

Municipal Solid Waste Management: A Case Study of Kamakhya Devi Temple, Assam, India

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Abstract - Kamakhya Devi temple located in Guwahati, Assam is a Hindu temple considered as most sacred and oldest of the 51 Shakti peethas on earth. It is located in Nilachal Hills in western part of Guwahati city is an important pilgrimage destination and tourist place as well. Every day, People from different parts of the world visits the temple apart from local residents of Assam. As a result, waste generation from the temple premises is undoubtedly an important issue to mitigate it. Moreover, around 5000 peoples residing in nearby location of Kamakhya Temple also generates huge amount of solid waste which needs to be disposed of properly. Though the waste management system is monitored by the temple authorities under "Swaach Kamakhya Mission" but disposal of waste in an eco-friendly and sustainable way stands as a big problem for the authorities. Thus in order to build effective waste management programs we quantified solid waste generation and analyzed waste composition. Around 2-2.5 tons of solid waste is generated per day which is contributed from households, hotels and restaurants, various offerings such as flowers, fruits, leaves etc. About 84% of total waste generated goes to dumping site, and the rest 16% is recycled in organic waste converter plant set up by 'Coal India Limited'. Further to support municipal solid waste management (MSW) in Kamakhya Temple we analyzed the gaps and weakness to the systems and provided recommendations to be incorporated in the action plans for efficient management of solid waste.

Key Words: Solid Waste, disposal, sustainable way, temple premises, waste composition and total waste

1. INTRODUCTION

The management of municipal solid waste (MSW) has been identified as global challenges that must be carefully faced in order to create sustainable environment. Municipal solid waste primarily generated from households, hotels, shops, shopping complexes, schools, institutions etc. Developing countries like India facing major challenges in the field of solid waste management due to its scarcity of a suitable solid waste treatment and disposal system. Moreover, rapid urbanization and increase in the growth of population results in generation of huge amount of solid waste per day which degrades the environment and human health as well. A well designed solid waste management system can help

not only in treating and discarding the waste but also in maintaining a better environment.

1.1 Characterization of solid waste

It is the process by which the composition of different waste streams are analysed. Waste characterization plays an important role in treatment of waste. Depending on its origin (domestic, industrial, commercial, agricultural etc.) and its contents (organic, glass, metal, plastic, paper etc.) characterization of solid waste is done. [7]

1.2 Solid waste management system

Different steps are involved in the management of solid waste from its generation to its final disposal as shown in fig-1.

Waste generation: - Materials, which are no longer useful are discarded becomes waste.

Waste storage and processing: - The activities which are associated with the handling storage and processing of solid waste at the point of generation.

Collection: - The activities concerned with the collection of solid waste at specific location.

Transfer and transport: - Activities involved the transfer of waste from collection point to the vehicles and then transported to the disposal site.

Processing and recovery: - Methods and facilities that are used to recover the waste for recycling and other treatment.

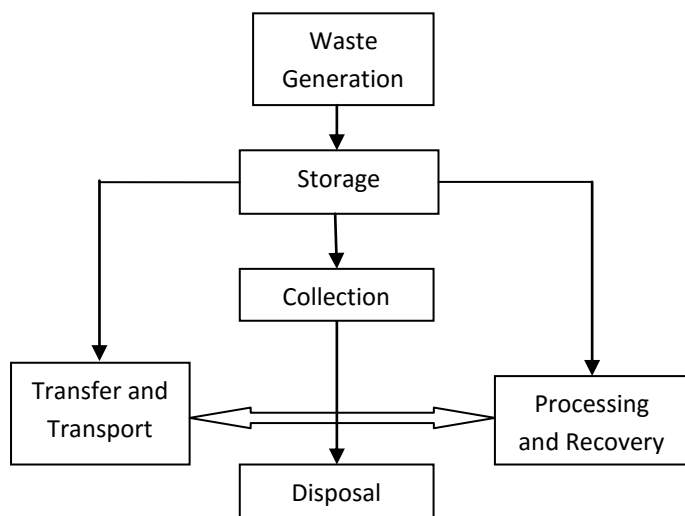


Fig-1: Solid Waste Management System

In India, people worship god and goddess whether in their own localities or go to the temples and offer various offerings to the deities which mainly consist of flowers, leaves, fruits, coconuts, clothes etc. After fulfilling their purpose, all these offerings becomes waste and needs to be treated or disposed of properly. Unlike other temples in India, Kamakhya Devi temple is no exception to it. Apart from the treatment of waste generated from the temple premises, there are still around 5000 population, 20 hotels and restaurants, other commercial establishments, school, hospital generates waste in huge quantity which needs to be managed productively so that to minimize the harmful effect to the environment. At present, they generally collect the wastes from households, commercial establishments, schools, hospitals, hotels and restaurants including the temple premises and loaded into the disposal van and transported to the “Boragaon dumping site”. Solid waste generated in the temple can be categorized on the basis of source as shown in the table1.

Table -1: Solid Waste categories based on source

Sources	Typical facilities, activities, or locations where wastes are generated	Types of solid waste
Residential	Waste from dwellings, apartments etc.	Leftover food, vegetable peels, clothes etc.
Commercial and Institutional	Stores, restaurants, markets, office buildings, hotels, medical facilities etc.	Paper, cardboard, plastics, food wastes, glass, metal wastes, ashes, biomedical waste etc.
Municipal	Residential, commercial and institutional	Leafy matter, paper, plastics, metals, food waste, etc.

2. Kamakhya Devi Temple

The Kamakhya Temple also ‘Kamrup- Kamakhya’ is a Hindu temple dedicated to the mother goddess Kamakhya Situated on the Nilachal Hill in western part of Guwahati city in Assam, India. Geographical location of this temple is 26.166426° N and 91.705509° E. It is an important pilgrimage destination for General Hindu and especially for Tantric worshippers. Being the centre for Tantra worship this temple attracts thousands of tantra devotees in an annual festival known as the Ambubachi Mela celebrated every year in the month of June.

3. Methodology

This deals with the various methods employed in the collection, segregation, transportation and disposal of solid waste samples for generating primary data pertaining to quantity and quality. Portable hanging digital scale was used for calculation.

3.1 Collection of Municipal Solid Waste (MSW)

At first, the whole area was divided into different small manageable parts and waste collection was done by the waste collectors working under the temple authorities. There were around 200 cleaning staff, 78 sweeping staff and 10 supervisors. The duties and responsibilities of all the employees are divided into three shifts- 6AM to 1PM, 1PM to 7PM and 7PM to 12AM daily. Door to door collection of waste was done by the waste collector. Also the MSW were collected from the community bins, street sweeping and roadside garbage irregularly. Majority of the shops and commercial establishments engaged some persons on daily/weekly/monthly payment basis to collect and disposed of their wastes into the nearest dustbins.

3.2 Segregation of Municipal Solid Waste Management (MSW)

Segregation was done manually as dry and wet waste before transportation to the dumping site. By using Portable hanging digital scale, total mass (in Kilogram) was calculated for dry and wet waste generated.



Fig -2: Segregation of MSW generated

3.3 Transportation of Municipal Solid Waste (MSW)

The waste collected by the cleaning and sweeping staff was loaded into the waste carrying vehicles. One tipper truck and one trax delivery van was available with the temple authorities for disposal of waste. Depending on the amount of waste generated, these vehicles were used to carry the wastes to the dumping site on 2 trip/ day/ vehicle basis.

4. RESULTS AND DISCUSSIONS

An estimate of the quantity and characteristics of solid waste generated in Kamakhya Temple and its locality is discussed based on the survey conducted. An accurate assessment of the quantity and characteristics generated is very important in formulating the solid waste management plans.

4.1 Waste Generation

Increase in urbanization and higher the income levels results in greater amount of solid waste generation. Table-2 shows the amount of waste generated from the sample collected related to 17 households. Major portion of MSW collected was food waste.

Table-2: Waste collected from 17 households

Dry Waste	5.7 Kg
Wet Waste	14.19 Kg
Contaminated	1.1 Kg

Total amount of waste collected from 17 household was found to be around 21 Kilogram/ day.

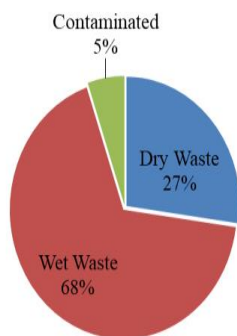


Fig-3: Composition of garbage (17 household)

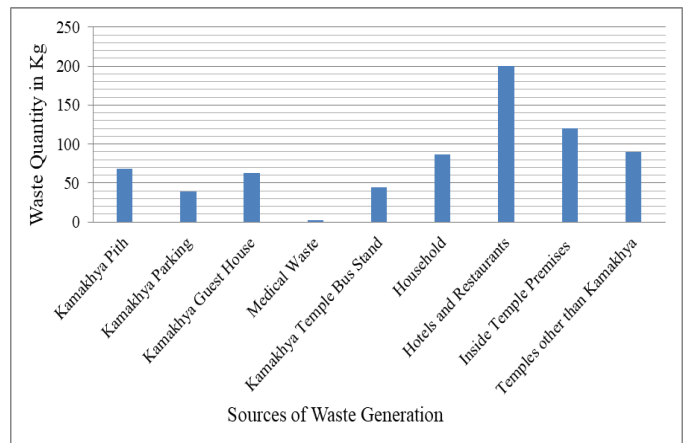


Fig-4: Different sources of waste generation

During the survey period, solid waste generated from different sources were analyzed and weighted as shown in fig-4. Waste generated from hotels and restaurants contributes substantially to the total generation of waste per day which comprises basically, left over foods, vegetables and non-veg waste.

Table-3: Waste collected from temple premises

Dry Waste	2.6 Kg
Wet Waste	14 Kg
Others (Earthen lamp, Incense stick, nut shell etc.)	25.5 Kg
Total	42.1 Kg

Table-3 shows the amount of waste collected from inside the temple premises. After segregation, it was found that apart from dry and wet waste, earthen lamps, incense stick, nut shell etc. that was used for worshipping in major quantity.

4.2 Current Solid Waste Management Practices at Kamakhya Devi Temple

The waste management system in Kamakhya Devi temple is managed by the temple authorities in an organized manner in a view to make the temple a “Swachh tourist destination” as well. Certain initiatives have been taken by the temple authorities to make the temple premises clean and green. The waste generated from the offerings such as flowers, leaves, fruits etc. are treated in a scientific manner in the compost plant installed near the temple premises. The Organic Waste Converter (OWC) plant has been set up by the Coal India Limited, Kolkata as a Corporate Social Responsibility (CSR) activity along with Art of Living on 10th November, 2016. The waste generated other than biodegradable are collected and transported into the dumping ground of Guwahati Municipal Corporation at Boragaon. They have their own waste disposal van. Moreover, the temple authorities imposed ban on the use

and sell of tobacco products near the temple premises. The whole area of Kamakhya temple has been made dustbin free.

5. Gaps and Weakness of Municipal Solid Waste Management (MSW)

In this research the identified gaps and weakness are as follows [5]

- Segregation of waste at source was not done.
- There was a lack of investment in provision of recycling activities.
- There was no technological improvement in terms of producing required equipment for reprocessing waste.
- Collection bins are neither properly designed nor properly located and maintained.
- The temple authorities did not organize any awareness programme among the residents for segregation of municipal solid waste (MSW) at source.
- There was not having any support from the temple authorities and collected rags without any protective wears like boots, gloves, masks etc.

6. Recommendations

Generation of solid waste can be expected to increase during the weekend and during functions, worships, ceremonies and festivals such as Durga Puja, Ambubachi Puja etc. Moreover, due to the impact of rapid urbanization and economic development also results in huge tonnage of solid waste generation by the human being itself but there are certain things that the temple authorities has not been practiced to overcome the difficulties in proper disposal of solid waste. Following recommendations may be incorporated in order to make action plan for municipal solid waste management effectively. [3]

6.1 Training and Workshop for Cleaners and Sweeping Staff

The cleaners and sweeping staff plays a vital role in recycling process of the solid waste. Though, door to door collection and transportation activities of solid waste continues properly, but certain initiatives for improving the working conditions of garbage pickers can make them professional in their work. This has resulted poor collection efficiency. Training/ workshop regarding waste collection, segregation, disposal etc. may be arranged by the temple authorities.

6.2 Public Awareness Campaign

Since, waste is the result of human activities and everyone needs to have proper understanding of waste management

issues. The attitude of people about waste should be changed and make to realize that the waste which they throwing in the streets are not actually waste, it is the raw materials for other processes. So it may be essential to organize public participation programs for efficient waste management plans.

6.3 Increase the Rate of Recycling

Recycling rate should be increased in order to reduce the waste generation. About 84% of total waste generated goes to dumping site and rest 16% is recycled at present. The temple authorities should reassess to increase the recycling of solid waste. Recycling will not only reduces the waste generation but also helps to generate revenues from recycled products.

6.4 Creation of Two Stream Waste System

Segregation of waste should be two stream- biodegradable and non- non-biodegradable waste. This will help in proper disposal systems. Segregation of solid waste should be done at source itself.

6.5 Promotion of Reduction, Reuse and Recycles

The 3R's (reduce, reuse and recycle) helps to cut the amount of waste that we throw away and increases the material recovery. Release of pollutants and greenhouse gas emissions can be prevented if these 3R's incorporated at all levels.

7. CONCLUSIONS

Solid waste management refers to separation, storage, collection, transportation and final disposal of waste in a sustainable manner. It therefore comes out as a necessary and specialised sector for keeping your locality healthy and liveable. Nowadays we have a number of methods that are used for waste disposal such as biometanation, incineration, sanitary land filling etc. but one of the most economically viable methods is Composting. Temple authorities have already incorporated the best practices of religious beliefs and sustainable living by converting flowers offered every day in the temples into compost which was installed by Coal India Limited. Moreover, from the field survey that was conducted the treatment of solid waste generated from household, commercial establishments like shops, hotels etc. can be made possible through composting technique. Apart from jobs it will surely create a healthy environment with a good amount of revenue and also less land will be required for the waste dumping which will be beneficial for future. By converting its wastes into wealth, it shall enhance social, economic and environmental efficiency, and promotes sustainable development.

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BIOGRAPHIES

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