Compost Case Studies: USask's Windrow + Dehydrator

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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.

Windrow + ECO-250 Food Dehydrator

Windrow composting is the process of pilling rows of organic waste are turned periodically. The size of the rows can vary depending on need and capacity of land and equipment used. Natural ventilation and turning provide the required oxygen for this system. Agitation, and therefore mixing, of the windrow occurs mainly along its height and width, with minimal mixing along the length of the windrow[i].

The ECO-250 Food dehydrator is an in-vessel system that can reduce the weight of organic waste by 85-93% through dehydrating it into a sterile biomass. The dehydrated biomass can then be added to the composting windrows, without the potential for pathogen leaching. The extracted moisture from the food waste is potable water, and can be applied directly to gardens, risk-free[ii].

Technical Specifications	Windrow*[iii]	Dehydrator[iv]
Cost	N/A	$ 76,000[iii]
Size (L)	100 m (328' 1")	3'9.3" (1.15m)
(W)	87 m (285' 5")	3'3.4" (1.00m)
(H)	3 m (9' 10")	3'5.4" (1.05m)
Theoretical input capacity	1,346,220 kg/year (2,692,440 L/year)	226 L/day (113 kg/day)
Power requirements	N/A	220 V 3 phase
Energy requirements	N/A	8.0kwh/cycle
Ventilation	Outdoors	N/A**Error! Bookmark not defined.**

Source: ecovimusa.com

**Because the system is adaptable to whatever size windrow formed, the case study dimensions will be used as an example for specifications.*

University of Saskatchewan, Saskatoon, SK

The following information, unless otherwise specified, has been collected though interviewing Gift Marufu, the Manager and Head of the Grounds department at the University of Saskatchewan, on May 10th, May 25th, June 16th, and June 27th, 2016, as well as on March 6th, 2017.

The University of Saskatchewan is a college campus in Saskatoon with over 22,000 students and staff[v]. Windrow composting is currently integrated in the campus' general landscaping, in particular its spring and autumn clean up, and the rows process over 1600 cubic meters of yard waste per year. Grass clippings,

deadfall, and other removed organic material is composted and cured to then be added to enrich the soil on campus fields and surrounding community gardens. Plant-based food scraps, collected from selected campus events, are also added to the piles. If sold, the resulting amount and quality of compost produced each year is estimated to be worth $60,000. The campus saves approximately $60,000 per year by avoided landfill tipping fees.

The university has expanded their operation to include food waste from Marquis Hall, the culinary center, using a food waste dehydrator to minimize the potential for nutrient leeching. The ECO-250 dehydrator was installed late February of 2017, which has been processing 250 pounds of food daily, to be added to the windrow once a large enough mass has been stockpiled.

Space

The windrow portion of the composting process is an open lot outside, occupying an area of about 87m x 100m (285' x 328'), over 300 ft (91 m) away from the South Saskatchewan River. This lot holds space for three piles of compost that are turned, as well as a finished pile of compost being cured and a pile of wood chips that is mixed in as required for bulking material. The following photo shows two piles of organic waste, actively decomposing on campus in June of 2016.

Two windows on U of S campus. Photo: Pam Groat

The food dehydrator is in the Marquis Hall kitchen, and occupies a 1.00 m x 1.05m footprint (45.3" x 39.4")[iv].

Materials

Due to their considerable scale, the rotating of the piles is aided by a payloader. As well, a hose system is used to ensure the piles have enough moisture. A wood chipper is also required to add the tree and bush deadfall to the pile in manageable sizes, which can then act as bulking material. For the dehydrator, a grinder is also required to break down the food waste into smaller, more manageable particles. For the U of S, all extra equipment was already available on campus.

Volume intake

Three piles of compost, with each pile is about 90 m long, 4m wide, and 1.5 m high, are processed every year. This translates to 1,346,220 kg/year (2,692,440 L/year)[vi]. Additionally, the dehydrator processes 791 kg (1582 L) of food waste per week[iv].

Time/effort required

Pre-processing

The yard waste collected during seasonal campus clean-up and regular landscaping is piled into a row, and shaped by a pay-loader, with an extra layer of wood chips added on top. This process takes minimal time in addition to the required tasks of cleaning up yard waste on campus. Concurrently, food waste from Marquis Hall is grinded and added daily to the food dehydrator, as part of regular cleaning, and is stockpiled until a large enough mass can be added to the row.

Processing

Once in piles, the compost is turned by a pay-loader every two weeks in the summer, and as often as possible in the winter. Turning the piles takes about 3 hours. The piles are monitored for moisture, and will be watered if too dry or will have wood chips added if too wet. Otherwise, minimal monitoring or adjustment is required. Processing the waste into usable compost takes about 3 months in the summer, and about 6 months in the winter.

Post-Processing

The finished product is screened by Dressler Soils, an independent consultant in Saskatoon, using a McCloskey 412 Trommel Screener. The larger particles are then returned to a pile that is currently processing. The sifted product is left in a large pile to cure for one month before being applied as compost. The curing compost can be seen in the following photo.

Curing compost. Photo taken by Pam Groat

Odour

Currently, so long as wood chips are added on top of the windrow pile, the proper moisture balance is possible and odour is minimal and manageable. The food dehydrator produces some odour, but once dehydrated and added to the rows, minimal odour is likely to be encountered.

Quality

The current quality of the finished compost without the addition of dehydrated food has not been formally tested for nutrient content. However, through monitoring its use on campus by field experts, including Compost Consultant Larry Mullen, and Plant Science Assistant Professor Grant Wood, the compost was given a premium rating and was recommended to be priced at $45/cubic yard, if sold. The compost has been applied on the University of Saskatchewan fields and surrounding community gardens with visible improvements to plant growth.

Troubleshooting

For the windrow, moisture balance is the most important to get right, and is determined to be optimal at 50%. Except for some odor, no issues have been found in using the dehydrator. However, the process of obtaining the dehydrator and implementing its use should be noted. While the system was purchased in the spring of 2015, it did not arrive at the University of Saskatchewan until May 2016. As well, the upgrades to the system required approval of its new electrical components to receive proper Canadian Certification and be used under warranty, which further delayed the system's use until February 2017.

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[i] Haug, R.T. (1993). The practical handbook of compost engineering. Boca Raton, Florida: Lewis Publishers, p.31

[ii] Sustainability Resources International, LLC. ECOVIMTM Food waste dehydrator systems. Retrieved online from http://sri-green.com/files/91789991.pdf

[iii] Marufu, G., Personal Communication (May 10, 2016)

[iv] Ecovim (2015). Our Products. Retrieved online from http://www.ecovimusa.com/products/

[v] University of Saskatchewan Data Warehouse (2016). Student Headcount by Level. Prepared by Information and Communications Technology - Reporting and Data Services. Retrieved online from http://www.usask.ca/isa/statistics/students/headcount-demographics.ph

[vi] EPA (2006). National Recycling Coalition Measurement Standards and Reporting Guideline. FEECO and CIWMB. Retrieved online from http://des.nh.gov/organization/divisions/waste/swmb/css/documents/vol-to-weight-conversion.doc