

# ABI BIOCHAR WORKSHOP

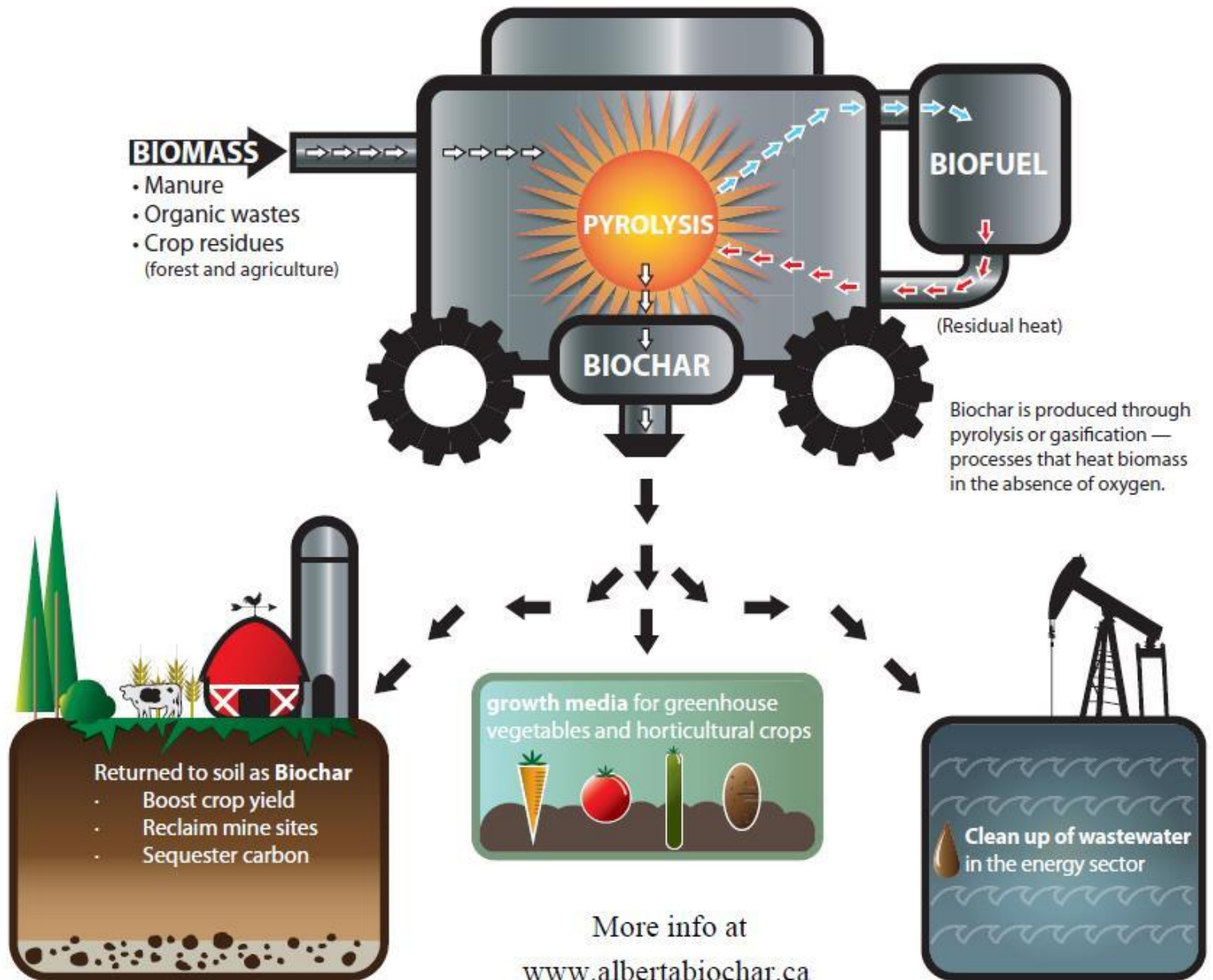
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## Biochar Production Process and Technology

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# How biochar is made, and its potential applications

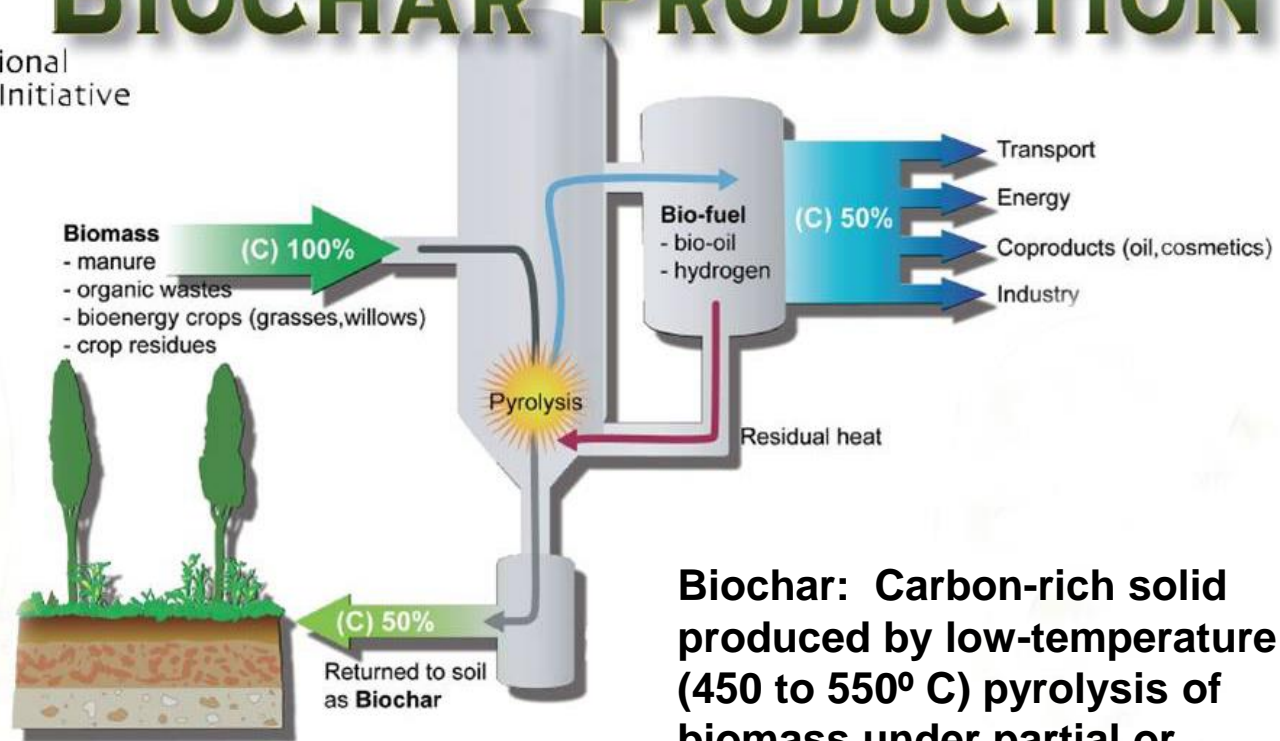


# Carbonization – Making Biochar



International  
Biochar Initiative

## BIOCHAR PRODUCTION



**Biochar: Carbon-rich solid produced by low-temperature (450 to 550° C) pyrolysis of biomass under partial or complete exclusion of oxygen.**

# Pyrolysis (Biochar, Bio-Oil, Syn Gas)

- Thermo Chemical Process
- Anoxic Conditions (absence of O<sub>2</sub>)
- Self Sustainable (heat from syn gas)
- Gas, Liquid, & Solid Produced
  - Pyrolysis syngas (CO, H<sub>2</sub>, CO<sub>2</sub>, CH<sub>4</sub>)
  - Bio-oil
  - Bio-Char
- Process Conditions (Yield & Quality)
- Fast (Liquid); Slow (Solid)



# Demo Scale Biochar Production (500 kg/day)



Auger Retort (Indirect Heat)  
Biochar Unit

**ABRI-Tech (Canada)**

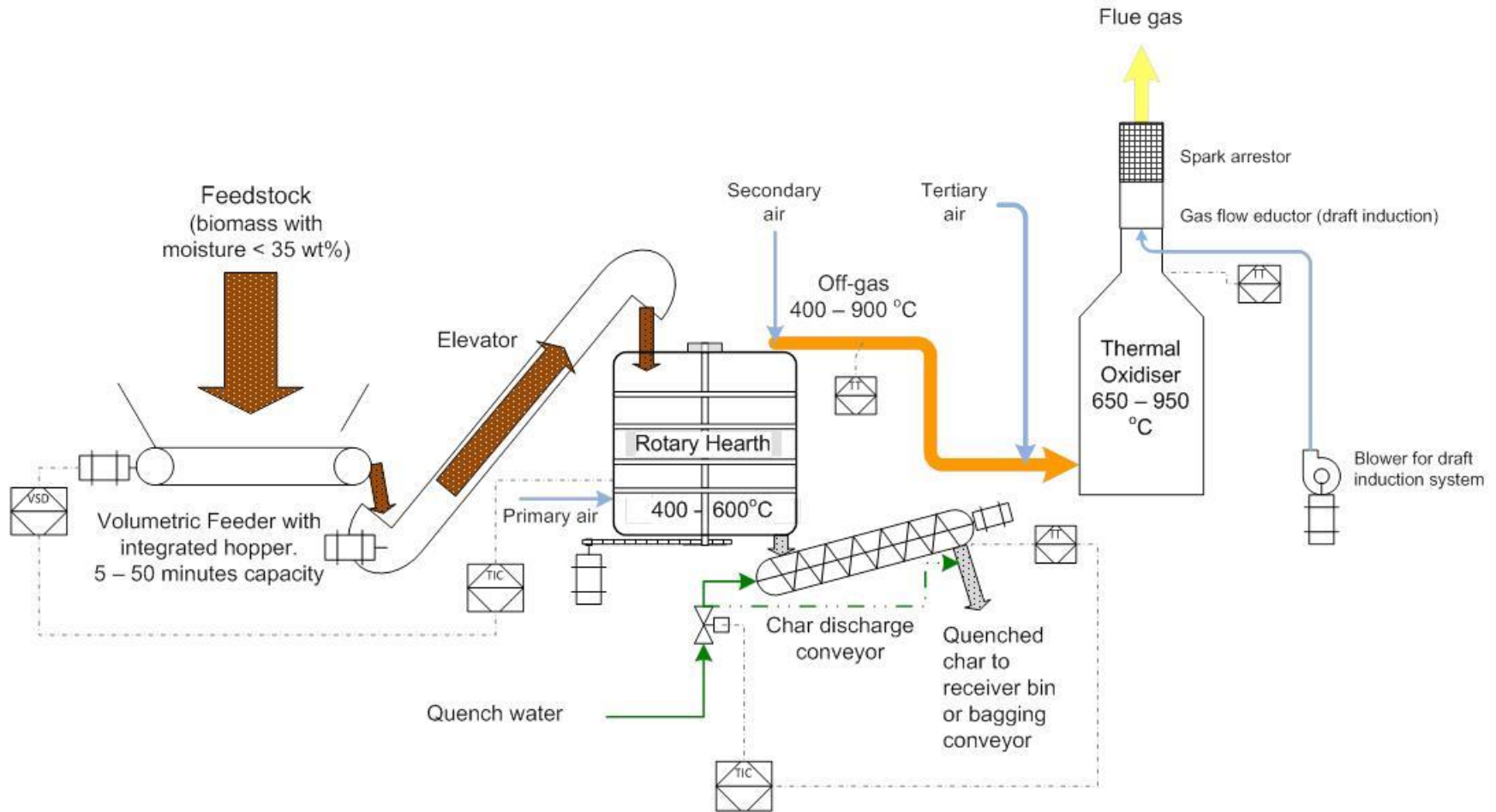


Multi-Hearth (Direct Heat)  
Biochar Unit

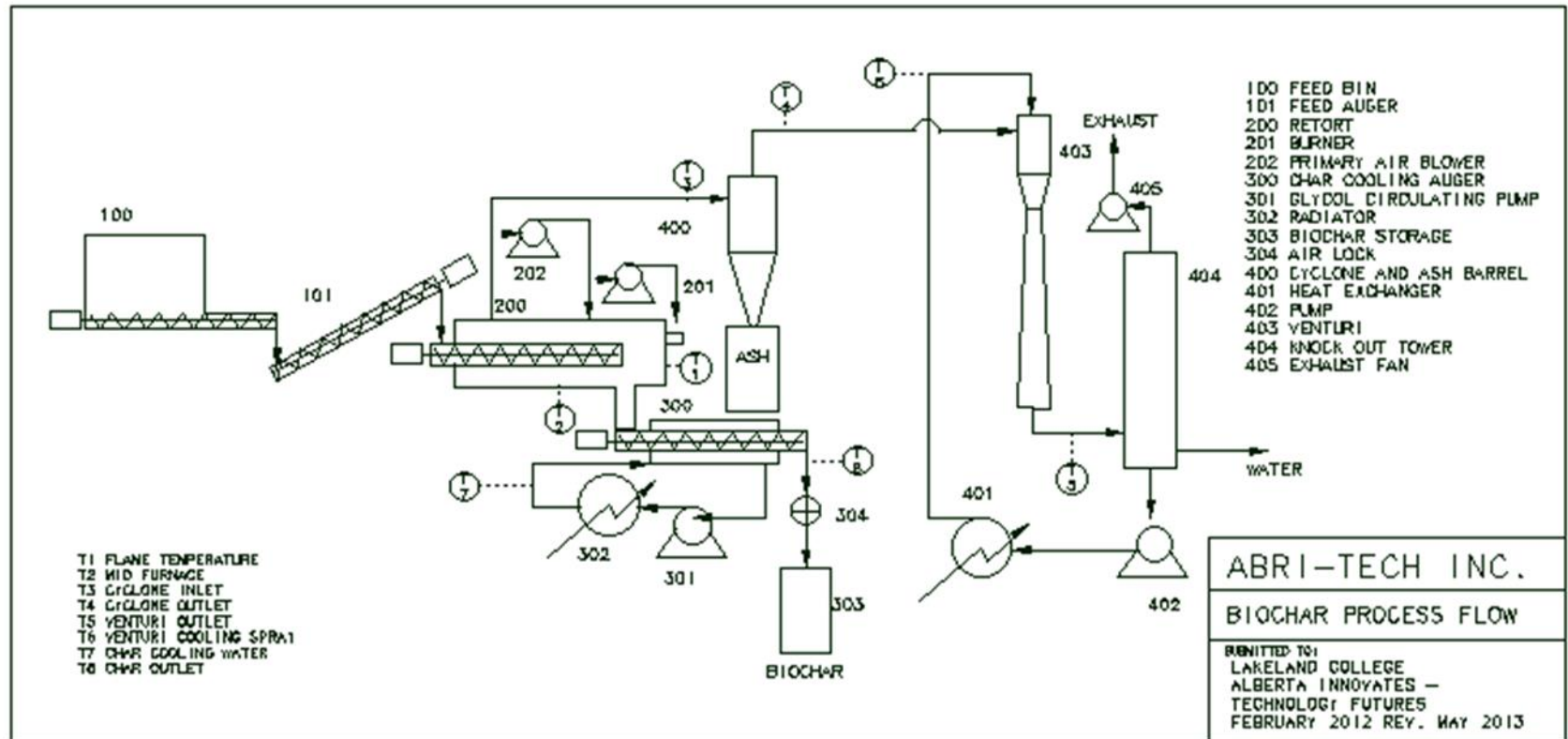
**BiG Char (Australia)**



# BiGchar Process Flow Diagram



# ABRI-Tech Process Flow Diagram



# Why Test Biochar?

- **Biochar is Heterogeneous material**
- **Multi-feedstocks vs multiple production methods**
- **Tested to ensure the biochar is acceptable for:**
  - **Environmental Safety**
  - **Food Safety**
  - **Human Health Safety**
- **IBI Testing Guidelines for Biochar in Soil Applications**



# IBI Biochar Quality Tests – Soil

- **Category A: Basic Utility Tests (Mandatory)**
  - Proximate Analyses: moisture, volatile, fixed carbon, & ash contents
  - Ultimate Analyses: elemental composition: C, H, N, O, S, Cl
  - H:C<sub>org</sub> atomic ratio: ≤ 0.7 Max
  - pH and EC: Liming capacity and cation exchange capacity respectively
- **Category B: Toxicity Tests (Mandatory)**
  - Germination Bioassay: Pass/Fail
  - Polycyclic Aromatic Hydrocarbons (PAHs): 6 – 20 mg/kg biochar (db) Max
  - Dioxins/Furans (PCDDs/PCDFs): 9 ng/kg biochar (db) Max
  - Polychlorinated Biphenyls (PCBs): 0.2 – 0.5 mg/kg biochar (db) Max
  - Heavy Metals: As, Cd, Cr, Co, Cu, Pb, Hg, Mo, Ni, Se, Zn
- **Category C: Advanced Tests (Optional)**
  - Primary Macro nutrients: N, P, & K Contents
  - Surface Area: Internal/External Surface and Porosity

# Biochar Classifications

- **IBI Classification: Based on organic carbon content**
  - Class 1:  $\geq 60$  wt.%
  - Class 2:  $\geq 30$  wt.% and  $< 60$  wt.%
  - Class 3:  $\geq 10$  wt.% and  $< 30$  wt.%
- **AITF Proposed Class 1 Sub-Classifications (Volatiles)**
  - Premium:  $\leq 8$  wt.% - Hydroponics
  - Mid Grade: 8 wt.% to 15 wt.% - Horticulture
  - Regular/Standard: 15 wt.% to 25 wt.% – Soils
  - Reprocessing Required: 25+ wt. %

# Biochar Reference Books

- **Suggested Readings:**
  - Biochar for Environmental Management (2009)
  - Biomass Processing Technologies (2014)
  - Applied Pyrolysis Handbook (2007)
  - The Biochar Revolution (2010)
  - The Biochar Debate (2009)
- **Websites:**
  - International Biochar Initiative
  - Alberta Biochar Initiative

# Questions?