Wahana MINDA MUDA

VERMICOMPOST TECHNOLOGY

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***Eisenia fetida*.**
Photographed by Zhang *et al*. 2015

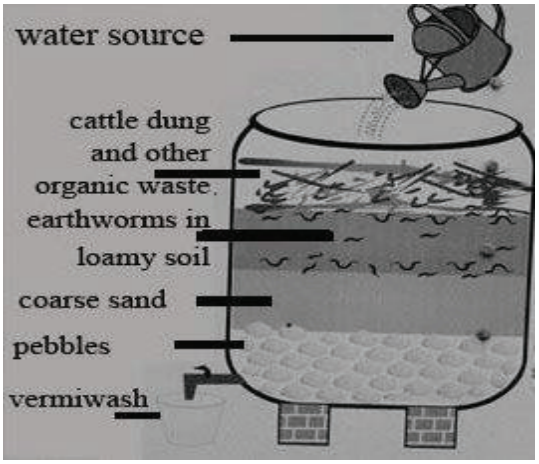
Vermicomposting is a biological waste management technology in which the organic contents of wastes are degraded by microorganisms and earthworms and converted into components that can be organised, reserved, and applied to agricultural fields under favourable environmental conditions without harming the environment. This method may be adequate for converting discharged muck into useful chemical. According to research by Yadav and Garg in 2011 entitle Recycling of Organic Wastes By Employing *Eisenia fetida* proposed that agricultural residues, animal excreta, as well as municipal and industrial organic wastes, are commonly employed as the vermicomposting medium since they are nontoxic, salinity-free, and degradable. Lots of studies also have been conducted on vermicomposting of animal dungs, sewage sludge with agricultural and industrial waste.

For instance, production of vermicomposting technology is nutrient rich clay-like material; vermicompost, it will possess more available nutrients per kg weight rather than organic substrate in parent wastes. Furthermore, due to humification and a faster disintegration process, it is extremely fragmented, spongelike, and microbially active as compared to original ingredients as noted by Sangwan *et al.* (2008) in their research about Vermiconversion of Industrial Sludge for Recycling the Nutrients.

MECHANISM OF VERMICOMPOSTING TECHNOLOGY

In vermicomposting technology, the epigeic earthworms such as *Eisenia fetida* is used for composting several organic substances and its ability in agricultural, animal, poultry and waste management is well known by several researchers. Physical and biochemical activity on organic leftovers are carried out by earthworms and microbes, respectively. Physical activities such as aeration, mixing, and grinding of organic wastes are carried out by earthworms, while biochemical degradation is carried out by bacteria. Meanwhile, with the help of aerobic and anaerobic microflora in their guts, those earthworms will ingest, gnash, and assimilate organic waste, transforming it into much finer, humified, and microbially active substances.
According to Suthar in his research on 2009 regarding Vermicomposting of Vegetable-Market Solid Waste Using *Eisenia fetida*: Impact of Bulking Material on Earthworm Growth and Decomposition Rate, earthworms act as mechanical blenders, blending organic matter by changing its biological, physical, and chemical state, progressively lowering the carbon to nitrogen ratio (C:N ratio) and increasing the surface area available to microbes for further degradation.

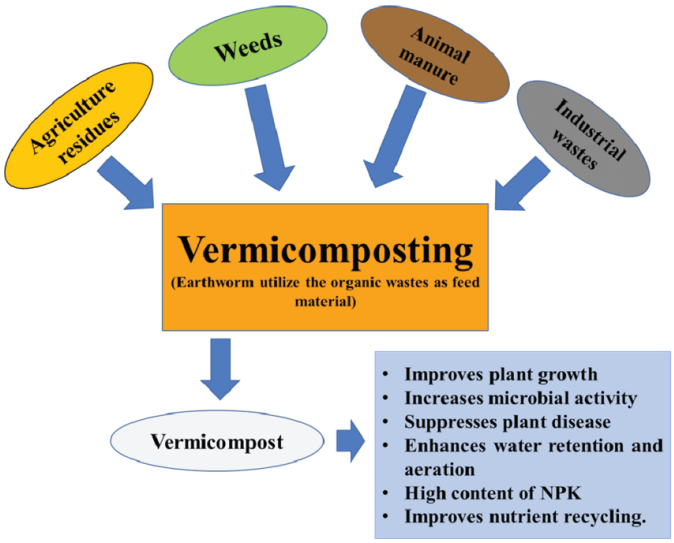
Previous research found out that during the transfer of materials along the earthworms' gut, plant metabolites which are crucial such as Nitrogen, Phosphorous and Potassium (NPK) are converted into chemical substances that easily absorbed by the plants. Plant nutrients such as NPK and calcium are converted into substrates that are more soluble to plants by the action of microbials, while the earthworms themselves create animal feeds such as protein sources. However, hard degradation of polysaccharide structure and low nitrogen content in the sludge may influence the composting process, so those sludge should be mixed with nitrogen-rich organic waste to obtain stabilised final products that are suitable for agricultural purposes and provide more nutrients. Thus, it is very significance to know the chemical composition and the appropriate mixture ratio to get the best quality and stabilized end products.



The vermiwash preparation stages are schematically depicted in the diagram. Photographed by Bidabadi 2018.

ROLE OF EARTHWORM IN VERMICOMPOSTING TECHNOLOGY

In recent years, degradation of voluminous of organic runoff, including animal excretion, crop trash and industrial wastes employing earthworms have been developed excellently in order to produce vermicomposts which termed as vermistabilization.



The process of vermicomposting of different types of organic wastes. Source: Kahlon *et al.* 2020

Additionally, earthworms may also generate bio fertilizers as they can ingest greater amounts of organic residues into essential organic vermicompost Previous researchers have reported that the role of earthworms are converting unstable materials and organic substances into vermicast that rich in nutrients in form of cast whereby they burrows to deposit some fecal substances on the surface. Continuously, those egested matter contain some hormones, enzymes, microbes, inorganic and organic matters attained when the soil passed in the earthworms' gut that consist of exogenic and endogenic enzymes to transform those wastes into more dissolved materials for plants.

To some extent, the epigeic earthworms can fix up a good quality of compost material rather than compost materials resulting from traditional composting method. Moreover, earthworms will fragment the substrates for microbial colonization as well as maximize rate of mineralization. Earthworms' biological activity will increase rate of decomposition of organic wastes and provides important nutrients which will promote the transfer of nutrients to plants.

"Plus, earthworms have many beneficial effects in terms of physical, biological and chemical on soil that may enhance plant growth and crops yield in ecosystems because the reformed of soil attributes and structure results in more available mineral nutrients for plants."

BENEFITS OF VERMICOMPOSTING TECHNOLOGY

In this regard, vermicomposting technology provides applicable, profitable and express technique for organizing solid wastes efficiently. It is also cost effective technology system. Previous research once added that generated products from this process are firms, consistent and have desirable aesthetics; that may turn down levels of foreign matters and moreover, is a worthwhile, marketable and good as plant growth medium.

In addition, vermicompost are applied as soil additives, medium of agronomical and container media due to its ability to enrich seed germination, augmented seedling growth and development; and bolstered up plant productivity greater than would be possible by transformation of mineral nutrients into plant absorbable forms. Plant growth hormones such as indole-acetic acids (auxins), gibberellins and cytokinins are produced by microorganisms, thus, by means of vermicomposting technology.

A clear declined in populations of pathogenic microbes such as *Salmonella sp., Escherichia coli* and other Enterobacteriaceae to nil concentration when the sewage undergo vermicomposting technology, so those survival pathogens are terminated as they are put into place in the earthworms' food chain. Hence, this reduction might be correlated to the coelomic fluids liberated from earthworms during vermicomposting, which contain antibacterial properties and would kill those pathogens. Vermicomposting technology may also help in reducing plant diseases by enhancing the action of vesicular arbuscular mycorrhizae and restraining population of plant parasitic nematode.