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VERMICOMPOSTING - A SUSTAINABLE TECHNOLOGY (CASE STUDY OF NALGONDA, ANDHRA PRADESH)

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ABSTRACT

The conventional aerobic and physicochemical treatment processes adopted for treatment of municipal and industrial wastewater in the developed countries have sparse chances of success in developing countries due to high energy requirements, operation and maintenance costs, and constraints in stable maintenance. Thus, it has become imperative to resort to simpler alternative technologies which are natural, less mechanized and simpler in operation and maintenance. Vermiculture appears to be an innovative sustainable technology for waste treatment which holds a promising future in the field of wastewater management. Presently it is being used successfully for solid waste management. The concept of using earthworms for waste processing is not a new one. Nature has been effectively doing this since millions of years. However, the concept of harnessing this natural earthworm ecosystem for treatment of municipal and industrial wastewater is a relatively new one. Vermiculture means culturing of earthworms and it involves harnessing an entire ecosystem consisting of earthworms, beneficial bacteria and plant root zone for treatment of wastes. Vermicomposting is one of eco-friendly process. The vermicomposting in urban areas and municipalities also plays a vital role. In the villages farmers are maintaining vermicomposting beds, out of these only 60% of the beds are maintained well and are producing good results. The remaining 40%are just for record purpose only. The objective of this paper is to promote the adoption of this method and how the NOGs and government organizations are extending their help to promote this method. Some of the organizations like Peace, Jana Jagruti Samiti (JJS), Medvin, Satyam are implementing the vermicomposting process. Government is extending help to the farmers or individuals with financial and technical support.

INTRODUCTION

In vermiculture, earthworms are effectively used for maximizing the growth of aerobic bacteria for waste stabilization. When organic waste applied to a soil containing earthworms, simple compounds are readily degraded by bacteria, while complex wastes are first broken down to simpler ones by enzymes produced by earthworms and are then degraded by the bacteria. Since earthworms have an aerobic gut, the predominance of' aerobic bacteria harbored by earthworms ensures maximum energy utilization resulting in more biomass production, which in turn speeds up waste decomposition to a higher rate. Plants and biosoil also play important role in vermiculture. While plants absorb the metabolites of earthworms and bacteria, biosoil is the medium for activities of bacterial earthworms and plants. Soil particles serve as the grinding medium for earthworm and supply plant nutrients. Vermicastings are the

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excreta of earthworms, rich in bacteria and plant nutrients. Vermicastings have beneficial effect on plant growth due to presence of micro and macro nutrients. Thus all the components are interdependent. With the above understanding the vermiculture ecosystem can be assumed to consist of earthworms, bacteria, organic matter, plants, soil and rock particles, pests, and vermicastings, each performing a distinct function. vermiculture is rightly considered as a self-designed, self-regulated, self-improve! and self-powered ecosystem.

VERMICASTINGS

Cine excreta of earthworm is called the vermicasting. Vermicastngs are characterized by the presence of nutrients, finely ground/partially processed organic matter mixed with soil and very high microbial density The chemical composition of vermicasting is given in Table 1.

For in-situ vermiprocessing, application of 5 kg/ ml of vermicastings below a tree is suggested (Bhawalkar, 1995). This is expected to rejuvenate the soil such that it can take an organic loading of 100 g/ m2d and over a year organic loading could be stepped up to 1000 g/m^2d. The above concepts can be extended to organic wastewater too, except that hydraulic loading has to be considered additionally. It was observed that for strong wastewater, organic loading is to be controlled while for dilute wastewater hydraulic loading is controlling (Bhawalkar, 1995). At present, vermiculture is being used successfully for solid waste management and its applicability for treatment of liquid wastes is under investigation. Interestingly, vermiculture can be used for waste processing by harnessing the entire ecosystem or a part of it, that is just by introducing the vermicastings containing the desired microbial culture. Theoretically, all biodegradable organic wastes can be stabilized in the presence of a suitable microbial culture.

Vermiculture can also be used for treating toxic wastes by initially applying low organic loading rates within the tolerance limit of the earthworms till they develop a microbial culture to crack the recalcitrant molecules.

A CASE STUDY OF NALGONDA, ANDHRA PRADESH

Introduction

The vermi composting in urban areas and municipalities also plays a vital role. In the villages farmers are maintaining vermi composting beds, out of these only 60% of the beds are maintained well and are producing good results. The remaining 40%are just for record purpose only. Government fascination so many NGOs, organizations and individuals are interested on vermicomposting in the part of solid waste management. Vermi composting is one of the eco-friendly process. Many organizations are showing interest towards vermicomposting.

The case study is taken some of the Mandals in Andhra Pradesh which are implementing vermicomposting process, are Bhuvangiri, Choutuppal, Yadagiri gutta, Gundala, Aathmakur, Valigonda, Gurrampodu, Ramannapet which is recently declared as villages under Hyderabad Urban development authority of Andhra Pradesh. .Every mandal has minimum of 2-3 villages having vermicomposting process. Some of the organizations like peace, Jana Jagruti Samiti (JJS), Medvin, Satyam are imple-

Table 1. Chemical composition of vermicasting. (Kumar"1994)

Parameter	Value
Organic carbon (%)	9.15 to 17.88
Total nitrogen (%)	0.5 to 0.90
Available Phosphorus'(%)	0.1 to 0.26
Available potassium (%)	10.15 to 0.56
Available sodium (%)	0.05 to 0.30
Ca and Mg (MEQ/IOO g)	22.67 to 47.6
Copper (ppm)	2.0 to 9.5
Iron (ppm)	5.7 to 9.3
Zinc (ppm)	5.7 to 11.50
Available sulphur (ppm)	128.0 to 548.0

* Worms fed on different types of organic wastes

Table 2. Mandals, villages and number of bed in study area

S.No	Mandal	Villages & beds
1.	Bhuvangiri	Muttireddygudem (4), Koonur (2)
2.	Choutuppal	Choudaripally (4)
3.	Gundala	Sitarampuram (2), Marripdige (2), Gangapuram (2), AnanthAram (2), Kommai pally (2),Vlmajala (2)
4.	Atmakur	Posani kunta (2), Pullaigudem(2), Moripirala (2)
5.	Valigonda	Akkampally (2)
6.	Guurampodu	Gurram podu (2)
7.	Ramannapet	Nernemula (2)
8.	Yadagiri gutta	Cholleru (2), Mootakondur (2)

* Jana Jagruti Samiti (JJS)

menting the vermicomposting process. Govt. also helps the farmers or individuals with financial and technical support. Government provides the earthworms at a charge of 600 per kg and pay 1800 per bed per person as a loan.

The study area includes mandals and villages in Andhra Pradesh are mentioned in Table 2.

Vermi Composting

The period of composting is around 50-60 days and the final compost obtained will be approx 300kg per bed, According to this Rs.18, 000 loan pay back period is 1.5 years one bed per one person. By vermicomposting the agricultural waste as well as the waste generated from agricultural animals is perfectly reused and managed.Some of the raw materials for vermicomposting include grass, waste feed grass, jatropa, neem leafs and paddy slurry etc .One of the main ingredient in this is the "Glarysiri Leaf" which is mixed in the process .It plays a vital role in increasing NPK percentage naturally. It is advantage in this process comparatively municipal solid vermicomposting. This is echo friendly and is a small-scale industry.

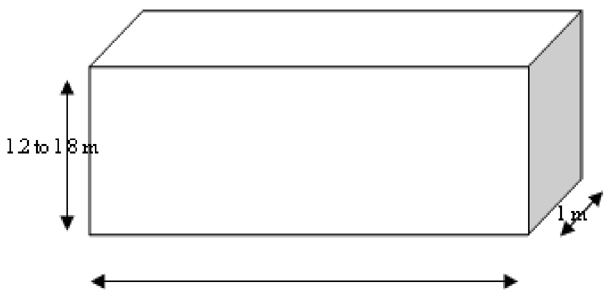
METHODOLOGY

Bed Manufacturing

The bed preparation is done in two ways

1) Closed bed system

Raw material - cement, sand, brick, water and granules (Or) Granite slab, cement, water and granules
Height = 3-6 feet, Length = 3 meters, Width = 1 meter
In this model the bottom was closed.



2) Open bed system

Heigh t= 3-6 feet, Length = 3 meters, Width = 1 meter
In this process 2-4 feet of depth is left and is filled with sand and granules.
Either it be closed or opened the raw material s required and the process remains same.

PROCEDURE

- Waste must be free from glass pieces and plastics
- The bed is filled with grass, waste feed grass, Jatropa, Neem leaves and Glarysiri leaves etc .
- The top of the bed should be covered with paddy slurry.
- It is kept wet up to 30-40 days but water should not be stored in the beds.
- The bed should be maintained in cold conditions or should be in shade.
- The bed volume decreases 3 feet to 1½ feet in 15-30 days , i.e. the initial bed volume, become half.
- Then the earthworms 1kg are introduced by making 2 to 3 holes in every bed (25 kg initial)
- It is recommended to shake (stir) the bed to decrease the heat generated inside the bed.
- To maintain optimal wetness, water is sprayed in alternate days. It becomes dried 30-45 days
- The top layer is taken out and screened after 45 days onwards.
- The compost will be ready within 55-60 days(around 1feet).
- After the screening procedure fine powder like compost is obtained which contain earthworms in larvae stage i.e.300 kg/bed
- These earthworms are introduced on to the other bed. This is batch wise continuous. Process some precautions should be taken, that are
- Gemaxin powder is sprayed around the bed to avoid ants, frogs, insects etc.
- If more than two beds are maintained then 15 days gap should be given from one bed to another bed.
- Otherwise NODE process can be preferred
  The Vermi composting gives good yields when used for mango plantation, lemon plantation, and orange plantation than compared to rice.

Cost/Income Analysis

Cost - Approximately Rs.10,000 to Rs. 18.000
Income: It takes 50-60days for one cycle period. From one bed we get approx 300 kgs.

1kg- Rs.3.00/-
300 kgsx3-Rs= 900/bed
If four beds
300x Rs3.OOx4 Beds=3600

If only paddy it takes 30-40 days for one cycle but it is not better than mixed bed. Glarysiri adds more value to the compost.

Fig. 1 Glarysiri Leaf

Fig. 2 Raw Solid Waste Stock

Fig. 3 Nodes of Municipal Solid Waste

CONCLUSION

1. Vermicomposting involves harnessing the services of epigamic earthworm species which consume the surface litter for the conversion of organic wastes into vermicompost, excellent organic manure.
2. Earthworms consume all types of organic waste under conducive conditions; these include kitchen waste, animal waste, agricultural residues and even paper.
3. Vermicomposting which harnesses these surface dwellers is a faster way of organic decomposition than pure vermiculture technique using deep burrowing earthworms.
4. But vermicomposting is a wasteful alternative for organic processing as the surface
5. Vermicastings have a wide variety of applications such as management of solid wastes, liquid wastes, as a bio-sanitation agent, etc.
6. In this process no technical persons required, it is one of the best way to solid waste management as well as eco re-functioning to the nature
7. In situ vermifilter containing a layer of vermicastings has been advocated for ground water recharge, but whether the effluent discharged to the ground is able to satisfy the disposal standards and its other implications should be investigated.

Recommendation

1. Vermiculture technology has good potential for application in wastewater treatment in developing countries. However, this technology is still in its inception stages and further research needs to be done before it can be commercially used. It has been realized that this method have several advantages over the conventional wastewater treatment processes.
2. The treatment plants are simple to construct with no mechanical or electrical equipment and require minimal maintenance which reduce the operating and maintenance cost. These plants also exhibit high process stability and extensive elimination of pathogenic organisms. However, huge land requirements, lack of adequate understanding and the uncertainties associated with these processes are some of the major constraints.

Fig. 4 Stack piles mixed with vermiculture

Fig. 5 Vermicompost ready to use

3. Based on the gaps identified in the available literature and experience gained while conducting the research, following suggestions are offered for future research. Bacteria seem to be the ultimate workforce for waste processing. So emphasis should be laid on a detailed understanding of the microbiological aspects of the vermiculture ecosystem.
4. Studies are required to identify the microorganisms which survive in a vermiculture ecosystem and those which are finally out competed by the faster growing ones. The ultimate fate of the fungi, yeasts, and pathogenic organisms should be determined.

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