



airterra

Odour Free Composting With Biochar

“Biochar: Chicken Soup for the Soil”

Environmental Services Association of Alberta Presentation

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Organic Waste is a Worldwide Problem!

Presentation Outline

Introduction

What is Composting and Why Compost?

Home & Garden Waste Options

What is Biochar and What Does it Do?

Composting Trials

What Science Tells Us

Commercial Applications & Municipal Examples

Conclusions

Introduction

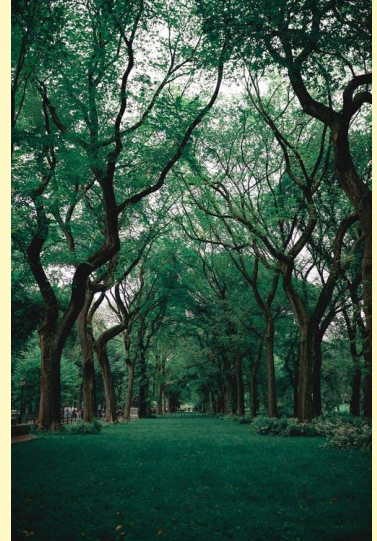


Problems:

1. Landfills are Filling Up
2. Composting Attracts Pests
3. Composting Smells
4. Non-Compliance Materials Can Be Toxic

Opportunities:

1. Containment Composting Eliminates Pests
2. Adding Biochar Suppresses Odours
3. Biochar Enhances Compost Quality



AirTerra Inc.

AirTerra is a Calgary, Alberta based consultant and provider of carbon capture regenerative solutions with a vision of living soils for healthy plants, nutritious food, and pure water.

AirTerra supplies CFIA approved and OMRI certified biochar suitable for horticulturalists, farmers, gardeners and specialty applications.



AirTerra® SoilMatrix® Biochar
“Capturing Carbon for Good!”

Organic Waste



Food Waste Collected in Bin



Composting in Covered Windrows

Why Composting Smells



- Too Wet (Anaerobic)
- Too Much Green Material
- The Pile Isn't Mixed Properly
- Added Meat, Fats, Dairy or Manure
- Too Compacted (Not Enough Oxygen)



Compost Chemistry



<u>Materials High in Carbon</u>	<u>C/N*</u>
Autumn leaves	30-80:1
Straw	40-100:1
Wood chips or sawdust	100-500:1
Bark	100-130:1
Mixed paper	150-200:1
Newspaper or corrugated cardboard	560:1
<u>Materials High in Nitrogen</u>	<u>C:N*</u>
Vegetable scraps	15-20:1
Coffee grounds	20:1
Grass clippings	15-25:1
Manure	5-25:1

Optimal C:N Ratio is 30:1 to Start and 10:1 to 15:1 Finished Compost

Source: <http://compost.css.cornell.edu/chemistry.html>

Organic Waste Processing Methods

Composting

Anaerobic Digestion

Integrated

Specialty Methods

Thermal Processing

Feedstocks Drive Everything!

Common Composting Steps

Home (Residential)	Commercial
Mesophilic Design – Narrow Limitations	Thermophilic Design – Broader Limitations
Acceptable Sources (Kitchen & Garden)	Acceptable Sources (SSO, ICI & Municipal)
Collection, Separation & Rejection	Receipt of Feedstock (Scale & Acceptance)
Feedstock Preparation (Size, Moisture, Blending Greens & Browns)	
Composting (Duration, Aeration, Moisture, Leachate Control, Odour Control)	
Testing and Adjustments	
Curing	
Screening (Oversize, Plastics, Inorganics)	
Usage – Mixing With Soil	Delivery & Sales & Usage
Applications – Garden, Plants & Shrubs)	Applications – Landscaping, Commercial

What Can Go Wrong – Ugh!?!

Pathogens

Attracts scavengers

Low Carbon Content

Smelly Odours

Leachate

It Takes Too Long

Neighbours Complain of Odours – OOPS!

Composting Basics – What to Avoid

Plant materials that have been chemically sprayed

Treated (chlorinated) water

Animal waste, meats and cheese



**This is no
Christmas Present
for your Compost
Bin!**

What is Composting With Biochar?

- **Add High Quality Certified Biochar to the Organics**
- **Biochar is Carbon Specifically Produced through Pyrolysis**



Why Compost With Biochar?

- Minimizes Odours
- Makes Compost Better
- Increases Total Organic Content
- Biochar Doesn't Decompose and Lasts a Lifetime



Residential Composting Options



Open Air Composting

Direct Composting

Tumbler Composting

Vertical Aerated Bin

Worm Farm Composting

Bacteria Composting

Combination Composting

Municipal Collection



ADD BIOCHAR TO ANY OR ALL OF THESE OPTIONS!



SoilMatrix[®] Biochar

What is Biochar?

Carbonized biomass that:

- **Remains** in soils for 100's to 1000's of years,
- Creates physical conditions in the soil that stimulates beneficial soil microbes (bacteria and fungi), and makes nutrients, and moisture more available for plants.
- Stores 2.3 kgs of CO₂ drawn by photosynthesis from the atmosphere for every kg of biochar amended into soil.

SoilMatrix® Biochar



Helping Gardeners



Helping Farmers

SoilMatrix[®] Premium Biochar - Screened



Biochar's Beneficial Soil Attributes

1. Improves **soil moisture** holding capacity
2. Increases **nutrient retention**
3. Increases **soil carbon content**
4. Improves **crop yields**
5. Improves **soil pliability**
6. Improves **pH (can be adjusted)**
7. **Stimulates** beneficial microbiological activity

Reference: www.airterra.ca



Photos of Composting Trials



**Dual Rotating Composter
& Plastic Bin of Dead Leaves**



**AirTerra® SoilMatrix® Biochar
“Capturing Carbon for Good!”**

Photos of Composting Trials



Blended Greens & Browns Being Added



Finished Compost
from 11 Cu. Ft Dual Composter

Photos of Composting Trials



Kitchen Scraps & Biochar To Be Added



Vertical Stationary Composter

Photos of Composting Trials



Our Small Garden With Stationary Composter

Residential Composting Trials - 2017

- **Performed over three summers**
- **First batch in 2017 used dead dry autumn leaves**
- **Second batch 2017 used wood shavings**
- **Both batches composted in rotating dual batch composter**
- **Biochar was added only to one side of the dual composter**

Residential Composting Trials – 2018/19

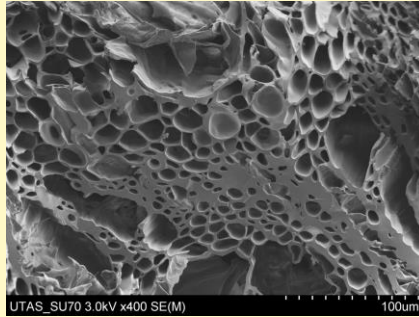
- **2018 trial was similar to 2017 using dry leaves**
- **2019 composting was less rigorous**
- **Performed in a stationary top fed composter**
- **Added biochar in the kitchen container and each composter load**
- **Dry leaves and/or grass clippings were added in layers**

Findings of Composting Trials

- Biochar addition eliminated time to condition the biochar
- Biochar addition eliminated odours indoors and outdoors
- Biochar ADSORBS nutrients ONTO the large charged internal surface area
- Biochar ABSORBS moisture INTO the large pore spaces
- Biochar makes better soil by increasing the soil carbon content, retaining nutrients and moisture

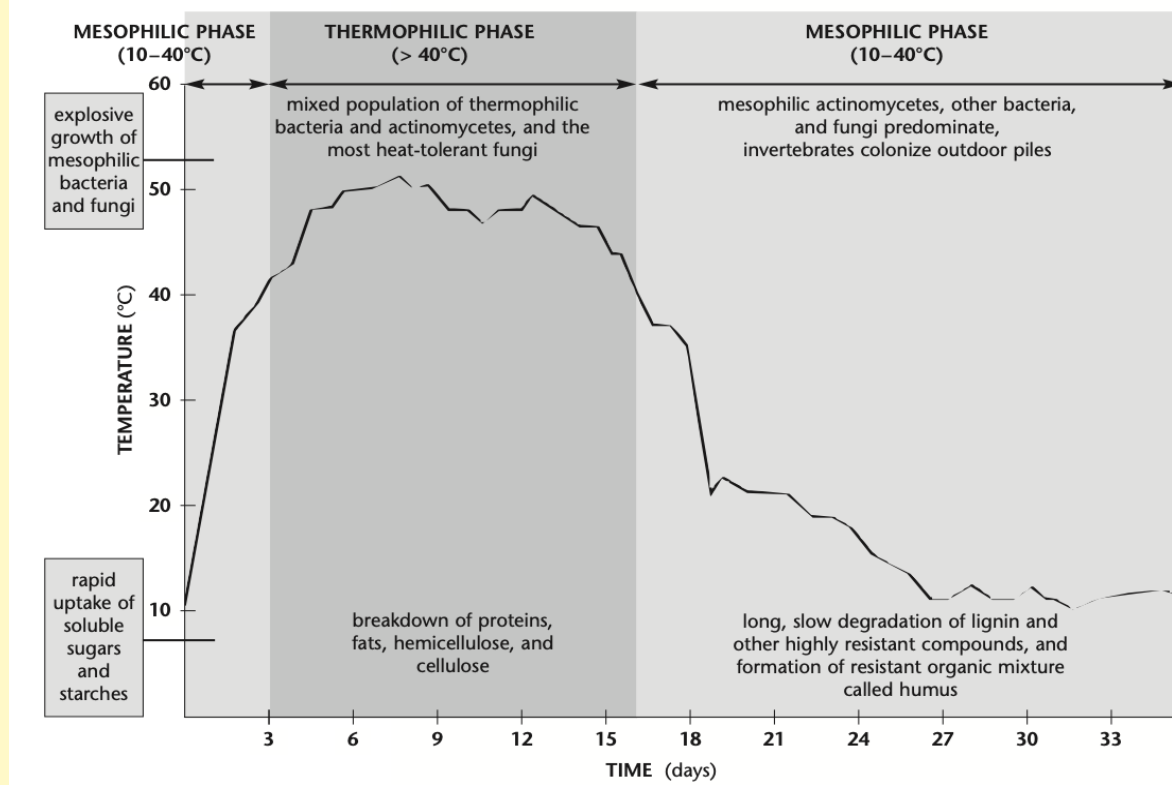
Why Biochar Reduces Odours

- **Biochar Adsorbs Ammonia and H₂S Emissions**
- **Biochar adsorbs gasses in the microscopic pores**



Adsorbed Emissions = Less Odours
=> Nutrient Enhanced Compost (\$\$\$)

Phases of Thermophilic Composting



Credit: "The Science of Composting" paper from Cornell University

What Makes Good Compost?

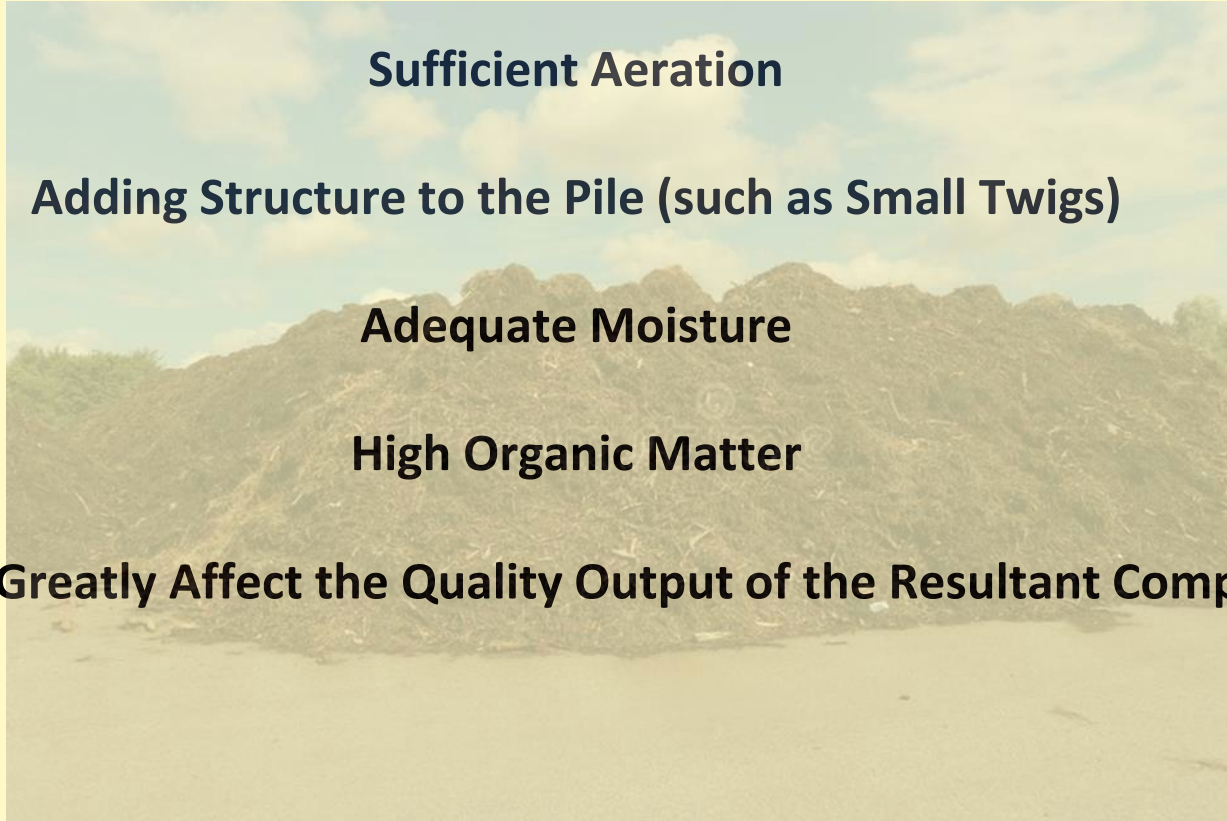
Sufficient Aeration

Adding Structure to the Pile (such as Small Twigs)

Adequate Moisture

High Organic Matter

Inputs Greatly Affect the Quality Output of the Resultant Compost



Practical Recommendations

Better Compost Using Fallen Leaves as the Carbon Source

Avoid Animal Matter including Eggshells

Compost and Soils tests are helpful

Compost Testing is recommended for large scale operations

What Science Tells Us About Biochar

Improves compost physico-chemical properties.

Enhances microbial activities and promotes decomposition.

Reduces ammonia (NH_3) and GHG emissions.

Upgrades compost quality by increasing plant available nutrient content

“Organic coating on biochar explains its nutrient retention and stimulation of soil fertility”

Nikolas Hagemann, Stephen Joseph, Hans-Peter Schmidt. Nature Communications, October 2017

Municipal and Agricultural Co-Composting



AirTerra Industry Advisor
UofA Student Design Project

AirTerra Field Trials

Soils Regeneration and Land Reclamation

Biochar Applications:

- Retail gardening
- Horticultural growing medium
- Urban market garden
- Urban Tree Care
- Farm Organic Fertilizer
- Agricultural Land Regeneration
- Industrial Site Reclamation



Industrial Site Reclamation

courtesy of Saskatchewan Polytech

(circled sites were **biochar amended** in the spring of 2019)

Commercial Applications

Composting operators must comply

Optimum composting conditions

Feedstock (and carbon content) varies over the four seasons

Animal matter including eggshells are typically included which requires

Thermophilic composting conditions

Monitoring of temperature and moisture levels are essential

Lab testing of organic matter and pathogens is often required

Alberta Composting Regulations

- **Activities Designation Regulation (AR 276/2003)**
 - Class 1 Composting Facility less than 20,000 t/yr (any type of organic feedstock)
 - Class 2 Composting Facility less than 20,000 t/yr (only vegetative matter or manure)
- **Standards for Composting Facilities (2007)**
- **New Code of Practice Expected Soon**
- **Coming Soon:**
 - The Department plans to include biochar in Code of Practice
 - Recent Correspondence states “Biochar will serve as a beneficial amendment for compost facilities”

Commercial Applications

Benefits	Opportunities
Biochar Reduces Odours	<ul style="list-style-type: none">• Add to Problematic “Green” Materials• Apply to Leachate Surface• Temporary Problem Areas
Biochar Makes Better Compost	<ul style="list-style-type: none">• Enhanced Regular Compost Grade• Premium Compost (5% Biochar)• Ultra Grade Compost (10% Biochar)• Specialty Blends (> 10% Biochar)• Custom Client Composts

Municipal Composting Methods

- **Windrows – Long Rows (Outdoors)**
- **Aerated Static Piles (Outdoors)**
- **In-Vessel (Enclosed Environment)**
- **Integrated Anaerobic Digestion With Composting**



Windrows (Outdoors)



Aerated Static Pile (Outdoors)



In-Vessel (Controlled Environment)



Integrated AD With Composting



The Hengelo, Netherlands plant employs a continuous plug-flow anaerobic digester integrated into a larger composting operation. The digester, supplied by Organic Waste Systems, processes one-quarter of incoming feedstock on a half-acre footprint at the facility.

Municipal Composting with Biochar

Biochar Blended Compost in Several US Locations



Minneapolis
Cleveland
Boulder
California



Municipal Initiatives

Federation of Canadian Municipalities

International Council for Local Environmental Initiatives

Carbon Neutral Cities Alliance – Global Carbon Neutrality



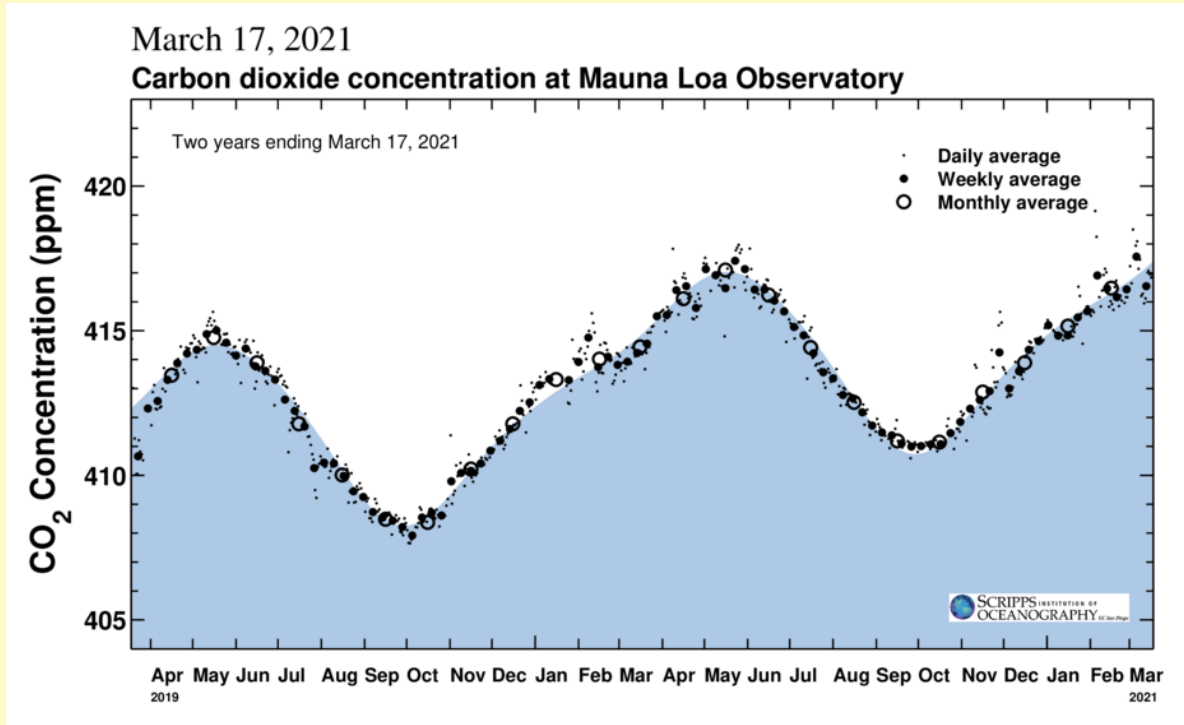
Vancouver



Toronto

Nature wants us to cooperate...

Photosynthesis!



Biochar Carbon Sequestration

Carbon Credits

Canada Has Carbon Tax System

Carbon Value Expected to Rise

Carbon Sequestered

Specific Life Cycle Analysis Required



Let's Do It!

Co-composting with biochar

Reduces odours, enhances compost value

Sequesters carbon in the soil

Why not Canada? Why Not Alberta?



Why Not Now?



Here's How!



Commercial Composting Trials



**Dry Weather Resistance for
Trees and Parks**



Thank You!

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