VERMICOMPOSTING FOR HOUSEHOLD AND MODERN GARDERNERS

An Alternative to Solid Waste Mangement

By

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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 introduces some of the basics of vermicomposting, its benefits,the current situation as well as it commercial potential in the management of other waste and environmental preservation.

Introduction

Malaysians are producing more wastes with each passing year. It is estimated that the amount of solid waste produced by Malaysians is about 15,000 tons daily. However, only less then 5% of that is recycled (Bee Dees, 2001). Valuable plots of land have to be sacrificed as dumpsites for the remaining 95% (especially food waste). 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 be expected to increase tremendously. With that, the environmental problems in relation to rotting wastes would also be expected to be doubled. Although some steps have been taken by the government to manage solid waste through the recycling programs, but 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 management.

Waste Management Alternatives

Most experts agree that we should use four steps to manage our waste problem. This includes source reduction, recycling, converting waste to energy and landfilling. Source Reduction is the process of reducing the amount of waste we produce in the first place such as using less aluminum to make an aluminum can. Recycling is using old products to make new products; Example: Using old newspapers to make egg cartons. Burning trash to produce steam and electricity is an effort to convert waste-to-energy. The last alternative is to bury waste (landfilling) when it cannot or should not be burned or recycled.

Another alternative that has not been seriously addressed in this country is composting. Not much effort has been made to study the feasibility and advantages of home composting methods i.e. worm composting, basic composting, underground composting and closed air composting. Through home composting, some of the

household organic waste (about 30% based on our waste composition) can be diverted and it helps the environment by recycling valuable organic resources and improving the fertility and health of the soil in the garden and house plants.

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 refers 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 20oC) compared to traditional composting where temperatures in the compost pile may go up to 60^{o} to 70^{o}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. Ttraditional composting only involve the decomposition of the organic waste through the activities of the aerobic microorganisms 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 then 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 vermicast) 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 contains 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" length. This size will handle about 1.5 kg to 2.0 kg 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 in 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 then 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 in the bottom of the box. The paper need 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 worm 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 persquare 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 practiced by farmers in Europe, Australia and the United States for quite a long time ago Applehoff, 1982; Frederickson, 2004; Murphy, 1993). Compost worms which are different from garden worms have been used to compost garden wastes by small farmers. Since vermicomposting is odourless and easy to conduct, it has gained acceptance by house owners in the developed countries to use it indoors to compost household food wastes particularly during the winter season. 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 advise and information related to the latest issue about worm composting and building their own wormery.

Vermicomposting is also popular in schools and office. 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 helps 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 has started to pick up this technology such as the Department Agriculture, and several researchers in University Sains Malaysia, University Putra Malaysia, UiTM (Pahang and Shah Alam) and 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 the 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 also purifies the waste water.

Conclusions

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. Concurrently, 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 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.

In due respect, a lot of research and development 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 the 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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