SOLID WASTE MANAGEMENT FOR AMRAVATI CITY BY USING VERMICOMPOSTING

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ABSTRACT
The quantity of solid waste produced in city depends on the type of the city, its population, living standards of the residents and degree of commercialization, industrialization and various activities prevailing in the city. Due to rapid growth of population in Amravati municipal corporation area and changing life styles has resulted in increased waste generation. Consequently, waste management has become a key issue needing to be addressed. Amravati city generates about 184.90 tons municipal solid waste per day. The various Solid waste streams in Amravati city include municipal solid waste, biomedical waste, industrial waste and electronic waste. Solid waste management strategies adopted by Amravati Municipal Corporation includes management of MSW at compost depot, management of biomedical waste, and implementation of MSW rules 2000. But these present facilities are falling short and hence new Landfill site proposal is sanctioned for AMC. This report consists of waste characterization data, number of beds required and land required for the vermicomposting. Efficiency vermicomposting method is suitable rather than other methods of waste management.

1. INTRODUCTION

Solid Waste Management (SWM) is a universal problem that the world is facing today and being no exception, over the years the new capital city will grow significantly both in population and in density, which may result a great pressure force on the resources of the city. The municipal solid waste of residential area and waste products of commercial area are the two major solid waste produced in the Amaravati region. The utmost challenge for Amaravati region is the disposal of enlarging quantities of solid waste. The present methods of solid waste disposals in the State are not been satisfactory. The wastes that are being disposed are most unscientific (land) thereby posing a great threat to environment and public health.

Amravati is second largest growing industrial city in Vidarbha region, situated at 156 Km towards west from Nagpur. As so many other small cities in India, Amravati is growing in terms of living quality. Amravati known as Indrapuri the capital of Lord Indra and named after ancient “Ambadevi” temple, which is famous for its ancient culture. Solid waste Management is a universal problem with Amravati being no exception. Solid waste includes garbage, ashes, rubbish etc. The quantity of solid waste produced in the Amravati city is mainly consists of residential area municipal solid waste and commercial area waste products. Disposal of increasing quantities of urban solid waste is a major challenge for Amravati municipal corporation. As per collected data, total solid waste generation of Amravati district is 352.139MTD wherein, dry waste segregated is 55.12MTD and Wet waste segregated is 39.95MTD. Total non-segregated gap is 257.06MTD. It is observed that Amravati Municipal Corporation stands on top with the highest quantity.

3. METHODOLOGY

Vermicomposting is a bio-conversion process

which is widely being used for solid waste management. In this bio-conversion process, earthworms feed on the organic waste to produce more earthworms, vermicompost and vermi wash as products. Earthworms which include Megascolex Mauritii, Eisenia Fetidin, Eudrilids' Eugeniae, Perionnyx Excavatus, Lampito Mauritii, Eisenia Andrei, Lampito Rubellus and Drawida Willis have been widely used for vermicomposting. Vermicomposting has been done for various wastes including animal, plant, pharmaceutical, food waste and sewage waste over vermicomposting periods ranging from 28-120 days using these earthworms. The process conditions during vermicomposting ranged from 18-67°C for temperature, pH 5.9-8.3 and moisture content 10.6-80%. Vermicompost yields of 30-50% have been achieved for various organic wastes and composting periods. The vermicompost and vermi wash produced were rich in nitrogen, phosphorous and potassium (NPK). The vermicompost obtained had NPK compositions ranging from 0.3-4.19%, 0.2-1.6% and 0.2-6.18% respectively. The vermiwash obtained had NPK composition ranging from 0.14-1.58%, 0.05-7.53% and 0.47-1.26% respectively. Vermicompost and vermiwash have been applied on cow pea, soy bean, maize and marigold as bio-fertilizers. Vermicomposting can be used for solid waste management and the production of bio-fertilizers.

Vermicompost (Vermi culture) is the product of the decomposition process using various species of worms usually Red Wigglers, White worms and other earth worms to create a mixture of decomposing vegetable or food waste, bedding materials and vermicast. The final product generated by thus process is called Vermicompost which essentially consists of the casts made by earthworms eating the raw organic materials . The process consists of constructing brick lined beds generally of 0.9 to 1.5m width and 0.25 to 0.3m height are constructed inside a shed open from all sides

Methods of Vermicomposting

- **BINS**: The simplest form of vermicomposting involves a bin made from plastic, non- organic wood. Some form of bedding such as shredded paper or composited animal manure or decaying leaves, fills the bin and mixes with a handful of soil to provide the worms with material through which they burrow. The bedding also requires water to moist and allow the worms to breathe. Feed the worms' organic food scraps such as vegetables, fruits, teabags and coffee grounds. Tossing in some eggshells and calcium for the worms and lower the bins acidity level. However never compost meat, fish or the other fatty, oil foods otherwise the bin will produce a foul odor. The best worms for vermicomposting in bin are red worms or wigglers

- **WINDOWS**: In most commercial farm vermicomposting involves windows which are lay rows of cow manure. Farmers typically stack the manure in rows 3 feet high and three feet wide with row often stretching more than 100 feet long. Farmers seed the windows with worms, making certain to keep the row moist. Fresh added to the ends of the existing rows draws the worms forward to keep the process moving.
- **PITS**: Some farmers use vermicomposting pits, digging a large hole in which bury the worms and organic waste material and adding earthworms in it.
- **TROUGHS**: Cemented troughs can also host vermicomposting usually the trough hold only manure which is aged for at least a week before being placed in the trough. This composting method begins with only a few inches of manure spread across the bottom of the trough. Farmers then add the worms, allowing them to feed on the manure for a few days before adding another layer of manure. More manure layers are added every ten days until the worm compost reaches the top of the trough pits.

How to prepare vermicompost

Composting is an excellent option for reducing your environmental impact and

preparing a natural beneficial soil additive. Thus, vermicomposting is a great alternative that allows an indoor compositing operation with minimal space.

- Setting up the worm bin: with ideal temperature for the worm bin that is 55 to 75 degree Fahrenheit or 12.8 to 23.9 degree Celsius. We can use worm bin or 20-gallon storage container from the store which is opaque.
- Drill holes in the bin for air flow.
- Set the bin on blocks with plastic under it.
- Order worms online or buy them at a garden store.

Vermicomposting using local varieties of earthworms

Out of two thousand five hundred species of earthworms identified in the world, more than five hundred species of earthworms have been identified in India. Earthworm diversity varies with soils and choosing a native species for vermicomposting is necessary and there is no need to import them. Local species used in India are Perionyx excavatus and Lampito mauritii.These earthworms can be cultured or used in composting applying simple procedures either in pits, crates, tanks, concrete rings or any containers.

How to collect native earthworms?

Identify worm-inhabited soils marked by visible earthworm castings on the soil surface. Dissolve 500 g jaggery (native sugar) and 500 g fresh cattle dung in 2 liters of water and sprinkle on an area 1m × 1m surface soil. Cover with straw lumps and cover with an old gunny bag. Keep sprinkling water for about 20 to 30 days. Native worms will aggregate in the spot and can be collected and used.

Preparation of Compost pit

Compost pit of any convenient dimension can be constructed in the backyard or garden or in a field. It may be single pit, two pits or tank of any sizes (manageable size is 2 m x 1m x 0.75m) with brick and mortar with proper water outlets. To combat the ant menace, have a water column in the Centre of the parapet wall of the vermipits. The 'four chamber' pit will Facilitate easy and continuous movement of earthworms from one chamber with fully composted matter to the one with the pre-processed waste in the chambers.

Preparation of Vermibed

Vermibed is the layer of moist loamy soil placed at the bottom, about 15 to 20 cm thick above a thin layer (5 cm) of broken bricks and coarse sand. Earthworms are introduced into the loamy soil, which the worms will inhabit as their home.150 earthworms may be introduced into a compost pit of about 2m x 1m x 0.75m, with a vermibed of about 15 to 20 cm thickness. Handful-lumps of fresh cattle dung are then placed at random over the vermibed. The compost pit is then layered to about 5 cm with dry leaves or preferably chopped hay/straw or agricultural waste biomass. For the next 30 days the pit is kept moist by watering it whenever necessary. The bed should neither be dry or soggy. The pit may then be covered with coconut or Palmyra leaves or an old jute (gunny) bag to discourage birds. Plastic sheets on the bed are to be avoided as they trap heat. After the first 30 days, wet organic waste of animal and/or plant origin from the kitchen or hotel or

hostel or farm that has been pre-digested is spread over it to a thickness of about 5 cm. Repeat this twice a week. All these organic wastes can be turned over or mixed periodically with a spade. Regular watering should be done to keep the pits moist. If the weather is very dry, it should be checked periodically.

When will the compost be ready?

The compost will be ready in 60 to 90 days and the material becomes moderately loose, crumbly with dark brown color. It will be black, granular, lightweight and humus-rich. Presence of earthworm castings

(vermicompost) on the top of the bed is also an indicator and vermicompost can be harvested. Stop watering two to three days before emptying the beds to facilitate separating the worms from the compost (80 per cent of the worms will move to the bottom of the bed).The harvested material should be placed in a heap in the sun so that most of the worms move down to the cool base of the heap. In the two or four pit system, watering should be stopped in the first chamber so that worms will automatically move to another chamber where the required environment for the worms are maintained in a cyclic manner and harvesting can be done continuously in cycle.

Separation of earth worms

The worms can be separated by using sieves/meshes. The earthworms and the thicker material, which remains on top of the sieve, are recomposed. The smell of the compost is earth-like. Any bad odor if formed is a sign that fermentation has not reached its final goal and that the bacterial processes are still going on. A musty smell indicates the presence of mold or overheating which leads to loss of nitrogen. If this happens, aerate the heap better or start again, adding more fibrous material and keeping the heap drier. The compost is then sieved before being packed.

Design of vermicomposting unit FOR Amravati city

In that unit vermicomposting bed size, no of beds required, land required for vermicomposting is calculated and usually used earthworm detailed is given.

Earthworm use for vermicomposting:

Characters Eisenia fetida

- Body length 3-10cm
- Body weight 0.4-0.6g
- Maturity 50-55days

Vermicomposting bed required for current year

Vermicomposting bed of size12 ft*4ft*2ft is used. Sample Calculations:

L = 12Ft (3.65 m) B = 4Ft (1.21 m) H = 2Ft (0.60 m)

Volume of 1 Bed = L*B*H

= 3.65*1.21*0.60

= 2.65 cubic meters Approximately volume of 1 bed is 3 cubic meters

Total biodegradable waste generation for current year per day=139000 kg Biodegradable waste required for one bed = 1500 kg

Sample Calculation:

139000/1500 = 93 beds

No of beds per day = 93 beds

Total number of beds for one cycle for 45 days = 93*45 = 4170 beds Number of beds required for the current year that is 2022 is 4170 beds. Land required for current year = 365256 square feet =

8.4 acres

4. CONCLUSIONS

 Hundreds of tons of biodegradable organic waste are being generated in cities and towns in the country, creating disposal problems. This waste can be converted into valuable compost by applying vermi-composting technology. This approach reduces pollution and provides a valuable substitute for chemical fertilizers.

 It is observed that present facilities for management of solid waste for Amravati city are falling short to cope with increasing population and increased waste generation.

 The vermicomposting units for solid waste management of a have designed. one cycle of vermicomposting process takes 45 days. For Amravati city number of beds required for one cycle is 4170 and the land required is 8.4 acres each bed comprises size 12x4x2ft

 In Amravati 65% people depends o farming as their occupation. vermicompost can is highly nutrious manure which can use in forms to increase yield by means of which can generate revenue for Amravati municipal corporation.

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