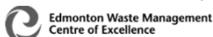



Integration of Anaerobic Digestion into Organics Processing: Co-composting of Digestate

Golnaz Arab & Daryl McCartney
EWMCE & University of Alberta

SWANA NL Conference, Calgary
13 May 2016



Background City of Edmonton



- Capital of Alberta.
- Population: 880,000.
- GDP = \$80,000 per year.
- Residential waste diversion goal of 90% by 2017.

Current situation

- Capacity issues.
- Wish to treat more biosolids
- Growth to ICI sector.
- Installing AD capacity.


Inputs

SSO from ICI
OFMSW
Manure

Anaerobic digester
(40,000 t y⁻¹)

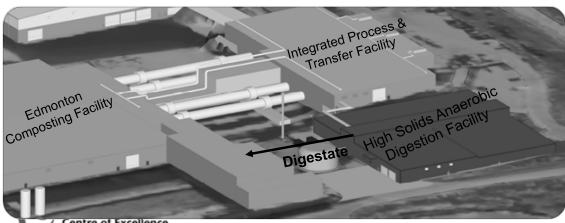

Final products

Biogas
Digestate

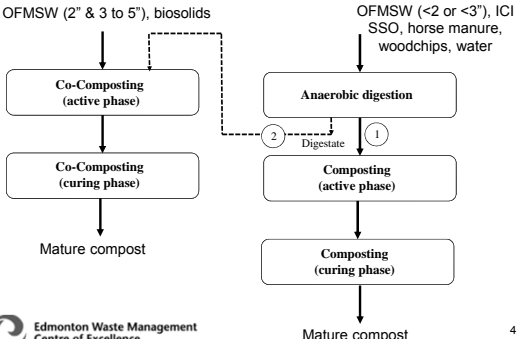


Digestate Co-composting Hypothesis

- Co-composting of digestate with fresh organics will reduce MRT of composting.
- Controlled variable:
 - Digestate portion ranged from 0 to 100%.

Background Simplified Full-scale Material Flow



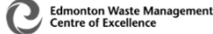
OFMSW (2" & 3 to 5"), biosolids

OFMSW (<2 or <3"), ICI SSO, horse manure, woodchips, water

Co-Composting (active phase) → Co-Composting (curing phase) → Mature compost


Anaerobic digestion → Composting (active phase) → Composting (curing phase) → Mature compost

Digestate (1) and (2) are shown as feedback loops between the processes.



Background Digestate Co-composting

- Why Co-compost?
 - Common MO in composting & AD processes.
 - Extracellular enzymes in digestate.
 - Nutrient addition, e.g. N, P, Mg, Fe.
 - Physical amendment: BD & MC.
- May result in:
 - Shorter lag phase.
 - Shorter retention times or more stable product.
 - Decrease in energy needs.
 - Lower costs??



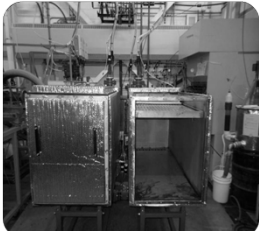
Key Objective for Today

Highlight potential of digestate co-composting.




Materials & methods Digestate preparation



- 500 L HSAD pilot-scale facility.
- With the same feedstock materials used in the full scale:
 - a. Pretreated OFMSW (-2"), 48%
 - b. ICI SSO, 51%
 - c. Horse manure, 1%
 - d. Woodchips, as needed.



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Materials & methods Composter Feedstock

- 2 to 5" material in spring 2015.
- Mostly yard waste, grass, & thatch.

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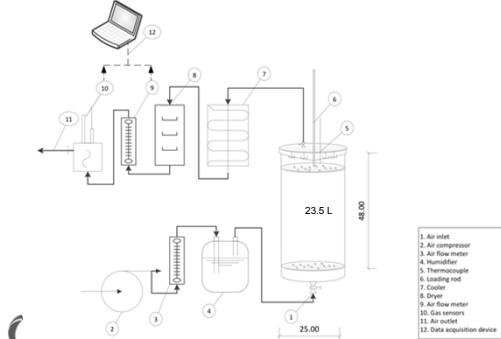
Materials & methods Composter feedstock

Composter ID	Main feedstocks		Amendments	
	Digestate (%_ww ¹)	OFMSW (%_ww)	WC ² (kg)	Water (kg)
C1	0	100	0	1.22
C2	10	90	0	1.04
C3	20	80	0	1.02
C4	30	70	0	1.04
C5	40	60	0	1.00
C6	50	50	0	0.50
C7	75	25	0.59 (5%)	0.00
C8	100	0	1.57 (15%)	0.00

¹ Wet weight.
² Woodchips.

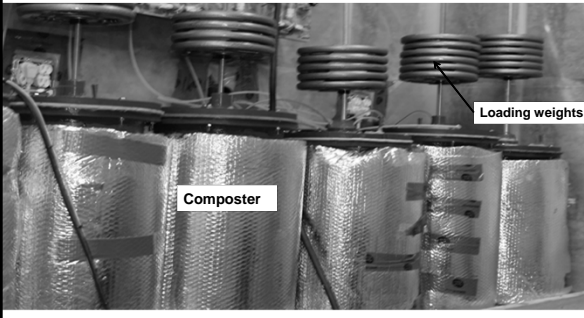
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Materials & methods Schematic Design of Composters



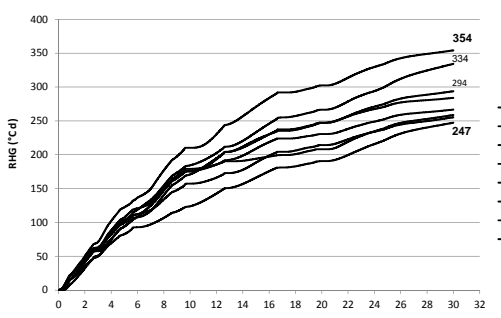
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Material & Methods Biological Load Cells

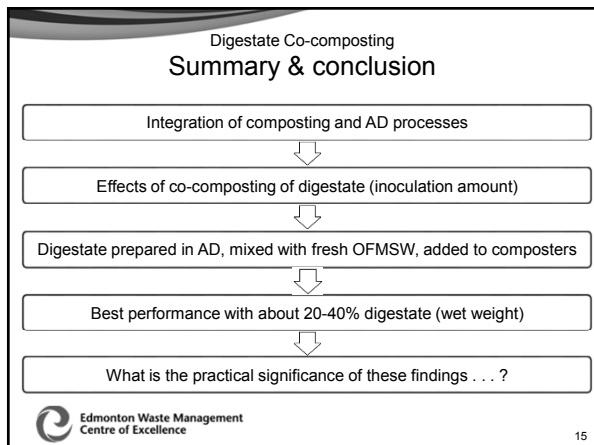
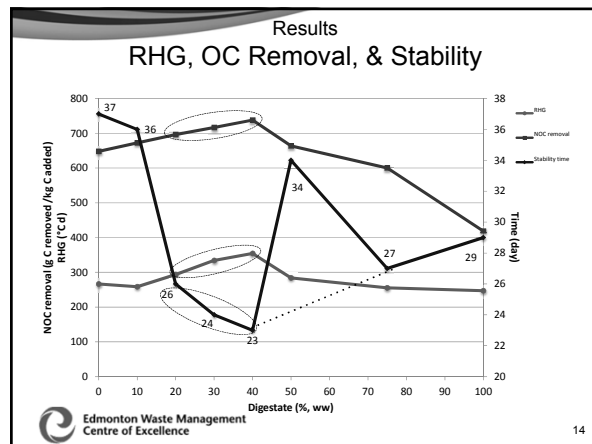
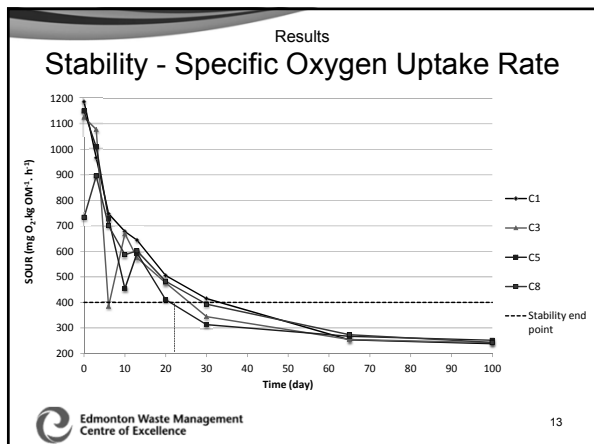


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Results Relative Heat Generation (RHG) Over Time

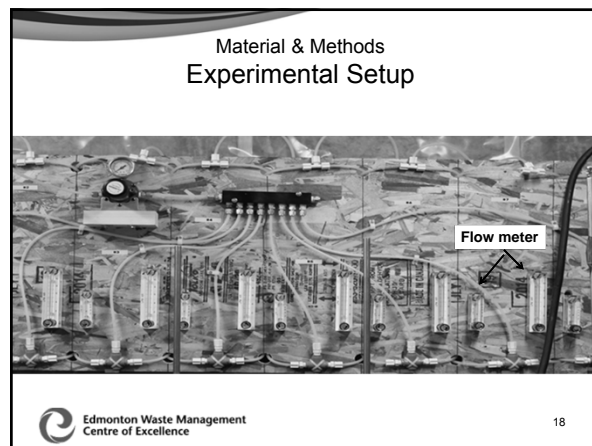


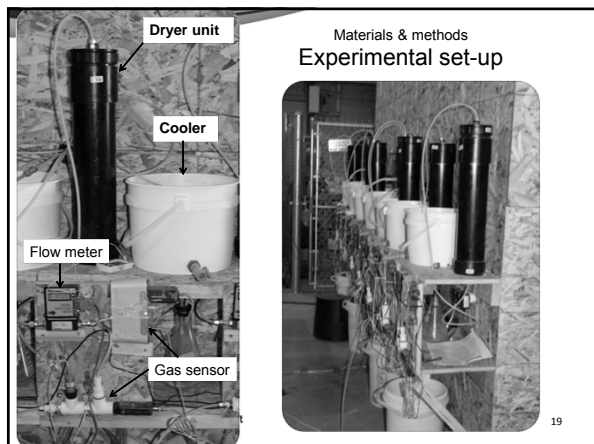
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Materials & methods (Analytical method)

	Analyses	Units	Stable/mature	Test method
Monitoring	BD	Kg.m ⁻³	NA ¹	TMECC 03.01A
	TS	% ww	NA	TMECC03.09
	OM	% dw	NA	TMECC05.07
	pH	-	NA	TMECC 04.11
	EC	μs. cm ⁻¹	NA	TMECC 04.10
	Temperature	°C	<8 ²	NA
	O ₂ concentration	%	NA	NA
	Microbial population	%	NA	Pyrosequencing
Stability	C/N	-	<25	-
	SOUR	mg O ₂ .g ⁻¹ OM. d ⁻¹	3-10	TMECC 05.08-A
	Solvita® CO ₂	Solvita color code for CO ₂	5-6	TMECC 05.08-E
Maturity	Solvita® NH ₄	Solvita color code for NH ₄	4	TMECC 05.08-E
	NH ₄	mg NH ₄ . kg ⁻¹ dw	75-500	NRAL-105
	NH ₄ /NO ₃	-	0.5-3	NRAL-105

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