Paper ID: RT-P24

Water Quality in Market drains of Khulna City Area: Sustainable Market Waste Management Perspective

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Abstract

Khulna is the statutory body to all types of conservancy services within the city area including management of the solid wastes. These cities are now struggling with the problems of high volumes of market wastes, the disposal technology and the impact of market wastes on the environment. This study revealed that most of the natural water bodies in the vicinity of market areas have been highly polluted sometimes became completely anaerobic state due to biodegradable market wastes. After testing water quality parameters of various market drains of KCC, it was found that the highest COD value was 3520 mg/L and lowest 1920 mg/L, the highest BOD was 240 mg/L and lowest 123.9 mg/L. The pH, turbidity, color and hardness varies between 7.39 to 8.08, 262 to 721 NTU, 680 to 4840 Pt.Co.Unit and 419.8 mg/L to 981.56 mg/L respectively. And the TC, FC & EC were more than 700 No/100mL. This information would help to prepare a master plan of market waste management and implementation technique for sustainable treatment process that would have been put forward here to address effectively the problems relating to the market wastes.

Keywords: *Water quality parameter, Market waste Management, Environmental pollution, Recycling, and Final Disposal Site.*

1. Introduction

Comprehensive solid waste management (SWM) programs are one of the greatest challenges to achieving institutional sustainability [4]. Effective SWM requires a complete understanding of the composition of a waste stream as well as the activities that determine its generation in the first place [5]. Examining waste by generation source is particularly important, as the characteristics and composition of solid waste vary according to its source [7]. Considering this, SWM programs that are based on the reality of the generating source, are far more successful than mimicked programs that have been implemented elsewhere [1]. A variety of approaches have been adopted for assembling detailed quantitative data on the amount, location, and characteristics of a waste stream [8] some of which include: reviewing waste management records, visual waste assessments, interviewing waste management staff and extrapolating data from other institutions [2]. Direct waste analyses or waste characterization studies, however, offer the most effective process for examining the various wastes generated and identifying opportunities for waste reduction, reuse, recycling, and composting [8].

Khulna is the third largest metropolitan as well as the second largest river port city of Bangladesh (Figure 1). It stands by the banks of the Rupsha and the Bhairab rivers. It is in the south-western part of the country with its location on the axis of Jessore-Mongla port, the second largest seaport of the country. Geographically, Khulna lies between 22°47´16´´ to 22°52´ north latitude and 89°31´36´´ to 89°34´35´´ east longitude. The city is 4 meter above the mean sea level (MSL). At present, it has a population of about 1 million [6]. The city is growing moderately in terms of its population and area. The existing public utility services and facilities cannot adequately cater to the needs of the burgeoning city population. The city generates a huge quantity of waste everyday from different sources. According to the Khulna City Corporation Ordinance, 1984 Khulna City Corporation (KCC) is responsible for collection, transportation, and treatment of solid waste in Khulna City [6]. Due to its resource and other

constraints and limitations, KCC has not been able to manage well entirely the whole task of solid waste as well as market waste disposal. In order to supplement the activities relating to the solid waste as like market waste disposal

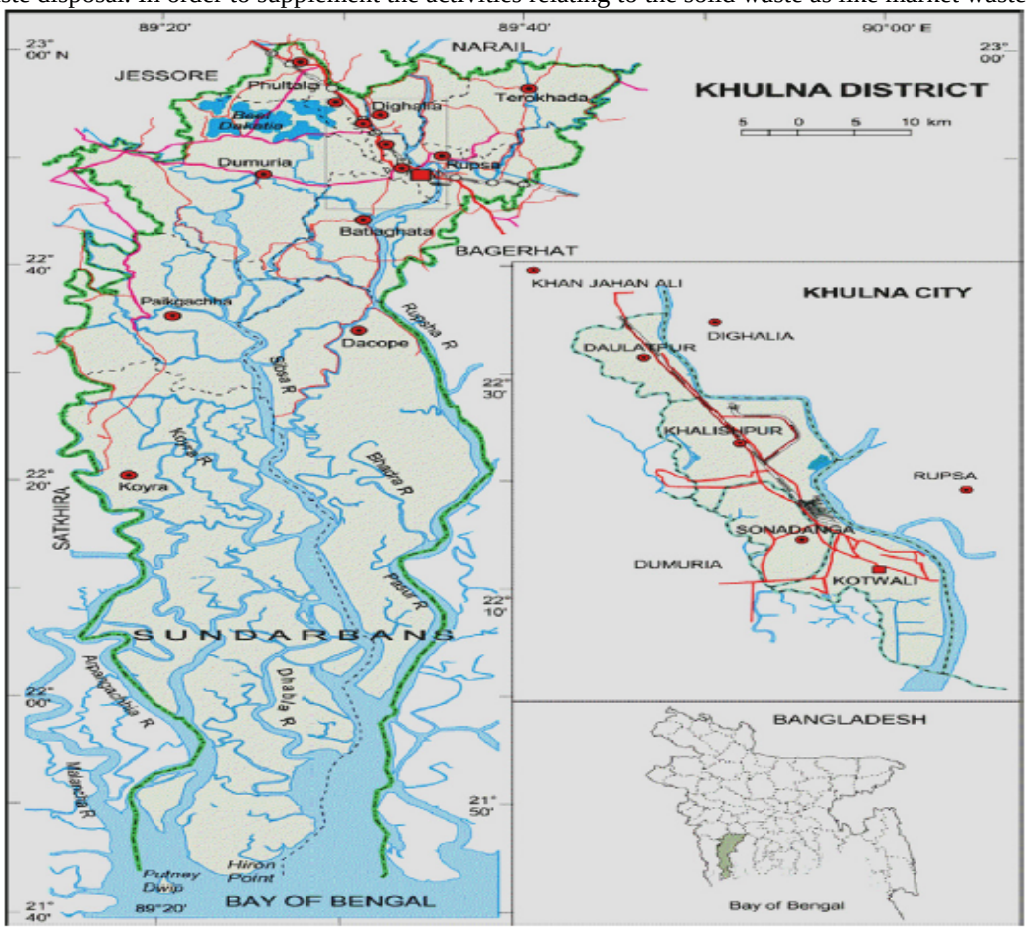


Figure 1: Khulna City Corporation Map

in KCC area, a number of non-governmental Organizations (NGOs), Community Based Organizations (CBOs) have come forward [6]. The first objective of this study was to test water quality parameter of various markets of KCC. Other objectives are to determine the scenario of ongoing market waste management in Khulna city area and hence formulating a general physical model of the waste materials flow path. The environmental degradation with regards to market wastes was also addressed in this study and safe strategies were proposed to reducing the environmental burdens.

2. Methodology

This study was conducted in the Khulna Metropolitan city (Figure 1) which is the largest river port city in Bangladesh. This research began in January, 2012 with an evaluation of internal policies and procedure related to the KCC sustainability and waste management, external documents including government regulations and guidelines and various municipal and waste composition studies. Waste haulage and disposal records were obtained through the various facilities department. The location of interior and exterior waste, recycling and compost receptacles were mapped and distinct flows of waste were documented. We identified three approaches to conducting a market waste characterization study: (1) the back end approach, which assesses the institution as a whole, (2) the activities approach, which tracks waste from distinct areas within the various market separately, and lastly, (3) an input/output approach, which tracks materials entering and leaving. There are total 12 big markets in KCC. So all the markets divided into 12 separate markets like Phulbarigate, Daulatpur, Chitrali, Boikali, Khulna borobazar, Khulna noyabazar, Khulna New market Bazar, Shandho Bazar, Khalispur, Nirala bazaar, Boyra bazaar, and Gollamari. The sizes of these markets are shown in table 1. This study documented the field survey data from “Tokai” (scavenger), cleaner, community service providers; waste resellers (Vangari shops) and many others shop keepers of Khulna city

area. After going to all markets of Khulna city area we contacted the shop keepers, tokai, cleaner, Community service providers and asked them for several data. After collecting these data primarily we collect data from waste collected people of Khulna city area. Then we compare these two data. We saw that there were very small differences among those data. In course of data collection and questionnaire we physically investigated the various environmental conditions in market places of Khulna city area.

Table 1: Major market areas (relative sizes) in Khulna City Corporation

SL.	Name of the market	Relative sizes of market areas
1	Phulbarigate	1.0
2	Daulatpur	3.5
3	Chitrali	1.0
4	Boikali	1.0
5	Khulna borobazar	11.0
6	Khulna noyabazar	2.0
7	Khulna New market Bazar	1.0
8	Shandho Bazar	0.8
9	Khalispur	1.0
10	Nirala bazar	1.8
11	Boyra bazar	0.8
12	Gollamari	1

Then we went again in all markets and collected drain water which is situated into the markets. We collected sample drain water from two different points of the drain, one was the sample into the market and other was the sample just falling before the river. After collecting the samples from different markets, we tested these samples to obtain water quality parameter.

Fig.2: Drain and Dustbin of Khulna city area market

3. Results and Discussion

Problems in ongoing market waste management

By almost any form of evaluation, market waste management is a growing environmental and financial problem in developing countries like Bangladesh. Despite significant efforts in the last decades, the majority of municipalities in the developing countries cannot manage the growing volume of waste produced in their cities. This inability to manage urban solid waste consists of failures in the following areas: Inadequate services, Inadequate financing, inadequate environmental controls, Poor institutional structure, Inadequate understanding of complex systems,

inadequate sanitation etc. This part considers the key constraints in terms of the development of integrated, sustainable, partnership-based market waste management systems in developing countries, and the issues that underlie these constraints. The irregular collection of solid wastes, unscientific disposal of wastes, lack of enthusiasm of the city dwellers, nonpayment of service charges by the beneficiaries, lack of research, lack of initiatives for recycling of resources, lack of co-operation, etc. were the main identified problems of the current market waste management in Khulna city area. We have developed a model for waste management and waste marketing that is attached in the next page of this article. This model is an aggregate and integrated model for waste management and marketing. In this model we have shown the sources of wastes, the collection process, the participatory groups, waste recognition and assortment system for marketing them and moreover the total marketing process is shown too. We have also shown the integrated waste marketing process that includes not only assortment but also grading, bagging and selling mechanism of different categories of wastes. A simple marketing mix analysis of the wastes and recommendations for waste marketing can explain the uncovered prospect for sustainable solution by using waste. This covered categorizing the waste as product, pricing them as per their commercial value; make the proper distribution channel, and lastly promotional activities include creating the awareness of the commercial value of the wastes among the community.

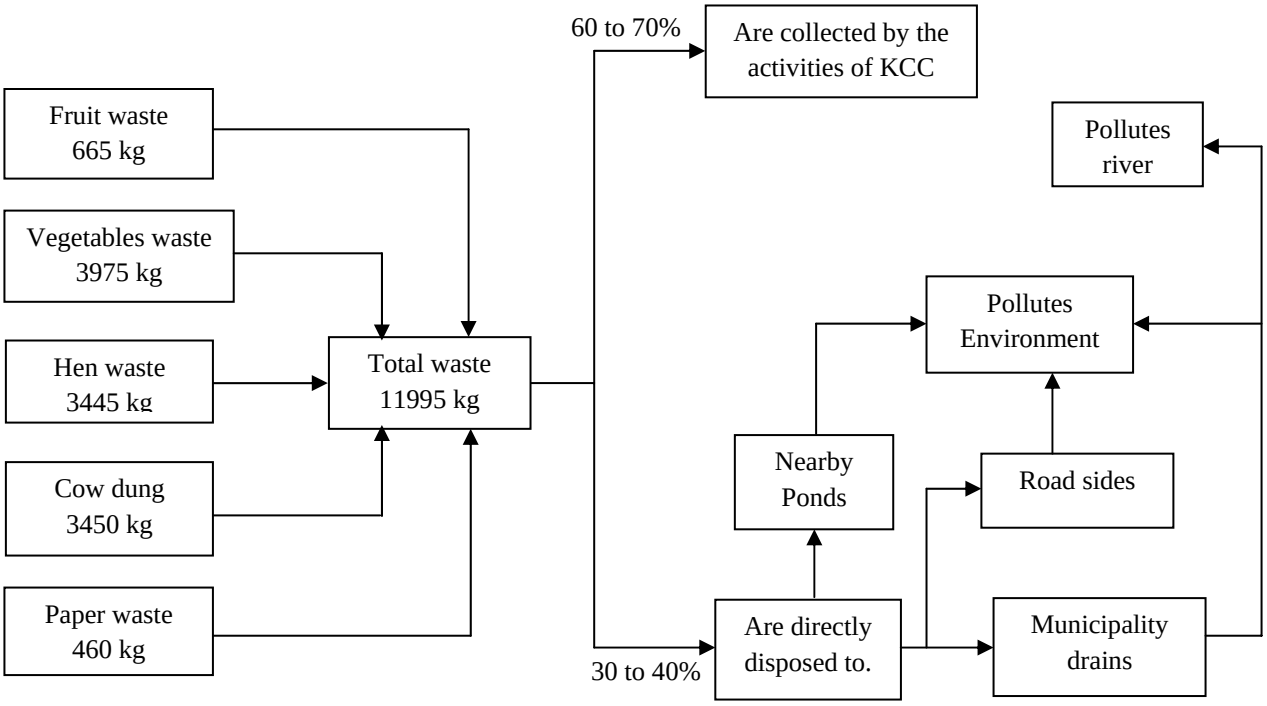


Fig. 3: Flow chart of analysis of market waste for KCC per day.

Strategies for Sustainable Market Waste Management

Strengthening inter-sectoral partnerships support a long-term vision of the goals of waste management in developing countries. This goal is to achieve sustainable solid waste management systems which are stable over time, and which are beneficial to the society, the economy and the environment. The point here is that it is possible, given the state of the art in both developed and developing countries, to bypass intermediate motivations, and to seek to create and implement sustainable waste management systems from the outset. This action plan is set up to pursue this goal. This paragraph defines the different elements of sustainability listed below:

- Sustainability will only be attainable if the current concept of refuse disposal, which imposes great burdens on the environment and resources, is transformed into a closed-cycle system, restoring various natural cycles, thus preventing the loss of raw materials, energy and nutrients.

Organic wastes are typically the heaviest component of a waste stream, thereby costing the most money to dispose of, and have the highest potential to emit green house gases, once buried in a landfill. The high financial and environmental costs of improperly disposed organic wastes make this component especially important when considering opportunities for increased waste reduction and diversion.

Table 2: Water quality parameter of Market drain water (Sample into the market)

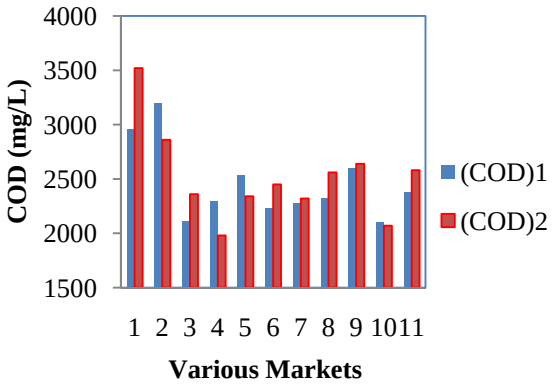
Various Markets	TC (Nos per mL)	EC (Nos per mL)	FC (Nos per mL)
Phulbarigate	54	13	44
Daulatpur	61	23	31
Chitrali	23	9	23
Boikali	34	13	33
Borobazar	42	19	15
New market	19	7	7
Shandho Bazar	33	13	12
Khalispur	24	11	10
Nirala bazar	51	21	27
Boyra bazar	49	31	37
Gollamari	30	17	11

Table 3: Water quality parameter of Market drain water (Sample just falling before the river)

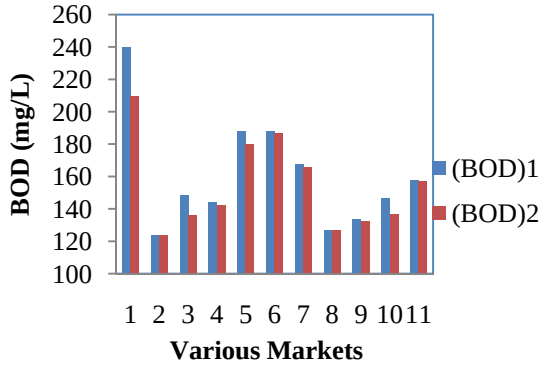
Various Markets	TC (Nos per mL)	EC (Nos per mL)	FC (Nos per mL)
Phulbarigate	34	19	32
Daulatpur	43	21	17
Chitrali	23	9	21
Boikali	51	24	12
Borobazar	41	19	21
New market	34	19	23
Shandho Bazar	29	13	19
Khalispur	48	23	11
Nirala bazar	28	12	17
Boyra bazar	45	17	13
Gollamari	47	29	21

Table 4: Name of the various Markets for water quality parameter graphs

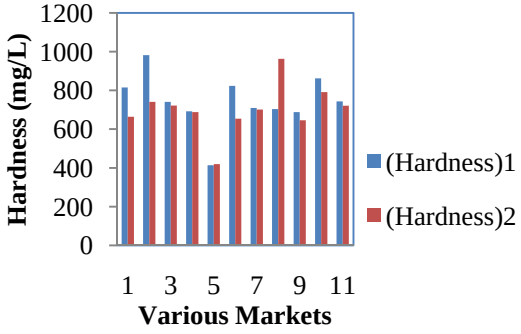
Various Markets		Various Markets		Various Markets		Various Markets	
1	Phulbarigate	4	Boikali	7	Shandho Bazar	10	Boyra bazar
2	Daulatpur	5	Borobazar	8	Khalispur	11	Gollamari
3	Chitrali	6	New market	9	Nirala bazar		



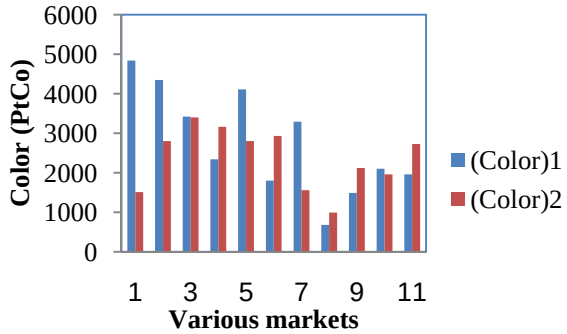
(COD)1= Sample into the market
(COD)2= Sample just falling before the river
Fig.4: Variation of COD of various markets drain in KCC



(BOD)1= Sample into the market
(BOD)2= Sample just falling before the river
Fig.5: Variation of BOD of various markets drain in KCC



(Hardness)1= Sample into the market
(Hardness)2= Sample just falling before the river
Fig.6: Variation of Hardness of various markets drain in KCC



(Color)1= Sample into the market
(Color)2= Sample just falling before the river
Fig.7: Variation of Color of various markets drain in KCC

4. Conclusions

There is a whole culture of waste management that needs to be put in place-from the micro level of household, market to the macro levels of city, state and nation. The general assumption is that Solid waste management should be done at the city level first and as a result; solutions tried out have been essentially end-of pipe. But we should keep this mind that rather than making a long-term holistic approach, we can start it within our community and can create an example for the whole country.

If we can start our waste management process at the micro level, like as community based system then it can be easily manageable as well as it can create examples for others. Most of the developed countries now a day are trying to rethinking about their waste disposal system and developing a wide range of system and approach to minimize the environmental hazard as well as reaching a profitable solution using these wastes.

In our country, we can also dream for a better future, where our environment will be protected as well as we can reach a sustainable solution by using market waste, and develop our entrepreneurial activities. Further this study tried only to develop a theoretical model for better waste management in Khulna city. It needs a complete empirical study to examine the feasibility of this model. This model will also provide the platform for further study and exploration of the waste management and practices in Khulna city.

5. Acknowledgement

The authors like to express thanks to various shop-keepers of different markets of KCC for the opportunity of collecting data form market. Appreciation goes to the Civil Department of KUET for the financial support for completing the author's project.

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