Chapter 15
Vermitechnology:
A Solution for Agricultural Waste

Kumar Anand
Vinoba Bhave University Hazaribagh, India

Pritam Bala Sinha
Amity University, India

ABSTRACT

Vermicomposting has been rising as an innovative ecotechnology for the conversion of various types of wastes into vermicompost. Vermicompost is humus like finely granulated and stabilized material which can be used as a soil conditioner to reintegrate the organic matter to the agricultural soils. Non-toxic and organic industrial wastes could be potential raw material for vermitechnology. The success of the vermitechnology depends upon several process parameters like quality of raw material, pH, temperature, moisture, aeration, type of vermicomposting system, and earthworm species used. Vermicomposting is a suitable means for waste remediation and organic manure production. Physical processes include substrate aeration, mixing, and grinding while biochemical processes involves decomposition of waste by various enzymes present in the gut of earthworms and is influenced by microbes present in their intestine. Earthworms have several medicinal properties and are also known to accumulate toxic residues from soil/substrates. The role of earthworms in sustainable farming is immense.

INTRODUCTION

It has been already made clear that one of the prominent problems which are being faced by mankind is solid waste management. Due to successive increase in the amount of waste being generated from various developments worldwide, there is an encroachment of fertile area and population explosion. Also due to fast urbanization, massive amount of waste is being generated (Atiyeh, et al., 1999; Kumar et al., 2017).Solid waste such as organic and inorganic waste materials are invaluable according to their owner. As a developing nation, India produces about 25 million tons of urban solid waste. Rough estimates indicate that near about 0.4kg/day of waste is being produced per capita. Approximately 50-60% of matter is compostable, i.e. 0.4kg/day. Among the most common practices related to waste production

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are deliberate dumping of the wastes to soil and also to water which results in extensive soil and water pollution. For the disposal of solid waste finally, there is a need to incorporate several other methods as like incineration and composting, other than sanitary land filling as well as dumping. For the conversion of solid organic waste to compost, vermiculture or most often said as earthworm farming is employed (Aalok et al., 2008; Ghosh, 2004; PBCB, 2015). Vermiculture as a discipline of biotechnology involves, the breeding and propagation of earthworms. In vermiculture we use the castings of it. Vermiculture has become a significant tool of waste recycling worldwide and has also been considered as a separate and fruitful discipline of biology. "vermitechnology" involves a low cost and environmentally sound waste management practice involving the use of earthworms in the form of natural bioreactors (Atiyeh et al., 2000).

Earthworms break the organic debris present on the surface of soil and soil turn over process, as already it has been explained by Darwin (1881). With the successful use of facilities provided due to vermicomposting, the technology has explored domestic market as well as industrial marketing of it is being done in several counties like Canada, USA, Japan and Italy. First of all, the process of vermicomposting was started in Ontario (Canada) in the year 1970. At present about75 tons of refuse per week is being processed. During 1978-80, the American Earthworm Company initially prepared a farm which had the capacity to produce about 500 tonnes per month. A well-known company of Japan, Aoka Sangyo Co. Ltd., produces three 1000 tonnes per month plants processing wastes from pulp and food industries. Other than these, about 3000 other vermicomposting plants in Japan also produces 5-50 tones capacity of vermicompost per month. Similar vermicomposting plants are also in Italy and Philippines. India should think about commercialization of "vermitechnology" (Bhawalkar, 1989; Belliturk, 2016).

Being a biological process, it involves interactions between earthworms and microorganisms. Due to this there is an efficient conversion of different type of organic wastes into nutrient rich manure (Amouei et al., 2017).There is also the use of worms during vermicomposting process, due to which worms are able to transfer organic waste into a nutrient rich fertilizer. Mutual actions exist between earthworms and microorganisms which alter the physical, chemical and biological properties of waste material and convert them into vermicompost. Vermicompost can suitably be homogeneous, stabilized, peat like material, odour free which contains significant quantities of nutrients with low level of toxicants (Dominguez & Edwards, 2007; Ndegwa & Thompson, 2001).

Vermicomposting is amongst one of the healthy as well as hygienic way to eliminate wastes going into our landfills, which improves the environment. Within 2-3 months results are produced and also it only takes two or three months to produce results and is inexpensive. Not only being a cost-effective process, it is also a simple an efficient method which degrades all of the non-toxic biodegradable waste. Various types of agro industrial wastes and crop residues were successfully converted into vermicompost (Sinha et al., 2010). Chauhan and Singh (2013) worked on the effect of different types of crop residues (straw and bran) on the growth and reproduction of *E. fetida*. Successful conversion of cattle manure, orange peel and filter cake into vermicompost's has also been reported. Some valuable reports regarding the vermicomposting potential of press mud a residue of sugarcane industry and cattle dung are also available (Pigatin et al., 2016). There are some significant contributions related to vermicomposting of household and paper industry waste (Amouei et al., 2017).