Compost Case Studies: PV Waste's Vermicompost

Pam Groat, EIT, MSEM

The following is one of six case studies on the effectiveness and usability of large-scale composting systems in Western Canada, as part of a Masters project with the University of Saskatchewan's School of Environment and Sustainability and the SWRC. The studies provide relevant and useful information to businesses and institutions that may be interested in managing their own organics waste by implementing their own indoor and/or onsite composting system. For each study, a brief description of the system is provided before introducing the actual case usage, to help familiarise the uninitiated. With the broad range of information provided, the goal is to help businesses and organizations decide what type of indoor composting system (if any) is most appropriate for their operation.

Flow Through Vermicomposting

Sustainable Agriculture Technologies' Flow Through Vermicomposting unit is a static, in-vessel composting system that relies on the relationships between waste, microorganisms, and red wiggler earthworms[i]. These special worms can digest half of their body weight in organic waste and micro-organisms per day, excreting nutrient-rich castings that further stimulate microbial activity and help supress plant diseases[ii]. Large-scale vermicomposting has been found to work well for the composting of manure or sludge due to the fine particle size of input material, as well as the manure's microbes[iii]. The Flow Through Vermicomposting unit, however, is built for processing the food waste, for institutions like schools or prisons.

The Flow Through Vermicomposting system has an automated periodic ventilation fan for temperature and moisture control. As the compost material is added with the worms, the bottom of the pile will become more mature and stable enough to harvest[i]. The system has two manual cranks that scrape the bottom 1-2 inches of the pile that is suspended above a collection area on the bottom that can be accessed by a front-latching door[i].

Technical Specifications[i]	
Cost	$8,000.00
Size (L)	6' (1.8m)
(W)	5' (1.5m)
(H)	4' (1.2m)
Theoretical input capacity	34 kg/day (68 L/day)
Power requirements	Standard single phase 240 volt
Energy requirements	(Not available)
Ventilation	Ventilation fan

Source: http://www.wormwigwam.com

PV Waste Solutions, Regina, SK

The following information, unless otherwise specified, has been collected though interviewing Karen Allan, the Waste Solutions Specialist at PV Waste Solutions, on January 28th, April 20th, June 24th, and October 21st, 2016.

PV Waste Solutions is a waste management company in Regina, Saskatchewan. The large-scale flow-through vermicomposting unit was purchased in December 2014 to breed and grow worms to sell with the Worm Factory 360 composting system, which PV markets to the public and provided to classrooms. PV also plans to eventually sell the vermicompost as a soil amendment at Farmers' Markets. As the first Canadian company to own this particular system, the business has had challenges processing the compost and sustaining the worm population. The food waste was initially sourced from the office waste produced by their company, two neighbouring companies, and an East Side Mario's restaurant, which did not offer a consistent feedstock. However, with the addition of waste from their recent piloting of a curbside pickup composting service, as well the collection of manure from a nearby rescue farm acreage, PV now has a more consistent feedstock and the worm population is thriving, allowing the organization to comfortably sell worms without drastically impacting the system's maintenance.

Space

The system is located onsite at PV Waste solutions, in the heated disposal bin rental facility. The minimum required workspace for the system is 10'x10' (3m x 3m)[i].

Materials

The initial setup requires worms and shredded paper for bedding. Collection bins, a spade for chopping organic waste, more shredded paper for bulking material, and a rake for mixing the compost are also required.

Volume intake

The amount of waste that can be processed depends on the number of worms present; for every kg of worms, 0.5 kg of combined food waste and bulking material can be processed daily. At PV, there are about 27 kg of worms that could process 13.5 kg of feedstock daily. Currently, about 23kg of waste is being added to the system every week, or 3.3 kg daily. The worms digest smaller particles of already decomposing food waste, making the manure and the week-old waste from the curbside pickup service ideal for feedstock. Meat and dairy food waste should not be added unless the system is consistently monitored[i].

Time/effort required

Pre-processing

Bedding must be created for worms through shredding paper, and food must be chopped to a small enough size for easy digestion, using a spade and rake. Every 18 kg of food requires about 2-3 hours of pre-processing, and should be added with an equivalent amount of shredded paper. Worms will only digest food that is already decomposing, so it is best to wait a few days before adding it to the system.

Pre-processing equipment. Photo taken by Pam Groat

Processing

The processing is mostly done by the worms and the fan system. However, monitoring of the progress and health of the population is necessary, and general maintenance, such as watering the bedding if moisture is low, adding more food if the worms are not fed enough, or less food if the system is overheating from microbial activity, is also required. At first, as the population was adapting to its environment, processing the food waste to usable castings took 6-9 months. Now the addition of waste is weekly. Theoretically, once established, the addition of waste and collection of vermicompost can occur as often as daily[i].

Post-Processing

To collect the finished product, the system is manually cranked to scrape the most processed product from the bottom of the pile to the collection area, as shown below. Some worms and immature waste may fall through to the collection area as well; these need to be screened from the finished product. The worms, however, can remain with the finished product, if desired[i]. It is recommended to collect the finished product once the bin is filled to two inches from the top[i]. Since the bin has yet to reach that capacity, collection has not been attempted and the required time for post-processing has not yet been determined.

Identified lower collection area and its interior. Photo on left courtesy of Karen Allan, photo on right taken by Pam Groat

Odour

The system has no offensive odor. It smells like earthy, healthy soil.

Quality

The compost has yet to be collected, therefore it has not yet been tested for quality.

Troubleshooting

Initially, there was a fruit fly infestation in the system that required the addition of diatomaceous earth to the unit and halting feedstock addition, which starved and killed a portion of the worm population. Also, the temperature of the system has not been completely consistent, because the decomposing food waste that the worms will digest increases the temperature to potentially unbearable, thus requiring a reduction of raw food waste. The addition of heatless pre-composted feedstock, such as manure, has ensured a reduction of pathogens and a more stable temperature within the unit.

With the system's industrial size, any issues with temperature control, moisture control, feeding, or infestation, affect the entire worm population. Consequently, the most successful implementation of this system has been with a more consistent input source, such as the recent addition of manure and waste from the curbside pickup program. For operations with inconsistent food input, multiple smaller bins may be more productive, as each bin can progress independently from each other, ensuring less populations are affected if any issues arise.

---

[i] Sustainable Agricultural Technologies, Inc. Operating Manual: Model 5-6 Flow Through Vermicomposting unit. Provided by Karen Allan, January 28 2016

[ii] Nelson, E., Rangarajan, A., Nicholson, C., Bonhotal, J., & Herlihy, T. (2010). Vermicompost: A living soil amendment. Cornell University, Department of Plant Pathology and Plant-Microbe Biology, Ithaca, New York. Retrieved online from http://cwmi.css.cornell.edu/vermicompost.htm

[iii] Khwairakpam, M. & Bhargava, R. (2009). Bioconversion of filter mud using vermicomposting employing two exotic and one local earthworm species. Bioresource Technology 100 (2009), 5846-5852