Vermicomposting for Household and Modern Gardeners

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ABSTRACT

Vermicomposting as a method of solid waste management alternative is gaining increasing consideration by most environmentalists around the world. Started by farmers in the temperate countries to decompose their solid waste particularly during the winter seasons, vermicomposting has become a common trend of solid waste management in most of the developed countries. However, this technology is quite new to the Third World particularly the Asian countries where the climatic and environmental conditions are quite different from those of the developed countries. This paper introduces some of the basics of vermicomposting, its benefits, the current situation as well as its commercial potential in the management of other waste and environmental preservation.

Introduction

The amount of solid waste produced by Malaysians is about 15,000 tons daily. However, only less than 5% of this amount is recycled (Bee Dees 2001). The other 95% (especially food waste) piles up in dumpsites around the country where valuable plots of land have to be sacrificed for this purpose. In addition to that, these piles of waste, particularly food waste give rise to environmental problems such as putrid smell and contaminated ground and surface water.

Considering that the population of Malaysia is expected to double in the year 2020, the production of food waste will increase tremendously. With that, the environmental problems in relation to rotting wastes

would also be expected to double. Although some steps have been taken by the government to manage solid waste through recycling programs, the activities do not include garden and food waste. Alternatively, these biodegradable wastes can be diverted from going to the landfills by taking up other options of appropriate waste treatment such as composting. With that, the recent trend of using worms to degrade solid waste into valuable compost material could be the answer.

What is Composting?

Composting is defined as the aerobic biological decomposition and stabilization of organic substrates, under conditions that allow development of thermophilic temperatures as a result of biologically produced heat, to obtain a final product that is stable, free of pathogens and plant seeds, and can be beneficially applied to land (Golueke 1982; Haug 1993). Normal composting is assisted by microbial activities in the presence of adequate levels of oxygen and moisture. The end-product of this process is what laymen refer to as the organic fertilizer, called compost.

Vermicomposting

Vermes is a Latin word for worms. Vermicomposting is the process of composting with worms. Organic matter such as garden and food waste naturally decompose with the help of microbial activities. However, vermicomposting speeds up the process of decomposition and the end product is a richer organic fertilizer called the worm castings (Frederickson 2004).

Both vermicomposting and traditional composting involve the decomposition of organic matter by aerobic microorganisms. However, the processes carried out in the two composting techniques are quite different. According to Frederickson (2004), vermicomposting is best carried

out at relatively low temperatures (around 20°C) compared to traditional composting where temperatures in the compost pile may go up to 60°C to 70°C. Vermicomposting involves the joint activities between earthworms and the aerobic microorganisms to break down the waste and the end results are the vermicompost and vermicast. In contrast, traditional composting only involves the decomposition of the organic waste through the activities of the aerobic micro-organisms resulting in the production of compost.

Advantages of Vermicomposting

Vermicomposting is a natural and efficient way of recycling organic garden and kitchen waste. Given the right environment and appropriate routine attention, our garden and household waste can be converted to valuable compost faster than the traditional composting procedure. Worm composting also prevents stinking smells from the decomposing materials due to the fast action of the worms in eating those garbage. With the right equipments, vermicomposting is quite clean and odourless and can be conducted indoors.

For urban dwellers or people with little or no yard space, vermicomposting is the answer for household waste management because composting can be conducted in containers and placed indoors. Wastes and food scraps can be disposed into the vermicomposting containers without burdening the water treatment facility or landfills.

For the gardeners or farmers, vermicompost (with vermicasts) is a nutritious fertilizer that can be used for their crops or ornamental plants without incurring cost for the purchase of fertilizers. The granular worm castings, when mixed into garden soils would react as a 'slow release' fertilizer to feed the plants and at the same time acting as a soil conditioner by improving the structure of the soil (Murphy 1993). Besides that, according to Murphy (1993), vermicasts also contain special hormones and enzymes secreted by various types of bacteria living

in the worms' body. These hormones and enzymes are beneficial in promoting plant growth.

Some Basics About Vermicomposting

There are five basic ingredients to start vermicomposting, that is; a container, bedding material, water, worms and garden or kitchen waste (Cochran 2004).

The Worm Bin

The worm bin or container can either be a plastic container or home-made plywood with a lid or cover. A good size for a bin is 12" high, and 16" ; wide and 24" in length. This size will handle about 1.5kg to 2.0kg garbage per week. For kitchen vermicomposting, the rough guideline is one square foot of surface area per 600gm of food waste per week. Drill holes at the bottom of the bin so that excess water can be drained out. Set the bin on wooden blocks or attach legs to the bin to increase air circulation. Plastic bins tend to get wetter than wooden bins. If the bin is too wet, ordour problems may occur and worms may die or leave the bin. Place the bins in a shady location where it is protected from the hot sunshine and rain. Recommended locations are under kitchen sinks, garage, patio or laundry room.

The Bedding Material

The compost worm's natural habitat is in piles of fallen leaves or manure above the soil surface. For household purpose, the best material to use for bedding is shredded paper or newspaper placed three to six inches deep at the bottom of the box. The paper needs to be moistened until it is damp (75% moisture). Cow manure or peat moss can be used to lighten the bedding and absorb excess moisture. In addition, a handful of soil with some well-crushed egg-shells can be added every few months to the bedding to provide grit and calcium. The bedding material must remain damp (not soggy) at all times because the worms

need moisture to live, feed and reproduce.

Other materials that can be used as bedding materials include grass clippings, chopped up straw, sawdust, fibrous garden waste such as corn husks, padi husk and shredded leaves (Applehof 1982). These materials can be used in any proportion and it can help to provide more nutrient for the worms and to create a richer compost.

The Worms

The best worms are the composting worms. These worms are not naturally found in Malaysia. There are several types of vermicomposting worms such as Eisenia foetida (Red Wiggler Worm or Tiger Worm) and Lumbricus rubellus (Applehof 1997). These worms have a big appetite, reproduce quickly, and thrive in confinement (Applehof 1982). For local vermicomposting, these worms are imported from Australia. Currently, the Crop Protection and Quarantine Unit of the Department of Agriculture is also supplying these composting worms in small quantities. For large-scale vermicomposting, we still need to import from Australia or Indonesia through the Crop Protection and Quarantine Unit of the Department of Agriculture.

The amount of worms needed will depend on the size of the worm bin. As suggested by Hirrel (2003), a worm bin will support up to 1 pound (600gm) of redworms per square foot of surface area. These worms are said to be able to process food waste about half of their total body weight daily.

The Kitchen or Garden Waste

Red worms will compost a large variety of kitchen and garden wastes. However, meat, dairy products and greasy foods are not recommended for vermicomposting. Food wastes such as vegetable scraps, fruit peelings, bread and grains, rice, tea bags, coffee grounds and crushed eggshells can be used for this purpose. According to Applehof (1982), the smaller the food scraps the faster the

worms will digest them. It is advised that the worms should be fed only a little at a time. As they multiply, larger quantities of food wastes can be given. The wastes should be buried into the bedding regularly, rotating around the bin as you go about doing it.

Harvesting The Compost

The compost can be harvested about three to six months after setting up the bin. The compost looks like rich, dark soil and can be separated from the worms by exposing the bins to light and placing fresh bedding next to it. In the presence of light, the worms will move away form the compost and burrows into the fresh bedding.

Vermicomposting-World Wide

Vermicomposting has been practised by farmers in Europe, Australia and the United States for quite a long time (Applehoff 1982; Frederickson 2004; Murphy 1993). Compost worms which are different from garden worms have been used to compost garden wastes by small farmers. Vermicomposting has gained acceptance by house owners in the developed countries who use it indoors to compost household food wastes particularly during the winter season since it is odourless and easy to conduct. Extensive research and development have been conducted in these countries and they have produced a wide variety of innovative composting bins and paraphernalia. They even have a compost hotline where farmers and housemakers can get advice and information related to the latest issue about worm composting and building their own wormery.

Vermicomposting is also popular in schools and offices. In the schools, vermicomposting can be an exciting class project where it can promote learning among students and recycling of school wastes such as food scrap, papers, pencil clippings and cardboards. In some cases, vermicomposting projects help the students to gain extra money from the waste that they generated (Cornish 1999). Some researchers in the Asian countries

such as India and Indonesia have also started venturing into vermicomposting studies.

Additionally, due to the efficiency of vermicomposting, most of the developed countries have started large-scale worm composting to manage the food and other organic wastes from food and other related industries. According to Frederickson (2004), several commercial vermicomposting units in the United Kingdom are capable of composting thousands of tons of wastes per year. In Malaysia, the knowledge and skills in vermicomposting is still insufficient. Several parties have started to pick up this technology such as the Department Agriculture, and several researchers in Universiti Sains Malaysia, Universiti Putra Malaysia, Universiti Teknologi MARA (Pahang and Shah Alam). Some private estates have also acted as pioneers to start and experiment with vermiculture and vermicomposting in their farms. However, hands-on technology about vermicomposting for local households and small farmers is not yet available, hence, the need for extensive studies and research to be taken up by local researchers.

Other Commercial Values and Prospects of Worms

Worm farming has become a new venture which will change the nature of solid waste management through out the world. As research and practical thinking continues about the potential of worms, new areas of opportunity are coming to light. As reported by Murphy (1993), the Bhawalkar Earthworm Research Institute of Pune, India has developed the technique of waterless worm-driven toilet and worm assisted sewage treatment.

According to this report, the waterless worm-driven toilet is odourless and can hygienically convert human waste into valuable pathogen-free castings which can be used as organic fertilizers. 'Vermifilters' are designed by Bhawalkar Earthworm Research Institute for sewage treatment (Murphy 1993). Using these, the Institute claims to produce drinking-quality water from raw sewage. It is a continuous process, is 100 per cent

worm-driven, and provides both primary and secondary treatment. This system seems to be able to successfully dispose off solids by converting them to castings and it also purifies the waste water.

Conclusion

Composting and particularly vermicomposting technology has not reached or gained wide acceptance from the majority of Malaysian farmers and households (including schools and offices) as compared to the developed countries. Currently, most Malaysian citizens are still not aware of the importance of recycling and solid waste management and their impact on the environment. This may be due to lack of information and inadequate Reasearch and Development (R&D) activities to facilitate the spread or diffusion of the benefits and appropriate techniques of vermicomposting and waste management suitable to the Malaysian climate and household habits.

A lot of R&D activities need to be carried out so that we can produce our own adapted technology of vermicomposting. People also need to be educated about the benefits of recycling and how vermicomposting can help to not just manage solid waste particularly farm or food waste, but to generate income and reduce production costs in the agriculture sector as well as the industrial sectors. The joint effort between research and the diffusing agents (extension workers) is needed to develop a really user-friendly vermicomposting system and technique as well as spreading that technology to the whole mass of the Malaysian population.

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