ISSN (Online) 2393-8021
ISSN (Print) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology (IARJSET)

National Conference on Renewable Energy and Environment (NCREE-2015)

IMS Engineering College, Ghaziabad

Vol. 2, Special Issue 1, May 2015

E-Vermi Synthesis: A new trend in Renewable Energy

Dr. Archana Pandey, Dr. S P Pandey

Associate Professor, Krishna Engineering College Ghaziabad, UP

IMS Engineering College Ghaziabad ,UP

Abstract: Vermicompost (also called worm compost, vermicast, worm castings, worm humus or worm manure) is the base-product of the breakdown of natural material by earthworms. Vermicompost is a nutrient-rich, organic fertilizer, and soil conditioner. The process of making vermicompost is called vermicomposting. It contains not only worm castings, but also bedding materials and organic wastes at a mixture of stages of decomposition. It also contains worms at different stages of growth and other microorganisms associated with the process. Earthworms' castings in the home garden usually contain 5 to 10 times more additional nitrogen, phosphorous, and potassium than the adjacent soil. Secretions in the intestinal tracts of the worms, along with soil passing through the worms, make the nutrients needed by plants more concentrated and available for plant uptake.

Using a worm box, pile, pit, bin, or windrow helps expand and develop many skills needed to enhance sustainability of farming activities. In essence, worms work as natural bioreactors. The technique generates organic fertilizers, permits harmless disposal of certain organic wastes and decreases the requirement for landfill.

E - Vermicompsting Synthesis can be performed all year-round, providing that environmental conditions remain within acceptable limits. For improved efficiency, care should be taken to ensure that organic feedstock and environmental circumstances allow worms to reproduce productively and tolerate climatic fluctuations. Given appropriate conditions, vermicomposting appears to offer a relatively uncomplicated solution to the management of compostable organic wastes.

Vermicompost is getting ready when a soft, spongy, sweet smelling, dark brown compost is noticeable. Adding of water can then be stopped. This compels the worms to move into the lower end of the bed and facilitates harvesting the vermicompost without much damage to the earthworms. The harvested vermicompost may be placed in the form of a cone on solid ground in bright sunlight. This further forces the earthworms still present in the vermicompost to move to the lower layers. By spreading out the vermicompost pile after about 24 to 36 hours, the earthworms from the lower layers of the vermicompost can be recovered and may be later transferred to new vermicomposting units. If necessary, the Vermicompost may be sieved through a 2-2.5 mm sieve and finally packed, preferably in polythene bags to retain its moisture.

E- Vermiculture Technology is increasingly used as an environmental management tool as well as potential recovery option in most pan of the world including India. Various aspects of the technology have been studied by different researchers, but the variations of the affecting parameters and detailed dynamics of the vermicomposting process have not been reponed earlier. This inspired the current work to probe into the engineering aspects of E-vermicomposting.

Increases in the human population, indiscriminate growth of cities, industrialization, and agricultural practices have led to an increased accumulation of waste materials. The present method of disposal by open dumping has made the problem more acute by disturbing the soil-air-water ecosystem, thus needing urgent attention by planners. Moreover, the most abundantly available biomass, the lignocelluloses, has attracted considerable attention as an energy resource because of their large quantity. The recovery of nutrients by modification of wastes like municipal solid waste, industrial solid waste, agricultural residues, and animal wastes, etc. is important for their management and for reducing environmental degradation. Also, the deleterious impact on the environment by chemical fertilizer urges the need for production of organic manure out of waste. Recycling organic wastes through vermiculture biotechnology is being considered as an economically viable solution. Earthworms are considered as natural bioreactors which proliferate along with other microorganisms and provide required conditions for the biodegradation of wastes. The present study examines the various dynamics of the soil-earthworm- plant relationship with special emphasis on vermiculture. The review assesses the following topics: earthworm biodiversity, earthworm species for waste management, substrates, consumption rates, enzyme activities, medicinal uses of earthworms, and methods of vermi- composting along with their advantages and disadvantages, impact of application of vermicompost to soil fertility, soil microorganisms and crop yield, characteristics of vermicomposts, sustainable agriculture, economic importance and future prospects.

VERMITECHNOLOGY

Vermi means earthworm and culture means rearing or far-ming, much the same as other specialized farming (e.g. fish farming or aquaculture, etc.), which involves the following steps: procuring of seed stocks, culture of the proper variety and providing optimum food, moisture, air and temperature conditions..Vermicomposting involves bio-oxidation and stabiliza- tion of organic material through the interactions between earthworms and microorganisms. Although microorganisms are mainly responsible for the biochemical degradation of organic matter, earthworms play an important role in the process by fragmenting and conditioning the substrate, in-creasing the surface area for growth of microorganisms, and altering its biological activity

Earthworms are well-known soil-inhabiting animals, having a cylindrical body and marked external and internal metameric segmentation. They do not have any appendages or suckers but have a few hooks like chaetae for gaining hold onto the substratum. Hence they are called Oligochaeta (oligo = few; chetae = hair) and belong to the Phylum Annelida. Earthworms are hermaphrodites and sexually matured worms have a distinctive epidermal ring-shaped clitellum, which has gland cells that secrete materials to form the cocoon Earthworms are major components of the soil fauna in a wide variety of soils and climates and are involved directly or indirectly in biodegradation, stabilization through humus formation, and various soil processes. SW management leading to the production of bio-fertilizers through vermiculture has a bright future. However, it is essential to select suitable species of earthworms capable of consuming organic-rich matter, that are efficient decomposers and stress-resistant so as to sus- tain adverse environmental conditions, and have high fec- undity rates

Vermicomposting uses worm bins, which are shallow boxes with holes drilled in the bottom to allow liquid to drain. Worm bins are filled with special bedding material that can be purchased commercially or made from materials such as shredded newspaper and cardboard. The best worms for vermicomposting are red wigglers or red worms (Eisenia foetida). Worms are fed kitchen waste such as fruit and vegetable scraps, coffee grounds and crushed eggshells. As the worms eat their way through the kitchen waste and bedding material, they break down the organic matter and excrete nutrient dencse casts. These castings build up in a layer on the surface and are harvested for use as plant fertilizer.

The Investigations in this E- Vermi Synthesis work have been done

Objective 1. to find the optimum input parameters for successful performance of technology alongwith microbial activity and nutritional quality of Vermi compost during interaction of plant spcies with Eisena fetida under different climatic condions.

ISSN (Online) 2393-8021
ISSN (Print) 2394-1588
International Advanced Research Journal in Science, Engineering and Technology (IARJSET)
National Conference on Renewable Energy and Environment (NCREE-2015)
IMS Engineering College, Ghaziabad
Vol. 2, Special Issue 1, May 2015

Objective 2 : To investigate the effect of moisture contents because of different weather during interaction of plant species with Esnia fetida

Objective 3. To Investigate the effect of initial substrate C : N Ratio variation on the performance of the process and

Major nutrient elements in Vermicomposts

	N	P	K	Ca	Mg
Cattle solids (UK)	2.20	0.40	0.90	1.20	0.25
Cattle (Cuba)	1.70	0.62	1.22	10.0	1.53
Cattle (peru)	1.20	0.95	0.47	-	-
Pig Solids (UK)	2.60	1.70	1.40	3.40	0.55
Pig (Cuba)	1.89	0.50	0.34	10.8	1.46
Sheep (Cuba)	1.51	0.64	0.78	4.40	1.37

The result is a very homogeneous, finely textured, odor free and visually appealing material, all decisive factors in increasing the chances of selling the medium for specialized agricultural use. When the nutrient content is compared with that of a commercial plant growth medium to which inorganic nutrients have been added, earthworm castings (independently of their parent material) usually contain .similar quantities of the main nutrients N, P, K and most other mineral elements, supplying the bulk of the nutrient element needs of plants (Handreck, 1986). Nevertheless, during the vermicomposting process most of the nutrients are changed to forms more readily available to plants, e.g. nitrate, ammonium, exchangeable P and soluble K, Ca and Mg contained in the waste materials (Edwards and Bohlen, 1996).

Humic acids are a very important constituent of earthworm-worked material and are a natural by-product of the microbial decomposition or alteration of plant or animal residues and of cellular components and products synthesized by soil organisms. Some important and beneficial properties of humus are slow release of plant nutrients, improvement of soil physical properties, and enhancement of micronutrient element nutrition of plants through chelation reactions, help in the solubilization of plant nutrient elements from insoluble minerals, high adsorptive or exchange capacity for plant nutrient elements, increase in the soil buffer capacity, promotion of heat absorption and earlier spring planting (in cold climates), support of a greater and more diverse microbial population which favors biological control, including disease suppression, reductions of toxic chemical substances, both natural and manmade, and increased soil water-holding capacity (Martin and Focht, 1986).

There is also often a higher humic acid/fulvic acid ratio as well as a higher humification rate or humification index in many earthworm castings than in those materials obtained by other composting means. However, the results are not consistent in all materials, suggesting that it depends on the raw materials utilized .esults of two seasons of work with earthworm-digested animal wastes used as a supplement with peat for hardy nursery stock grown in loam less compost in Efford Experimental Horticultural Station in the UK, suggest that the one major drawback to its wider use could be the variability of the product (e.g. soluble salts), not only between wastes of different animals, but also in wastes from the same source in different seasons (Scott, 1988). Plant growth regulators, belonging to the auxin, giberellin and cytokinin groups present in the earthworm-worked materials, are produced by a wide range of soil microorganisms, many of which live in the guts of earthworms or within the castings

The best results with cotton waste were in combination with cattle manure in the ratio 1:5. Grape cake gave only slight weight increases and the earthworms did not reproduce. Tobacco waste gave only very small weight increases and the eal 1 hworms did not reproduce When mixed with rabbit dung in 1 : 5 ratios, this waste was lethal to earthworms

Experimental Interactive analysis of plant Species with Eiseneia fetida during vermicomposting under climatic conditions were carried out to vary one parameter (within a limited range) at a time keeping rest of the input parameters initially same in all the experimental runs to investigate the effect of variation of particular parameter. Experimental data base thus generated by performing different experiments have been used for analysis**.** The interactive analysis of plant Species with Eiseneia fetida during vermicomposting under climatic conditions(summer and Winter) of Ghaziabad- Shahibabad Industrial area site IV (Just border of National capital New Delhi) with large density of traffic movements

There are several parameters influenced due to variation of climate effects the performance of the vermiculture technology that vary at a time (controllable external input parameters: optimum waste thickness, temperature, moisture requirement, initial earthworm population density; solid waste inherent parameters: pH, CN ratio; types of waste: carbohydrates, celluloses, lignin, proteins, nutrients; biochemical transformations: reducing sugars, organic carbon, enzyme, protein, lipid variations; microbial activity during the vermicomposting process; proportionate role of earthworms and microbes on the decomposition process; aeration and oxygen requirement; effect of particle size on the decomposition process, sending and mixing requirements). It is not possible to investigate all of them together within limited resources. Similarly, some of these parameters have very wide range Therefore, prior to start of actual experimentation, several experiments were performed in different conditions at various places to assess the effect and importance of various parameters on decomposition process in vermicomposting.

REFERENCES

Abdul R. and Abdul, M. (1994) Los gusanos de tierra y el medio ambiente, Mundo Cientiflco 146 : 408-415.]

Agenda Notes (1992) Meeting of the National Wiste Management Council, Ministry of Environment and Forest, Govt of India.

Albanell, E., Plaixats, J. & Cabrero, T. (1988): Chemical changes during vermicomposting (E. fetida) of sheep manure mixed with cotton industries waste. – Biology and Fertility of Soils 6(3): 266–269.

Allee, W.C., Torvik, M.M., Lahr, J.P. & Hollister, P.L. (1930): Influence of soil reaction on earthworms. – Physiol. Zoology 3(2): 164–200.

Bahl. K.N. (1950) The Indian Zoological Memoirs I. Pheretima (4th ed.) Lukhnow Publishing House, Lucknow.

Bajsa. O. Nair. J., Mathew, K. and Ho. G.E. (2003) Vermiculture as a tool for domestic wastewater management. Water Science Technology - 48 (11-12): 125-32.

Bansal. S and Kapoor. K.K. (2000) Vermicomposting of crop residues and cattle dung with Eisenia foetida. Bioresource Technology 73: 9.5-98.

Banu. J.R. Logakanthi, S. and Vijayalakshmi, G.S. (2001) Biomanagement of paper mill sludge using an indegenous (Lampito mauritii) and two exotic (Eudrilus eugineoe and Eisenia foetida) earthworms. J Environmental Biology 22(3): 181-5.

Barkdoll, A. (1994) South American operations. Biocycle 3.5: 64.

Barley, K.P. (1959) The inf1uence of earthworms on soil fertility, Consumption of soil and organic matter by the earthworm *Allolobophora caliginosa*. Australian Journal of Agricultural Research 10: 179-18.5.

Camp, Dresser, McKee. Inc. (1980) Compendium on solid waste management by vermicomposting Cincinnati. OH. Municipal Environmental Research Lab, EPA.

Carmody. F. (1996) The history of vcrmiculture Wonn Digest Magazine 14.3.9.15 and 23.

Datar, M.T. Rao, M.N. and Reddy. S. (1997) Vermicomposting a technological option for solid waste management. Journal of Solid Waste Technology and Management 24 (2): 89-93,

Davila. M.T. Arango. LG. and Zuluaga, 1. (1990) Utilizacion de 13 pulpa de cafe para el cultivo de la lornbriz raja californiana (Eiseniafoetida, Sav.) Serninario Para lit Valorizacion dellos Subproductos del Cafe, Conacyt-Ecuador. CEE. TRee. June, Quito, Ecuador.

Edwards, C.A. (ed) (1997) ISEE 5. Fifth International Symposium on Earthworm Ecology. Soil Biology and Biochernistrv 29: 215-766.

Gaur, A.C., Mathur, R.S. and Varshney, T.N. (1970) Decomposition of different types of added organic matter in soil. Agrochemica 14: 524-32.

Gaur, A.C. Neelakantan, S. and Dargan K.S. (1984) Organic Manures, ICAR, New Delhi.