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Waste Management in Bhopal Municipal Corporation Issues and Perspectives

Tapas Dasgupta
Research Scholar, AISECT University, Bhopal
Dasgupta16@gmail.com

Abstract : ***Bhopal is the capital and the second largest city of Madhya Pradesh. There is no arrangement for segregation of waste at source. It is a known fact that even elaborate Municipal Solid Waste Management (MSWM) schemes also fail. Hence people in MS WM activity schemes should design appropriate MSWM plan, water and landfill gas monitoring system.***

Key Words : *Municipal Solid Waste (MSW), Compost, Vermicompost, Thermophillic Composting,, Anaerobic Digestion, Aerobic Composting, Collection , Disposal, Source, Factors.*

Introduction

People are crowding in Urban areas for employment opportunities, due to industrialisation in and around urban areas. Growing population and growing needs are the well felt problems for researchers, planners, and executors (Giesele Yasmin)[3]. Observed effects of mega cities are decrease in farm and landfill areas. So it became urgent need to utilise maximum possible area for better crop yield and also better treatment of solid waste in minimum available area. In this particular research study researcher wishes to focus on the treatment of solid waste collected in Bhopal city and emergent issues and the suitability of centralised and decentralised processes of treatment. It is essential to concentrate the study on the out-come of the different treatment methods like vermi-compost, compost, biogas generation, energy generation and try to find out the method by which all the waste can be treated effectively, in minimum possible time and also to overcome the problems in collection, transportation, segregation and treatment. It is also essential to consider related issues.

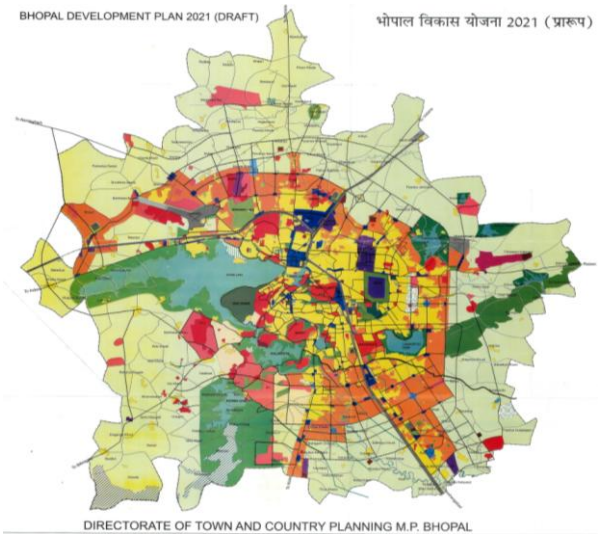
Study Area:

Bhopal Municipal Corporation (BMC) has about 285.88 sq. km. of area with about 1844000 population, according to census 2011.Average waste generation is about 365 gms. per capita per day, in Bhopal city.

Municipal Solid Waste:

As per projection, the waste generation quantities are estimated to increase from 427 metric tonnes per day in 2001 to 569 metric tonnes in 2011 and 886.5 metric tonnes per day in year 2021, in Bhopal.

Biodegradable Waste: Biodegradable Waste consists of vegetable stems and left over vegetables, waste food from restaurants and houses, spoiled fruits and vegetables from market, garden waste etc. The sources of collection are scattered throughout the city. Out of 670 metric tonnes to 569 metric tonnes of waste generated in Bhopal city, hardly 10 to 15 % is segregated at source, remaining 85% requires segregation.



Source : BMC

The biodegradable waste is the waste which can be biologically degraded, from complex organic to simple form in the environment. In warm Indian conditions, organic waste decomposes quickly, within a day or so.

Dealing with Municipal Solid Waste:

As the urbanisation continues to take place, the solid waste management becomes conscious about public health and environmental degradation, in urban areas of developing countries.

Treatment of Municipal Solid Waste (MSW):

Any solid waste management will emphasize first on maximum waste reduction and then on reuse, segregation at source, recycling, organic waste treatment and use of recycled products.

Segregation of Waste:

Dry and wet waste required to be segregated and collected at source, is the bottle neck of the Municipal Solid Waste Management.

Dealing with Biodegradable Waste:

Food to Animals:
During ancient days, left over food was given to animals and beggars and remaining was put in to pits for composting.

Anaerobic digestion:
Many microorganisms prevail naturally in absence of air and oxygen and also decompose organic matter. Anaerobic digestion on decomposition of organic matter gives rise to methane which is 23 times more harmful than carbondioxide (Jonathan-Rouse) 1.Hence wherever anaerobic digestion treatment is employed for organic matter, it becomes vital to collect methane and use it. Actually such practice is used for animal and human waste but certain examples are there, that they are successful in generating methane and use it. Biogas is a source of energy with lowest carbon footprints of all. Methane can be burnt on simple stove. The main problem is the quality of waste. Sand, soil, plastic contamination in the waste reduces the effectiveness of the plant and chemical contamination could compromise the microorganisms as well as the resultant compost.

Aerobic Composting:
Compost is the product of controlled aerobic decomposition of organic waste with the use of microorganisms, insects and worms. Microorganisms thrive in a moist, warm environment with an abundance of air and organic matter'. The composting may be compromised because of extreme conditions of hot, cold, wet and dry. The decomposing activities of microorganisms generate heat even up to 65 degrees centigrade which is responsible for pathogen kill and denature seeds.

Compost is a stable, dark brown compound with soil like appearance. It can hold moisture, air and nutrients. Naturally made compost, smells like fresh forest floor and does not have rotten smell. Compost contains plant nutrients, minerals and also nitrogen, phosphorus and potassium (NPK),It also contains some microorganisms beneficial to plant growth. It can be used as a soil conditioner to reduce requirement of chemical fertilisers and also to reduce soil erosion

Vermicomposting:

Through the simple act of eating, earthworms promote bacterial growth, enhance soil structure and hasten the decomposition of organic matter. However, due to different feeding habits, not all earthworms are suitable as a vermi culture. Earthworms are divided into two groups: humus formers and humus feeders. The first group dwells on the surface and feed on nearly 90% fresh organic materials and 10% soil. They are usually red in colour, have a flat tail and are also called epegic or detritivorous worms. It is these worms that are harnessed for Vermicomposting. The second group, the humus feeders, are deep burrowing worms those are useful in making soil porous and also mixing and distributing humus through the soil. The earthworm species Eudrilus eugeniae is widely used for this purpose. During the vermicomposting the substrate composition is very important. The composted product is very rich in nutrients called vermicast and also produces shiny water called vermiwash which is also rich in nutrients.

Thermophilic Composting and Vermicomposting:

During recent days due to less availability of land and huge quantity of biodegradable waste, it became very difficult to treat the same by city corporations. Considering this fact Thermophilic composting is preferred by city corporations.

In vermicomposting, the earthworms take over the role of turning and maintaining the material in an aerobic condition thereby reducing the need for mechanical operations. In addition to this the product vermicompost is homogenous. However, the major drawback of the vermicompost process is that the temperature is not high enough for pathogen kill. Where as in traditional thermophilic composting temperature exceeds 65 degrees centigrade, which is good enough for pathogen kill, as compare to less than 35 degrees centigrade maintained in case of vermicomposting.

Innovative Techniques:

With growing population and growing needs, waste generation has shown exponential growth in various cities like Bhopal. It is well felt problem for researchers, planners and executers. Naturally the issue attracted the attention of all that, how to overcome the problem? Because of this curiosity many experiments, many techniques were tried. Out of which some eye catching techniques like Pre-composting followed by Vermicompsting and Prevermicomposting followed by composting, are discussed in this research paper.

Precomposting followed by Vermicomposting:

Traditional thermophilic composting relate to the problem of long duration of the process, frequent turning of the material, raw material size reduction to increase the surface area. There is loss of nutrients to some extent because ofhigh temperature and prolonged process. Also resultant material is the heterogeneous product.

Prevermicomposting followed by composting:
In vermicomposting earthworms take over both the roles of turning and keeping the material in aerobic condition and thereby reducing the need of mechanical operation. The vermicomposting product is homogenous. The main drawback of the process is the process temperature is not high enough for pathogen kill (65 degrees centigrade or more). The vermicomposting process temperature is 35 degrees centigrade or less up to 28 degrees centigrade.

Comparison of Combined Processes:
During the study it is observed by the researcher that, the duration of the combined process viz. Thermophillic composting followed by Vermi- composting is about four

weeks. While in case of other combination, namely, Vermi-composting followed by Thermophllic composting, the time required only for vermicomposting is about 56 days minimum and then question of composting arise for ten days with higher temperature.

The combination of both these processes, in both the forms, shortened treatment and stabilization period and improved quality product. The end product is stable and consistent, and also with less bad impacts on environment and meet the requirement of pathogen kill.

Perspectives:

As per researcher's observations, outlined above, though there are many ways and means to tackle the issue, garbage issue is totally neglected one. As per the researcher's opinion there are certain problems, especially the waste treatment, has following issues.

Collection and Disposal of MSW:
The generated municipal solid waste in municipal areas is a daunting task for all municipalities due to poor implementation of solid waste management programme. No efforts for segregation of solid waste at the collection point, are tried and at the same time it is noticed that there is shortage of sanitary workers and lack of awareness among the citizens.

Anaerobic Digestion:
Biogas is a source of energy, one of the lowest relative carbon footprints of all; it is a very clean household fuel, producing mainly carbon-di-oxide and water. Contamination from plastic, sand, soil can reduce the efficiency of the plant, and also chemical contamination can compromise microorganisms.

Traditional Thermophific Composting:
In this process the problems are frequent tan ing of the material and loss of nutrients to some extent because of higher temperature for the prolonged time.

Vermicomposting:
Earthworms are very vulnerable to temperature change.They can be safe only at 28 degrees centigrade, + or - 2 degrees centigrade. In this particular process the executors cannot achieve the necessary pathogen kill temperature.

How to Resolve these Issues:
It is necessary to make a note of it that nearly 40% of domestic waste, 25% hotel waste, and 25% of commercial waste which is organic in nature can be segregated, collected and treated separately. BMC is having separate truck arrangement for hotels and commercial complexes but segregation is not done at source. Similarly in case of domestic waste, nearly 40% of the total waste, is not segregated at source and collected with dry waste.

Source reduction and source separation are important ingredients for sustainable municipal solid waste management. However, waste managers find it as a challenging task. This situation is more difficult in developing countries. Lack of public awareness, lack of environmental awareness and lack of public cooperation are the main barriers[6]. This can be handled effectively by awareness programmes and by implementation of MSW Rule 2000.

Anaerobic digestion in reality is a very appropriate system, in which methane is generated, captured and burnt. Methane is a greenhouse gas, 23 times more active than carbondioxide. This process should be run very carefully; otherwise it will spoil the environmental conditions.

Traditional thermophific composting:
The high temperature and long duration, some percentage of ntirients may get lost. The use of mechanical equipments and shredding of the organic matter will reduce the process time. The end material is not homogeneous, but it is free from pathogen.

Vermicomposting
Vermicomposting is a lengthy process, takes minimum sixty days. The final product is homogeneous and granular. The main disadvantage in this is that the final product may not be pathogen free and taking care of earth-worms is not easy.

Integration of thermophillic composting and vermicomposting can be a better choice, if processed simultaneously. Duration of the total process is about a month and in the final product pathogens will be well within tolerable range.

Use of organic Waste for electricity generation is the clean and economical technology than ever before, including landfill gas capture, gasification etc.

Optiofls:
There may be a need of Revitalization of the total BMC's, MSWM system. This can include transfers, training of workers and staff for the service which they are rendering to the city. Management of MSW is to be revitalized for making strong decisions and implementations.

More number of treatment plants may be required to be installed in 70 wards of BMC. This will take care of inadequate capacity of treatment plants. This also will take care of stop gap arrangements in case of breakdowns.

Perspectives:

Reduce the Waste, Segregation at source:
As mentioned above, source reduction and source segregation are important ingredients for sustainable municipal solid waste management. (Panate Manoma)[6]. This can be made possible by public awareness and public participation and by tightening the implementation of MSW Rule 2000. At source segregation is a failure in case of all municipalities, so centralised sorting system can be applied with the help of mechanical sorting facilities, using magnetic and electrical field separation, density separation, size separation and other techniques.

Efficient Collection:

After segregation, collection is rather easier. Then decide the proper schedule of lifting of dry and wet waste separately and divert truck load to the treatment site, before contamination.

Use of Organic Waste:

The processing of MSW for energy generation has become cleaner and economical technology than before, including combustion pyrolysis, plasma arc gasification etc. Incineration plants also emit high level pollutants.

Application of supply chain management, integrated municipal solid waste management and heading towards green economy may be the important strategy for waste free Bhopal city.

Conclusion:

M. P. Agro industries composting plant at Bhanpura might be running with low capacity which can be operated with full capacity.

Currently all types of composting appear to be well developed in Rural India (Furedy 2000)2. Especially Mumbai, Pune and Bangalore are the most prominent places for various types of composting activities.

Considering all the processes discussed above, anaerobic digestion holds the better position of treating the organic waste, but it is required to take at most care for its foul smell, corrosiveness and it spoils the environment due contamination, if proper scientific care is not taken.

It is very much essential to study integration processes composting and followed by vermicomposting, and also vermicomposting followed by composting, both can be preferred. Transportation cost is very high, so BMC should try for private partnership.

Organic waste can be effectively used for energy generation as a clean technology in near future.

There must be a trained MSWM for selecting the proper treatment method and the percentage of waste handling by a particular method.

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