends to increase with rapid urbanization, improved living standards and changing consumption patterns (Chandrappa and Das, 2012). The Asian Development Bank (2011) estimates that the South Asian region has the potential to produce around 8 million tons of compost per year, worth an estimated US\$709 million, or alternatively, an estimated 3,340 million kilowatt-hours per year of electricity (from biogas) with a market value of around US\$701 million per year. Furthermore, diverting this waste from landfills would save around 27.88 million cubic meters of landfill volume, with associated cost savings at the municipal level. Dhaka generates approximately 1.65 million metric tons of solid waste annually. At present there are 112 markets registered to operate in the north and south parts of Dhaka City Corporation (DCC) (north and south). These include more than 87 are Kitchen markets. Vegetable, fruit, fish, poultry and meat shops are usually found in these food markets. Apart from the registered food markets, there are also many other kitchen markets in the area, all of which generate an enormous total of waste every day (DSCC and DNCC, 2014). DCC, with its limited resources, technical know-how, and inadequate policy framework, is facing an uphill task to keep the city clean at an acceptable level (Kundu, 2008). Kitchen market wastes are mostly dumped in open places nearby; some are burnt too, in open fires. In the most common practice, various waste transfer points are established around the cities from where motor vehicles carry the waste to nearby

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landfills or dumping sites. There is no available modern sanitary landfill to accommodate the MSW generated anywhere in the country (Bhuiyan et al, 2012). The waste stream is more than 80% organic matter (APO, 2007). The unmanaged organics that form most of the MSW causes environmental pollution and consequently affects the public health (Moqsud and Omine, 2010). DNCC and DSCC are the formal organization responsible for waste Limited capacity of the DNCC and DSCC authority to collect the waste, inadequate budget for management of the market waste, limited land for disposal, lack of public awareness etc. are the major problems regarding kitchen (food) market waste management in the DNCC and DSCC area (Reza and Hasan, 2016). This Improper management is also responsible for Environmental degradation- groundwater and surface water contamination, air and odor pollution and subsequently triggers pollution induced health problems (Bhuiyan et al, 2012).



Source: Developed by the Authors, 2018 based on Balsura, n.d.

Fig 1: The Concurrent Triangulation Approach for Conducting the Study

Generation of bio fertilizer can be a best option for managing kitchen market's organic wastes. In Dhaka UN-approved clean development management (CDM) under the Kyoto Protocol has already registered the project which will entitle its owners to get certificates for 'non-generation of carbon'. And they will sell those to developed countries. Collecting the organic waste from the markets, mainly Karwan Bazar vegetable market, local private firm Waste Concern, in association with its Dutch partners, has launched a compost plant at Bhulta in Narayanganj. But this type of environment friendly initiatives are very less compare to problem. So this study tries to study the present waste management system of these two kitchen market and finding the problems and best possible solutions.

Objectives and Methodology

Research questions for this study were, what are the problems and potentials of the kitchen market waste management in Dhaka city? and how can the present kitchen market waste management system be improved to ensure sustainable waste management system in Dhaka city? The objectives of the study are to study the existing waste management system of the kitchen markets of Dhaka city and identify the problems and prospects of kitchen market waste management system. To end with recommend some guidelines for effective and sustainable waste management system considering the existing deficiencies. This study was based on both primary and secondary data. Primary data were collected from field survey, observation, questionnaire survey of buyers and sellers and key informants. Considering \pm 10% precision level sample size has been selected. Secondary data were collected from DNCC, DSCC, Two kitchen market offices and other literatures. The qualitative data has been organized according to some themes for gaining meaningful insight to address the research questions, themes are- Problem of kitchen market waste on environment/market linkage, Perception of the buyer about the haphazard waste on their free movement. Problems created by the Kitchen market waste from buyer, seller, key Informants and officials perspective, Kitchen market waste management issues, Suggested solutions (Buyer, Seller, Key Informants and officials perspective) and Required policy support. . A field survey is conducted by the combination of Stratified, Convenience and Purposive sampling technique for collection of data. Some secondary data were collected from the market authority and the relevant organization (mainly Dhaka North City Corporation and Dhaka South City Corporation). The collected data were analysed and interpreted to find out the existing scenario of the kitchen markets.

Study Area

Two Kitchen markets were selected for case study; Bonolota Kitchen Market or New Market and Mirpur-1 kitchen Market. Bonolata Kitchen Market is one of the renowned kitchen markets under Dhaka South City Corporation locating besides the largest shopping complex of Dhaka, New Market. It is providing service since 1986. Due to its unique location with accessibility, it meets the kitchen market need of the residents of Dhanmondi, Staff and teacher's quarters of Dhaka University, BUET and DMC and the surroundings of this market. Besides, the various buyers of New Market are greatly influenced by this market. Mirpur is one of the prominent regions of Dhaka



Source: Constructed by Authors 2018. Fig 2: Location map and lay out map of Bonolota kitchen market.

city. Mirpur-1 Kitchen Market locating at Mazar Road is one of the largest kitchen markets of DSCC. It was established in 1978. Mazar Road is located at the south side of the market. There are huge residential areas surrounding this market and it meets the need of a kitchen market of those areas (Field survey, 2018).



Source: Constructed by Authors 2018.

Fig 3: Location map and lay out map of Mirpur-1 kitchen market.

Existing Kitchen Market Waste Management System

Waste Generation and Waste Stream

Mainly vegetable, fish, poultry, slaughter house, fruit, plastic products and grocery shops are found in the three kitchen markets. From those shops both organic wastes (e.g. Vegetable Scrap, Fish Scale, Bird Dung, Animal Blood/ Dung/Bone, Fruit Scrap etc.) and inorganic wastes (e.g. Polythene, Plastic Paper etc.) are generated every day. The amounts of organic wastes are higher than the inorganic wastes in those kitchen markets. Waste stream is the amount of particular wastes generated from different shops. Here the waste stream is calculated in relation with the amount of particular wastes generated from the total sample shops.

In Mirpur 1 Kitchen Market, approximately 250-270 kg wastes are generated per day. The total amount of wastes generated from the total sample shops of this market is 101 kg per day (Field Survey, 2017).

Percentage		
Organic	Inorganic	
25		
11		
39		
20		
2		
	3	
	Perce Organic 25 11 39 20 2	

Table 1: Waste Stream of Mirpur- 1 Kitchen Market

Source: Field Survey, 2017

Here organic waste stream is higher than the inorganic waste stream. Among organic waste stream, the vegetable scrap occupies the higher portion (Field Survey, 2017).

In New Market Bonolata Bazar, approximately 460-480 kg wastes are generated per day (Field Survey, 2017). The total amount of wastes generated from the total sample shops of this market is 122 kg per day. The waste stream (in percentage) is shown in following:

Table 2: Waste Stream of Bonolata (New Market) Kitchen Market

Source: Field Survey, 2017

Here organic waste stream is higher than the inorganic waste stream. Among organic waste stream, the poultry dung occupies the higher portion (Field Survey, 2017).

Waste collection and disposal

• Mirpur 1 Kitchen Market Waste Collection & Disposal

The bazar authority appoints four workers to collect the waste which is generated from the shops. They come every day at two times, one at the morning and other at the evening. The shopkeepers store the waste corner to the shop using polythene, paper or small container and then the workers primarily collect the waste from shops to shops. The

Waste Type	Percentage		
Organic	Organic	Inorganic	
Vegetable Scrap	54		
Fish Scale	10		
Poultry Dung	19		
Animal Blood/ Dung	5		
Fruit Scrap	3		
Inorganic			
Polythene, Plastic, Paper etc.		9	

workers carry solid waste from the shops. But the liquid waste discharge to the surface drainage from the shops. Then the waste discharge to the underground drainage which have link to the main sewerage line.

The appointed workers use three vans to carry the generated waste to the disposal site. The capacity of each van is about 50-55 kg. Each van comes two times a day to collect the waste. There is primary disposal site to storage the waste besides the bazar. So, the workers directly dispose the waste to the primary dumping site from the bazar which is situated besides the Mazar road near the main entrance of the kitchen market. At the disposal site there are five communal depots to store the waste. The waste from the other areas is disposed here. The total area of this site is about 2000 sq. ft. Here the inorganic waste is segregated by the street children. Paper, plastics, polythene, bottle, glass etc. are the main inorganic wastes which are separated from the organic waste. The DNCC trucks collect the remaining waste and carry to the Amin Bazar land filling area which is the final disposal site.

Bonolata (New Market) Kitchen Market Waste Collection & Disposal

The DSCC authority appoints seven sweepers to collect the waste which is generated from the shops. The sellers store the wastes in one corner of their shops and the collectors collect the wastes two times daily (at early morning & afternoon). The market authority has 3 sweepers of their own for shop to shop waste collection mainly in the vegetable, fish, meat and grocery shops. The poultry shopkeepers have arranged four sweepers for cleaning up the chicken wastes privately. The liquid waste is mainly generated from fish, meat, poultry and vegetable shops. The liquid waste is discharge to the surface drainage from the shops. Then the waste discharge to the underground drainage which have link to the main sewerage line. The sweepers collect the wastes by carrying carts and after the primary collection they transport the wastes by pick-up van to the dumping site near the New Market 1 no. gate for waste dumping.

The secondary disposal site is 200 yard far from the kitchen market. There are two communal depots at the dumping site. Here the inorganic waste is segregated by the street children. Paper, plastics, polythene, bottle, glass etc. are the main inorganic wastes which are separated from the organic waste. The DSCC trucks collect the remaining waste and carry to the Matulail land filling area which is the final disposal site.

Major Problems of the Both Kitchen Markets

Structural Problems

The internal drainage system in Mirpur 1 Kitchen Market is inadequate for this market. The drains are overflowed and not properly cleaned. The drains are blocked here and there because of the waste thrown by the sellers haphazardly. The sellers are not aware about the situation and thus they throw the wastes, solid and liquid, and block the drains badly (Field Survey, 2017). The drainage condition of this market is comparatively better in Bonolata (New Market) Kitchen Market.

In Mirpur 1 Kitchen Market and Bonolata (New Market) Kitchen Market some manholes are open. So the shopkeepers dump the waste into it directly. Thus manhole blocks and overflowed. It is also dangerous for the movement of the buyers (Field Survey, 2017).

The width of the internal road of these two markets is narrow and congested. This is not sufficient for easy movement. The shops are not properly arranged. It encroach the path for movement of buyers. The storage of waste beside the shops also creates encroachment. This situation is seen in two markets



Source: Field Survey, 2017 Fig. 4: Uncovered Manhole in Bonolata (New Market) Kitchen Market

(Field Survey, 2017). Permanent and temporary shops expand the market area illegally. These shops block the main excess road. These shops are settled along the both sides of main access road In Bonolata (New Market) Kitchen Market, the access road is very narrow. This road is occupied by illegal parking of cars, motorcycles and other vendor. It creates congestion. In Mirpur 1 Kitchen Market illegal parking is also found (Field Survey, 2017).

Problems with Waste Management

Most of the shop storage wastes haphazardly beside the shops. Some sellers use bin or small container to store the waste. When the bin is filled the waste are stored beside the dustbin. There is no community bin for storage of waste. So, inadequacy of dustbin creates problems at the time of waste generation and storage. This scenario is found in all our study area (Bonolata Kitchen Market, Mirpur 1 Kitchen Market) as both market is leased by local business association, the market management committee tries to clean the stored waste timely (Field Survey, 2017).

Inadequacy of collection system is another cause of present critical scenario of kitchen market waste management system. In Bonolata (New Market) Kitchen Market waste collected twice a day but it is not sufficient (Field Survey, 2017). In Mirpur 1 Kitchen Market the regulation of collection of waste is to collect waste twice a day, but the waste is collected only once a day. They collect the waste during evening period. It is not sufficient.



Source: Field Survey, 2017 Source: Field Survey, 2017 Fig. 5: Overloaded Carrying Carts in Bonolata (New Market) Kitchen Market and Mirpur 1 Kitchen Market

The throwing waste creates many problems as they are not collected properly (Field Survey, 2017). At present there remains only a very limited numbers of equipment's by which it is almost impossible to maintain and manage the total system properly. There is also lack of carrying carts and equipment of primary collection of waste is found. Lack of equipment's creates problems to collect the waste properly. In case of carrying waste from the market area to the dumping sites, the wastes are overflowed from the carrying carts and pollute the roadside environment (Field Survey, 2017).

Problems faced by Sellers during waste collection & Disposal Procedure

According to the opinion of the respondents, problems are due to late collection of the wastes by the sweepers in Mirpur 1 Kitchen Market. Besides, without adequate manpower proper disposal system cannot be ensured. In this market there is a lack of adequate dustbins. So the shopkeepers have to store the waste in the personal container or by the side of the shops which is really unhealthy and unhygienic. The sweepers do not collect the waste timely which causes a major problem to the sellers. Besides, from the market authority there is no provision for segregation of organic and in organic wastes (Field Survey, 2017).

According to the opinion of the respondents (seller), problems are caused due to late collection of the wastes by the sweepers in Bonolata (New Market) Kitchen Market. Besides, due to lack of proper manpower proper disposal system cannot be ensured. In this market there is a lack of adequate dustbins. So the shopkeepers have to store the waste in the personal container or by the side of the shops which is really unhealthy and unhygienic. The sweepers do not collect the waste timely which causes a major problem to the sellers. Besides, from the market authority there is no provision for segregation of organic and in organic wastes (Field Survey, 2017).



Source: Field survey, 2017





Source: Field survey, 2017

Fig 7: Problems Faced by Sellers during Waste Collection & Disposal Procedure of Bonolata (New Market) Kitchen Market

Problems Faced by the Buyers

The buyer faces problems of environmental, health and other issues due to lack of precise and adequate waste management system. The buyer usually faces environmental impacts mostly such as water pollution, air pollution, odour, termites/other insects and others (Field Survey, 2017).



Source: Field survey, 2017

Fig 8: Types of Problems Faced by the Buyers in Mirpur 1 Kitchen Market



Fig 9: Types of Problems Faced by the Buyers in Bonolata (New Market) Kitchen Market

Besides, they are harmfully affected by the encroachment of footpath due to waste, illegal shops and water logging to blockage of drain. Besides, due to odours and other aspects they face health impact of vomiting, sneezing, cough and others. The damping of waste by the side of the road is not pleasant to the buyers (Field Survey, 2017).

In Bonolata (New Market) Kitchen Market, the buyer faces problems of environmental, health and other nature. The main problem faced by the buyer is environmental impacts such as water pollution, air pollution, odour, termites/other insects and others. The illegal damping of waste and their inadequate management creates a visual look which is not pleasant to the buyers. Besides, they are harmfully affected by the encroachment of footpath due to waste, illegal shops and water logging to blockage of drain. Besides, due to odours and other aspects they face health impact of vomiting, sneezing, cough and others (Field Survey, 2017).

Satisfaction Level of the Existing Kitchen Market Waste Management System

Most of the buyers expressed that they are not satisfied with existing waste management system. They claimed that wastes are placed by the site of the shops for long time which is unhygienic and unaesthetic. Odour generation of flies, and other insects are the result of inadequate waste management system. Besides, due to lack of proper management of waste water, the internal market road remains all time wet and soggy (Field survey, 2018).



Source: Field survey, 2017

Fig. 10: Buyers Satisfaction Level of the Existing Waste Management System of Mirpur 1 Kitchen Market

Most of the seller expressed that they are not satisfied with existing waste management system in Bonolata (New Market) Kitchen Market. They claimed that wastes are placed by the site of the shops for long lime which is unhygienic and un aesthetic. Odor, generation of flies, and other insects are the result of inadequate waste management system. Besides, due to lack of proper management of waste water, the internal market road remains all time wet and soggy.



Source: Field survey, 2017

Fig. 11: Buyers Satisfaction Level of the Existing Waste Management System of Bonolata (New Market) Kitchen Market

Recommendations

An effective kitchen market waste management system may be helpful to ensure a clean, health hazards free and aesthetically pleasing environment. To enhance the drawbacks of present kitchen market waste management system the following recommendations may be considered.

Integrated Kitchen Market Based Composting

This scheme may be either small-scale and is integrated with a Dhaka City Corporations (North and South) kitchen market waste collection service. Inputs may be either sorted at the source or after collection, depending on the degree of initiative of sellers and market authority. This composting scheme can recycle organic waste up to a maximum of 5-10 tons per day (tpd).

Other option may be the Medium-scale public/private sector-composting enterprises which may handle around 5–50 tons/day of organic waste. They mostly use the windrow or box methods of composting, and treat pure, biodegradable market waste that they collect themselves from the source of waste generation. In this case if the organic wastes, generated from the households which are served by the Dhaka City Corporations (North and South) kitchen market, are integrated with the kitchen market wastes then this option may be more viable and effective. Dhaka City Corporations (North and South) may technically and financially contributes to this type of composting option along with the respective private sectors.

An organic waste-recycling plant comprises an operation area and a green buffer zone. The buffer zone, formed by a belt of bushes and trees surrounding the operation area, improves the visual appearance of any recycling plant. It also buffers odor during windy periods. The plant's design capacity should be based on the organic waste to be processed per hour and the number of shifts to be operated per day. The design of the plant should be modular so that as the waste-processing capacity increases, additional operational areas can be easily added. Since land is a constraint for compost plants, the box method with static pile and forced aeration, which requires less area may be considered.

The operation area of a recycling plant should be divided into different zones. A composting plant should contain space for waste unloading and sorting, composting, maturing, and sieving and bagging of the compost. Space is also required for storage of compost and recyclables, and storage and treatment of wastewater. These zones must be arranged to ensure efficient workflow of the composting process. Additional space should be allocated for storage for machinery, an office, a dining area, first aid supplies, toilet and bathing facilities for the workers, and a day-care center (for a plant processing more than 100 tpd of waste). It should be noted that the final setup of the site is strongly dependent on local conditions.

Since our country experiences 4–5 months of monsoon, the operation area should be protected with a roof in order to operate the plant year-round. This will also help avoid odour problems and leachate from fresh waste. At least 50%–55% of the plant area should be covered in compost plants. There is a need for a leachate collection tank in compost plant. Leachate may be recycled. The compost, biogas, and RDF site should have separate storm water drainage and leachate collection systems. There are always risks of rodents and ground and surface water pollution from waste treatment and recycling plants, therefore compost plants should have a concrete floor. Moreover, compost plants must have a boundary wall and green space in front to act as buffer. In addition, the following additional features may also be considered for the organic recycling facility:

Water Supply and Rainwater Harvesting

A reliable onsite water supply is a basic infrastructural requirement in a composting site. Water is needed for hygienic purposes and for watering the compost heaps, and may be provided by a standpipe in the operational area. An additional water storage tank is, however, advisable if the water supply is not continuous. A further useful feature is a rainwater harvesting system. The roof of the composting shed and other facilities can be specially designed to collect rainwater. During the rainy season, water can be collected in a tank for use during water shortages in the dry season. Rainwater can be used for the composting process, for cleaning and washing of the composting plant, and for watering the green belt.

Organic Farming Demonstration Site

If sufficient land and staff are available, a small plot inside the composting plant can be used as a demonstration unit for organic farming, or as a nursery for potted plants. The core idea is to encourage the owner of the composting plant to keep the facility as "clean and green" as possible. A clean, hygienic, and pleasant environment near a composting plant can combat negative perceptions of waste treatment, and the use of compost can be directly demonstrated to visitors.

Waste Water Reuse System

A significant amount of wastewater is generated during the facility's cleaning and composting processes. Onsite-generated wastewater can be reused for new compost piles to maintain the moisture balance and enhance the decomposition process. Wastewater from the drainage system can be collected in a small covered storage tank below ground level. By mixing this wastewater with fresh water, or water from the pipes or rainwater tank, water may be conserved.

Energy-efficient lighting system

If the compost plant is connected to the electricity grid, an energy-efficient lighting system should be fitted to reduce operational costs in the long run.

• Barrel Type Composting

Successful result of community based composting model helped Waste Concern to realize that a large portion of population residing in the slums of Dhaka city cannot be covered with the model of community based composting approach. A large group of urban poor are not included in the existing model. The slums are provided with two barrels- green barrel and yellow barrel. The slum dwellers were imparted with training and motivated to dispose their kitchen waste into the green barrel. Slum dwellers are motivated to dispose their inorganic waste in the yellow barrel.

This method may be applied for Dhaka City Corporations (North and South) kitchen market waste management. The green and yellow barrel may be provided to each market. The market authority and sellers should be imparted with training and motivated to dispose their organic waste into the green barrel and they should be motivated to dispose their inorganic waste in the yellow barrel. The potentials of this method are that:

- ✓ The wastes are segregated directly in the market and there is no need to segregate the organic and inorganic wastes.
- ✓ The organic wastes may be directly placed to the composting plant and the inorganic wastes may be placed to the refuse derived fuel (RDF) or other plants suitable for handling such wastes.
- ✓ There is no need to place the wastes to the land fill sites hence saving of land as well as transportation cost and additional workers for this purpose.

• **Biogas Production**

Biogas is produced by means of a process known as anaerobic digestion. It is a process whereby organic matter is broken down by microbiological activity and takes place in the absence of air (anaerobic means 'in the absence of air'). The amount of gas production in biogas digester depends upon the quantity of feeding added to it daily provided the plant is technically all right. Kitchen market wastes and household wastes, human excreta, urine of animals, water hyacinth, cattle dung and poultry droppings are the major feeding materials used to feed biogas plants. The Dhaka City Corporations (North and South) Kitchen market wastes may be integrated with the following waste materials to produce biogas. The following Table shows the composition of feeding materials being used in biogas plants.

• <u>The Centralized Biogas Plant Concept</u>

This method is concerned with collecting the organic waste from the kitchen market and other composition of the waste necessary for biogas plant. Then the waste is transported to the main biogas plant for treatment. This method may be applied for the Dhaka City Corporations (North and South) kitchen market wastes management in the sense that only the wastes produced from the markets may not be of enough quantity to generate required amount of gas or other by products of the



Source: Developed by Authors, 2017

Fig 12: The Centralized Biogas Plant Concept

biogas plants. So by applying this method, necessary amount of waste composition may be collected from other sectors to integrate with the kitchen market wastes.

The Centralized Biogas Plant Concept is shown in the following flowchart which represents that the kitchen market wastes along with necessary amount of waste composition is collected in a centralized approach and then transported to the biogas plant for treatment to produce combined heat and power production. The digested manure may be utilized as agri-fertilizer and also for producing livestock feed (e.g. chickens, birds, fish etc.)

• <u>Electricity Generation</u>

The Microbial Fuel Cells (MFC) use food garbage to produce electricity. A rectangular acrylic container (10 x 10 cm) was used as the cell. The container is filled with well mixed food waste (120 g), leaf mold (120 g), effective microorganisms (15g) and distilled water (80 g). The maximum generated power is 682mw/m^2 during the laboratory test of the MFC by using the food waste. The by-product of the electricity generation in MFC by composting method can be used as soil conditioner after further treatment which is another way to serve the agricultural based country (Moqsud and Omine, 2010).

The organic wastes from the kitchen market can be utilized for electricity generation purpose. Recently a Joint initiative has taken by DCC and an Italian company namely Management Environment Finance SRL to generate electricity from the wastes (The Daily Inqilab, 2013). The secondary outputs from such plants are organic manure and diesel. At the first phase 50 MW electricity will be produced which would be extended to 100 MW in second phase. This electricity would be distributed through the Dhaka Power Distribution Company (DPDC), Dhaka Electricity Supply Company (DESCO) and Rural Electrification Board.

Everyday approximate 5000 metric ton wastes are produced in DCC area and DCC will provide approximate 4000 metric ton/day to this plant (The Daily Inqilab, 2013). For this reason, Dhaka City Corporations (North and South) may introduce integrated kitchen market waste collection system to provide organic wastes to the electricity plant.

• Animal Feed and Other Products

The animal bones from the slaughter houses and the fish scales can be utilized to produce chicken/bird and animal feed, button, comb etc. The residues of organic wastes from the kitchen markets being utilized in the composting plant and biogas plants can be used to cultivate maggots/worms which may be used for producing livestock feed (e.g. chickens/birds etc.).

The fish scales from the Bonolata (New Market) Kitchen Market are being sold to a private organization which produces fish feed from the fish scales. The bones from the slaughter houses of the Mirpur 1 Kitchen Market are being sold to a private organization which produces fertilizer, button and combs etc. Dhaka City Corporations (North and South) should be taken initiatives to sell fish scale and bones. These initiatives can be advantageous both utilization of such kitchen market wastes as well as economic benefit to the market authority. The overall kitchen market wastes is shown in the following figure 13 :



Source: (Cahyari and Putra, 2010), (Reza & Hasan 2016) modified by Author 2018 Fig. 13: The Proposed Kitchen Market Waste Management System

Conclusion

In developing country like Bangladesh there is a huge opportunity to use the kitchen market waste for composting, electricity and bio-gas production. In Bangladesh everyday huge amount of organic wastes are generated which can be used. By this way the government, people and the nation can be benefitted. But the existing kitchen market waste management system of the concerned two kitchen markets is not at satisfactory level. Proper management option is enforced then the present scenario can be changed. The broad field of waste management is a complex discipline that includes environmental protection, waste reduction, recycling, composting, waste collection, land filling and maintenance, data gathering and analysis, government regulation, public education and awareness. It requires organization that is complying with government regulations and adapting and advancing techniques of waste collection, transportation and disposal. A planned kitchen market required a proper waste management system to ensure a better condition for both the sellers and buyers. So an efficient management system is required to overcome the existing situation. To confirm the growing concern about the sustainable environment, the management of waste should be considered with due importance. The future lies on the betterment of the environment and it is the high time to protect the environmental degradation to ensure a better environmental condition. Consideration should be focused on outlining, determining and weighting the different options of waste management that make up the sustainable environment.

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