International Biochar Initiative

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Consulting and Project Development

Standardized Product Definition and Product Testing Guidelines for Biochar That Is Used in Soil

Final Version – 2012

International Biochar Initiative
and Leading Carbon Ltd.
April 2012

Today's Presenters

International Biochar Initiative

- Shiva Scotti
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Outline

- Introduction
- Process
- Biochar Guidelines Scope and Content
- Summary of Comments
- Overview of Document Changes
- Using the Biochar Guidelines
- Next Steps

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Introduction – Who is IBI?

The International Biochar Initiative Mission:

The International Biochar Initiative (IBI) is a non-profit organization whose mission is to promote the development of biochar systems that follow Cradle to Cradle sustainability guidelines.

IBI's VISION:

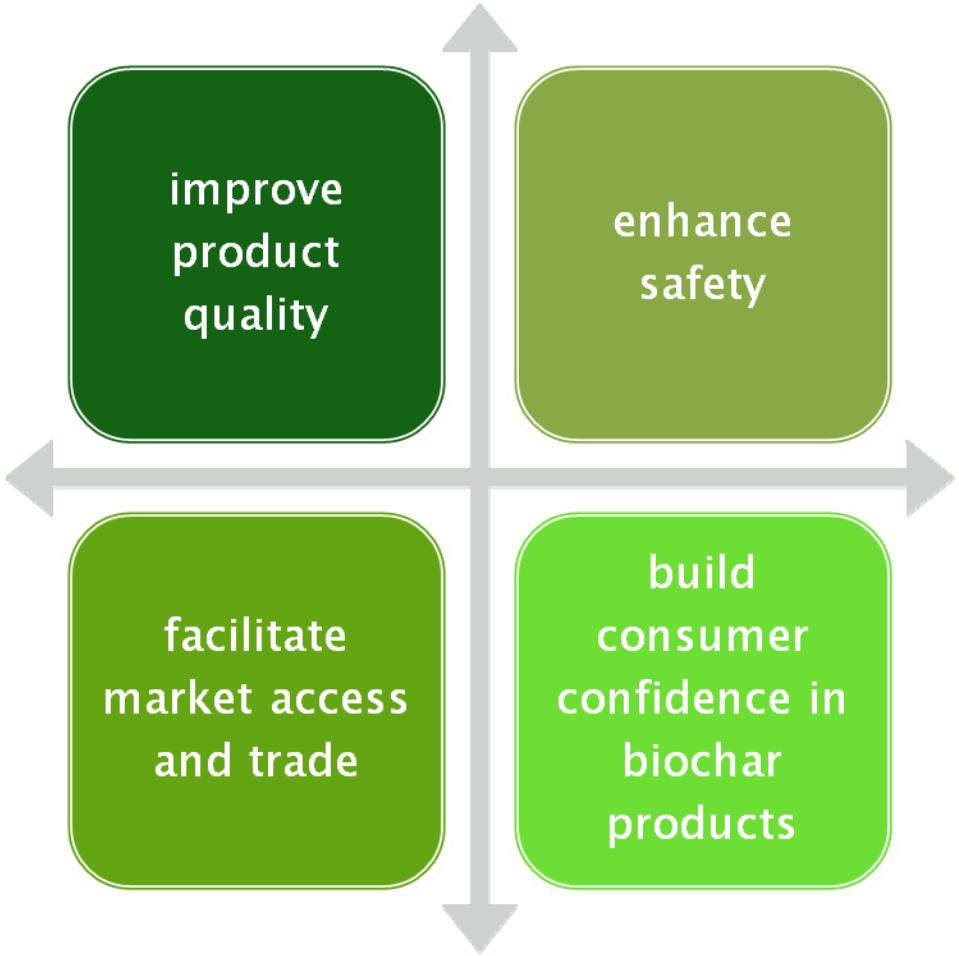
Help attain the commercial viability of sustainable biochar production and utilization at all scales, to

- Enhance the global soil resource, and
- Help combat climate change

Introduction – Why Guidelines?

- Before the industry can succeed, we must be able to define, analyze and communicate the essential characteristics that define biochar, and what biochar is.
- To do this, we must establish guidelines and tests to confirm that a product intended for sale or use as biochar possesses the necessary characteristics for safe use.

Introduction – Why Guidelines?



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Process – Approach

- A global, transparent, fully-documented process congruent with existing standard-setting bodies such as ISO
- Relies on existing research and knowledge and builds on accepted methodologies, standards, regulations and tests
- Public input solicited and incorporated throughout the process
- Document will evolve over time in an iterative process with revisions as warranted by new science and developments

Process – Outcome

The Guidelines will become the basis for an IBI Biochar Certification program.

USDA CERTIFIED BIOBASED PRODUCT
PRODUCT 57%

CERTIFIED PRODUCT

MULCH & SOIL COUNCIL

	Premium Potting Soil
	Standard Potting Soil
	Landscape Soil & Soil Amendment
	Specialty Soils
✔	Mulch

This product has been registered and tested for conformance to the standards of the Mulch & Soil Council for the indicated product category. The Mulch & Soil standards do not contain a product category for pesticides, and this certification mark does not apply to pesticide claims. For more information, refer to the MSC website at www.mulchandsoilcouncil.org.

RAINFOREST ALLIANCE CERTIFIED EST 1987

SOIL ASSOCIATION ORGANIC STANDARD

GUTEZEICHEN KOMPOST RAL

USDA ORGANIC

flower & vegetable GARDENS

US Composting Council Seal of Testing Assurance

Process – History

- Guidelines process began in 2009 with IBI Advisory Committee creation of a seed document
- Public process launched in Brazil at IBI 2010
- **Phase 1**: Collaborative International Working Groups (volunteers) meet to draft initial document – December 2010 through March 2011
- **Phase 2**: Live Meeting of Experts in Frankfurt to merge drafts from different Working Groups– July 2011
- Posting of draft document for public review and comment – October 2011

Process – History

- Comment Period Oct 15 – Nov 15, 2011
- Evaluation of comments and suggestions with input from International Working Groups – Nov 15 – Dec 21, 2011
- Revised Guidelines document posted for review – Jan 10, 2012
- Comment period – Jan 10 – Feb 10 2012

Process – History

- Evaluation of comments and suggestions– Feb 10 – 29, 2011
- Revised Guidelines document sent for legal review of disclaimer and copyright – Mar 1 – 16, 2012
- Final review and revisions – Mar 16 – Apr 10 2012
- Posting for review before balloting – April 11

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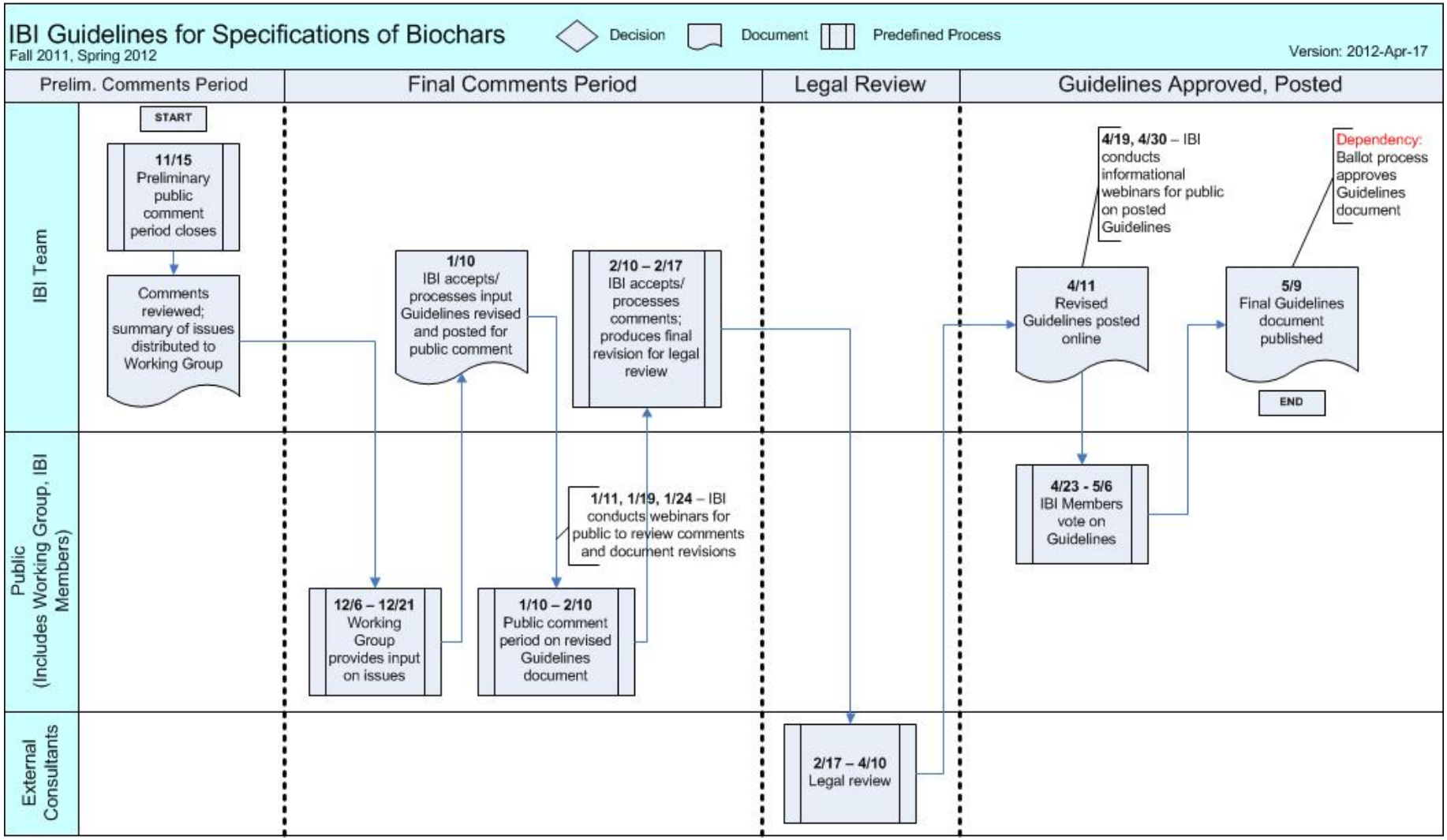
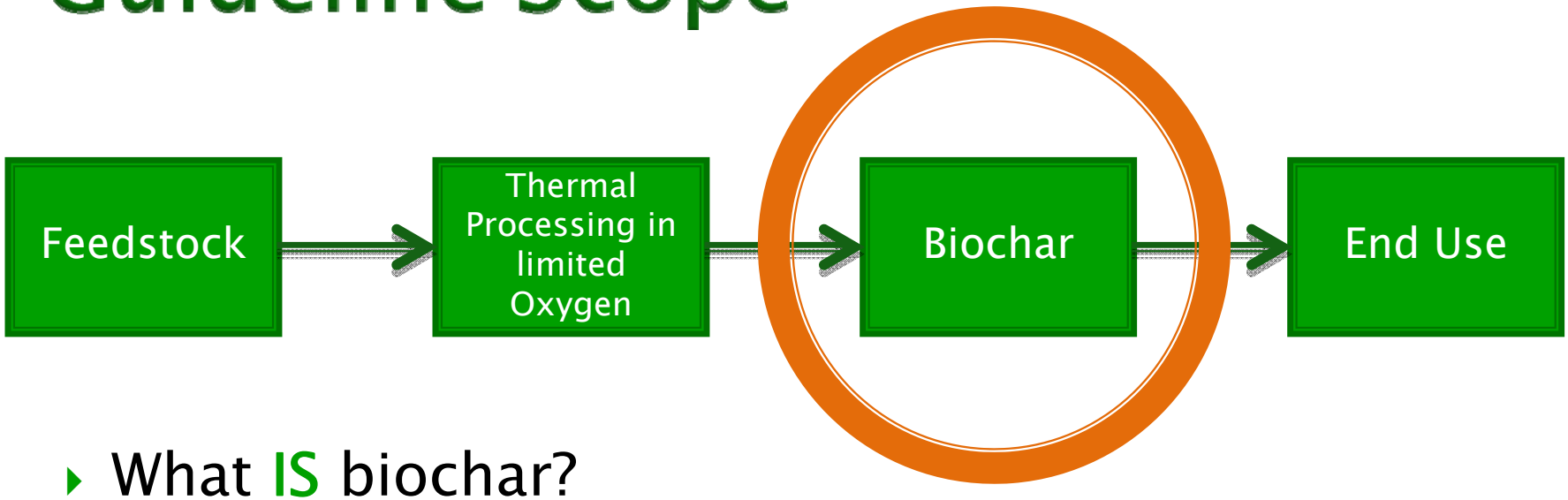
Process – Final Steps to Completion



Guideline Scope



- What IS biochar?
- Physical and chemical properties of biochar
- Material properties reporting
- Basis for IBI certification and 3rd party standards
- NOT a sustainability standard
- NOT a production procedure guideline
- NOT an end-use guideline

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Biochar Guidelines Scope

Who will use the Guidelines?

- Commercial biochar producers
- Biochar marketers and distributors
- Users
- Regulators
- Researchers
- National and regional IBI affiliates can work with local jurisdictions to adapt these guidelines

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Biochar Guidelines Content

- Title: *Standardized Product Definition and Product Testing Guidelines for Biochar That Is Used in Soil*

- Ownership and Copyright Notice

- Foreword

- Table of Contents

1 Scope

2 Terms and Definitions

Biochar Guidelines Content

3	Biomass Feedstock Material and Biochar Production
3.1	General Feedstock Material Requirements
3.2	General Biochar Production and Material Handling Recommendations
4	Biochar Material Test Categories and Characteristics
4.1	Test Category A – Basic Utility Properties
4.2	Test Category B – Toxicant Reporting
4.3	Test Category C – Advanced Analysis and Soil Enhancement Properties
5	Product Labeling and Documentation
5.1	Labeling Instructions
5.2	Product Information Requirements
5.3	Conformity and Record Keeping
5.4	Chain of Custody
6	Testing Protocols
6.1	Laboratory Standards
6.2	Timing and Frequency of Testing
6.3	Category B Test Requirements for Unprocessed Feedstocks

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Biochar Guidelines Content

- 7 References
- Appendix 1 – Sample Biochar Label
- Appendix 2 – Recommended General Sample Analysis Procedures and Protocols for Specific Tests
- Appendix 3 – Toxicant Assessment and Determination of Thresholds
- Appendix 4 – Determining a "Material Change" in Feedstock
- Appendix 5 – The Use of H:Corg to Indicate C Stability
- Appendix 6 – Glossary
- Appendix 7 – Creative Commons License

Summary of Comments Received

1. Toxicants and metals – what should be tested and how often?
2. Class 1 biochar should have higher C content.
3. $H:C_{org}$ – what is the right threshold level?
4. Volatile Matter – why is this test not included?
5. Methods suggested for determining surface area, EC.
6. Feedstock categories – what counts as "processed"?
7. Feedstock changes – how to determine?
8. Testing protocols – how often to test?

Overview of Document Changes- Title, Copyright, Disclaimer:

- Document Title – changed:
  - *"Guidelines for Specifications of Biochars for Use in Soils"* to:
  - *"Standardized Product Definition and Product Testing Guidelines for Biochar That Is Used in Soil"*
  - the new title is less ambiguous
  - Shorthand version of the title remains: *"Biochar Guidelines"*
- Ownership and Copyright Notice – Added Creative Commons License – this license protects IBI's commercial rights to the *Biochar Guidelines* while allowing free access to the document for reference purposes.
- Disclaimer section – legal review

Section 2. Terms and Definitions

- **All definitions moved to Glossary, Appendix 6**
- **Definitions are important**
- Biochar: A solid material obtained from the thermochemical conversion of biomass in an oxygen-limited environment.
- Biomass: The biodegradable fraction of products, waste and residues of **biological origin** from agriculture (including vegetal and animal substances), forestry, and related industries including fisheries and aquaculture, as well as the biodegradable fraction of industrial and municipal waste (including municipal solid waste).
- **Biochar MUST be made from biomass**

Section 2. Terms and Definitions

Biochar Characteristics: those physical properties that affect the following uses of biochar:

1. biochar that is added to soils with the intention to improve soil functions; and

2. biochar that is produced in order to reduce emissions from biomass that would otherwise naturally degrade to greenhouse gases by converting a portion of that biomass into a stable carbon fraction that has carbon sequestration value.

Section 2. Terms and Definitions

Processed vs. Unprocessed Feedstock – some changes:

- Processed Feedstock: Biomass that has gone through chemical processing (for example, paper pulp sludge) or biological processing (for example, digestion, such as manures and sludge from waste effluent treatment) beyond simple mechanical processing to modify physical properties. Because animals may bioaccumulate toxicants in their tissues, all animal parts and products are considered to be Processed Feedstocks for purposes of these guidelines. Any biomass material that may have been grown on soils contaminated with heavy metals or other toxicants will also be considered a Processed Feedstock for purposes of these guidelines. (IBI, 2012)
- Unprocessed Feedstock: Biomass from the plant kingdom (or other non-animal taxa such as fungi and algae), grown in a clean, uncontaminated environment, that may have gone through mechanical processing to change its physical properties (e.g., particle size), but has not gone through chemical processing or treatment, or biological processing (e.g., digestion). (IBI, 2012)

Section 3. Biomass Feedstock Material and Biochar Production

Restrictions on feedstock contents & quality:

- Must be biomass
- Feedstock affects final product quality – therefore, feedstock type and composition must be declared.
- No more than 2% (dry wt) contaminants
- MSW containing hazardous materials or wastes may not be included as eligible feedstocks under these guidelines
- Diluent (sand, dirt, clay) content of 10% or more must be declared as part of feedstock

Section 3. Biomass Feedstock Material and Biochar Production

Production Recommendations:

- Recommends adherence to local regulations
- Material Safety Data Sheet (MSDS)
- Good business practices

Section 3. Biomass Feedstock Material and Biochar Production

- Not prescriptive of production and handling
- Does not address sustainability
- Process and Sustainability Guidelines will be addressed by IBI in future documents
- View background papers on biochar sustainability on the IBI Biochar Sustainability page:

www.biochar-international.org/sustainability

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Section 4. Biochar Material Test Categories and Characteristics

Test Categories are designed to:

- Provide a uniform presentation format by which a biochar user would be able to fairly compare different biochar materials.

Section 4. Biochar Material Test Categories and Characteristics

Tests were chosen according to these criteria:

- Tests that could accurately measure biochar characteristics of concern
- Use standardized, peer-reviewed, already approved & in-use tests, thresholds and methodologies
- Affordable

Section 4. Biochar Material Test Categories and Characteristics

Over time, as scientific knowledge and technology advance, the tests and test categories may change:

- Better or more accurate tests may be developed to replace current tests
- New tests measuring new attributes may be developed
- Modular nature of the test categories allows for expansion as new tests for biochar characteristics are developed and published

Section 4. Biochar Material Test Categories and Characteristics

Modular Test Categories:

- Test Category A: Basic Utility Properties – ***required for all biochars***
- Test Category B: Toxicant Assessment– ***required for all biochars***
- Test Category C: Advanced Analysis and Soil Enhancement Properties – optional

Section 4. Biochar Material Test Categories and Characteristics

- Consolidated all toxicant tests into one group – Category B. All biochars must report Category B test results
- Biochar made from Unprocessed Feedstocks can report Category B tests every 3 years instead of annually if it meets thresholds initially.
- Optional Category D tests are now called Category C, and Volatile Matter is added.

Section 4. Biochar Material Test Categories and Characteristics

Test Category A – Basic Utility Properties – Required for all biochars – declarations:

- Physical properties – moisture, particle size
- Chemical properties – Electrical Conductivity (EC), pH and liming
- Chemical properties, elemental constituents – C, H, N, ash

Section 4. Biochar Material Test Categories and Characteristics

Test Category A – Basic Utility Properties – Required for all biochars – thresholds:

- Stable C – H:C_{org} ratio $\leq$ 0.7

- Total C_{org} – 3 Classes:
  - Class 1: $C_{org} \geq 60\%$
  - Class 2: $30\% \leq C_{org} < 60\%$
  - Class 3: $10\% \leq C_{org} < 30\%$

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Section 4. Biochar Material Test Categories and Characteristics

Test Category B – Toxicant Analysis–Required for all biochars.

- PAH – Polycyclic Aromatic Hydrocarbons
- Dioxins
- PCB–Polychlorinated Biphenyls
- Metals
  - As, Cd, Cr, Co, Cu, Pb, Mb, Hg, Ni, Se, Zn, B, Cl, Na*
- Vegetative and Invertebrate Vigor tests provide additional assurance against a range of toxic substances.

*underlined elements have maximum content thresholds; non-underlined elements require content declarations only

Section 4. Biochar Material Test Categories and Characteristics

Test Categories B –Toxicant Analysis, determination of threshold levels:

- Toxicant threshold values are given as a range of values based on regulatory requirements for soil amendments or fertilizers of a number of countries (Australia, Canada, EU, UK, USA).
- Reported toxicant levels must be below the maximum allowed thresholds, and must specifically be below thresholds established in countries where biochar is produced and/or intended for use.
- New threshold level for dioxins
- See Appendix 3, *Regulatory Toxicant Ranges*, for more information.

Section 4. Biochar Material Test Categories and Characteristics

Test Category C–Advanced Analysis and Soil Enhancement Properties–Optional:

- Analysis properties are Volatile Matter, Surface Area and Porosity
- Moved EC to Test Category A
- Soil enhancement properties are mineral N, total and available P & K
- All Test Category C tests are optional – producers can test all, some, or none

Section 5. Product Labeling and Documentation

Labeling: requires visible label with all information, or a clear and easy to follow link to a website with information.

- Feedstock material(s) and type, whether Processed or Unprocessed.
- Country of origin for both biochar feedstock and production.
- Country where the biochar will be sold for use.
- All required test results and any optional test results.

Section 6. Testing Protocols

Testing Frequency:

- Annually; or
- ~~After every 600 metric tonnes (dry weight) of consistent feedstock through-put; or,~~
- After a material change in feedstock; or,
- After a material change in production parameters;
- Whichever is more frequent.

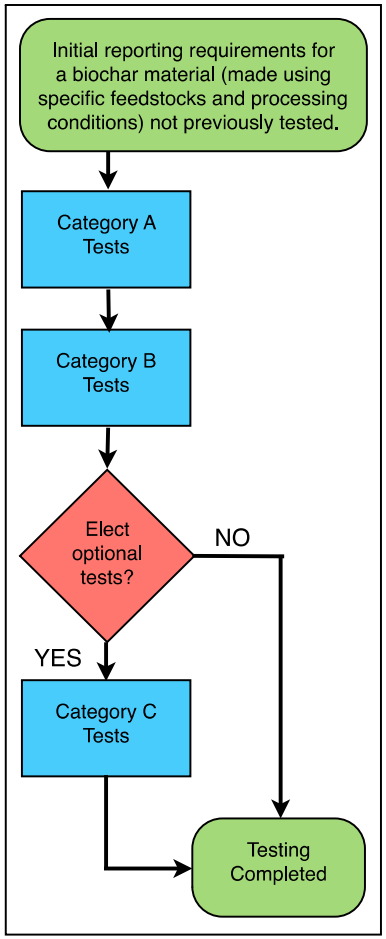
- Before final storage and shipping
- Conducted by trained & accredited professionals
- Category B exception for Unprocessed Feedstocks

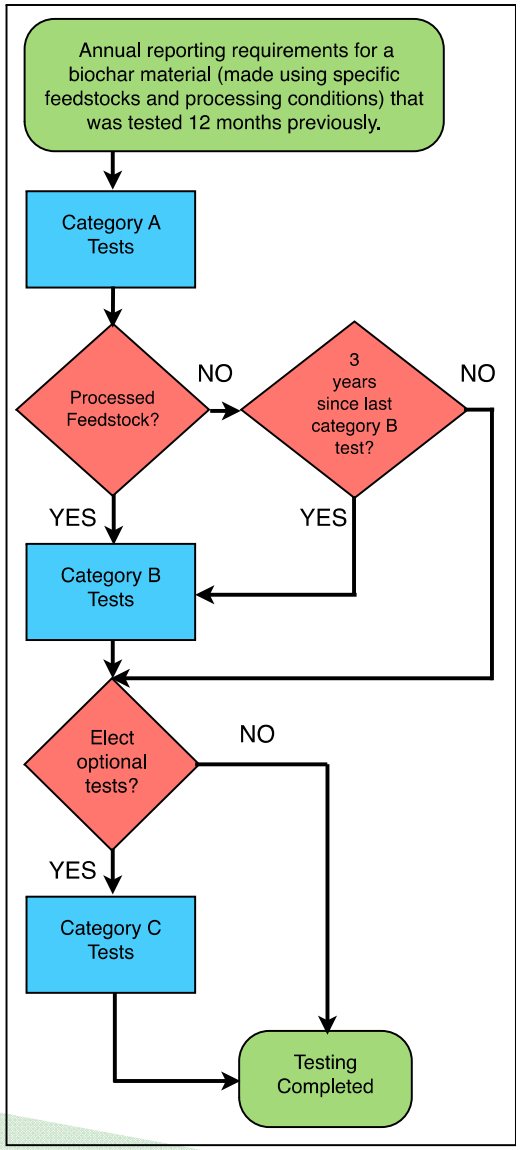
Section 6. Testing Protocols

Category B exception for Unprocessed Feedstocks:

"If the initial Category B test results for biochar made from an unprocessed feedstock are all within the Maximum Allowable Thresholds established by these *Biochar Guidelines*, then the Category B tests may be repeated every three years rather than annually, as long as the thermochemical production parameters and the feedstock composition all remain the same."

Section 6. Testing Protocols





Process flowcharts illustrate the testing requirements and options with different testing frequency requirements for Category B tests based on feedstock type.

Using the Guidelines

Determining Material Change in an Unprocessed Feedstock:

Unprocessed Feedstock Types for determining "material change" in feedstock
Rice hulls & straw
Non-maize cereal straws & switchgrass
Maize cobs & stover
Sugar cane bagasse & trash
Softwoods (conifers)
Hardwoods (angiosperms)
Bamboo
Miscanthus

Based on Phyllis, database for biomass and waste, Version: 4.13, Energy Research Centre of the Netherlands (ECN), http://www.ecn.nl/phyllis, (accessed January 2012).

Using the Guidelines

Determining Material Change in a Processed Feedstock:

Processed Feedstock Types for determining "material change" in feedstock
Cattle manure
Pig manure
Chicken manure
Sheep manure
Horse manure
Paper mill sludge
Sewage sludge
Distillers grain
Anaerobic digester sludge
Biomass fraction of MSW
Food industry waste

Based on Phyllis, database for biomass and waste, Version: 4.13, Energy Research Centre of the Netherlands (ECN), http://www.ecn.nl/phyllis, (accessed January 2012).

Using the Guidelines –SAMPLE LABEL

GOOD GROW BIOCHAR	
MATERIAL TYPE	Biochar made from declared feedstock
COUNTRY OF ORIGIN	Australia
COUNTRY OF USE	Australia
FEEDSTOCK COUNTRY OF ORIGIN	Australia
FEEDSTOCK TYPE	Processed Feedstock
FEEDSTOCK COMPOSITON DECLARATION	poultry manure - 83%, wood chip bedding - 17%

Using the Guidelines –SAMPLE LABEL

BIOCHAR BASIC UTILITY PROPERTIES	
Moisture (at time of analysis)	20% - DECLARATION
Organic Carbon	42% - CLASS 2 BIOCHAR
$H:C_{org}$	0.6 - PASS
Total Ash	40% - DECLARATION
Total N	5.4% - DECLARATION
pH	7.5 - DECLARATION
Electrical Conductivity	7.3 dS/m - DECLARATION
Liming	23% $CaCO_3$
Particle Size Distribution	5% <420µm;
	35% 420-2,380 µm;
	45% 2,380-4,760 µm;
	15% >4,760 µm

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Using the Guidelines –SAMPLE LABEL

TOXICANT ASSESSMENT	
Earthworm Avoidance Test	PASS
Germination Inhibition Assay	PASS
Polycyclic Aromatic Hydrocarbons (PAH)	6 mg /kg TM - PASS
Dioxin/Furan (PCDD/F)	0.02 ng/kg I-TEQ - PASS
Polychorinated Biphenyls (PCB)	0.2 mg/kg I-TEQ - PASS
Arsenic	10 mg/kg - PASS
Cadmium	1.2 mg/kg - PASS
Chromium	60 mg/kg - PASS
Cobalt	14 mg/kg - PASS
Copper	143 mg/kg - PASS
Lead	125 mg/kg - PASS
Molybdenum	5 mg/kg - PASS
Mercury	0.5 mg/kg - PASS
Nickel	25 mg/kg - PASS
Selenium	10 mg/kg - PASS
Zinc	320 mg/kg - PASS
Boron	20 mg/kg- DECLARATION
Chlorine	90 mg/kg- DECLARATION
Sodium	140 mg/kg- DECLARATION

Using the Guidelines –SAMPLE LABEL

BIOCHAR ADVANCED ANALYSIS AND SOIL ENHANCEMENT PROPERTIES	
Mineral N (ammonium and nitrate)	21 mg/kg - DECLARATION
Total P&K	3.1% P, 4.4%K - DECLARATION
Available P	16 mg/kg - DECLARATION
Volatile Matter	6.8% - DECLARATION
Total Surface Area	790 m2/g- DECLARATION
External Surface Area	160 m2/g- DECLARATION

Next Steps

- Informational Webinars
  - April 19 at 10:00 am (New York, USA time)
  - April 30 at 10:00 pm (New York, USA time)
- Balloting
  - open to all dues-paying IBI Members in good current account standing
  - Online voting-members will get email with link
  - Balloting dates: April 23 – May 6, 2012
- Certification Program – planning currently underway

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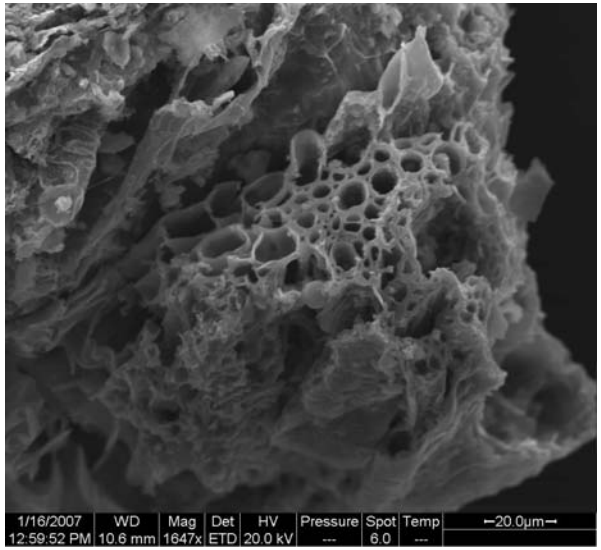
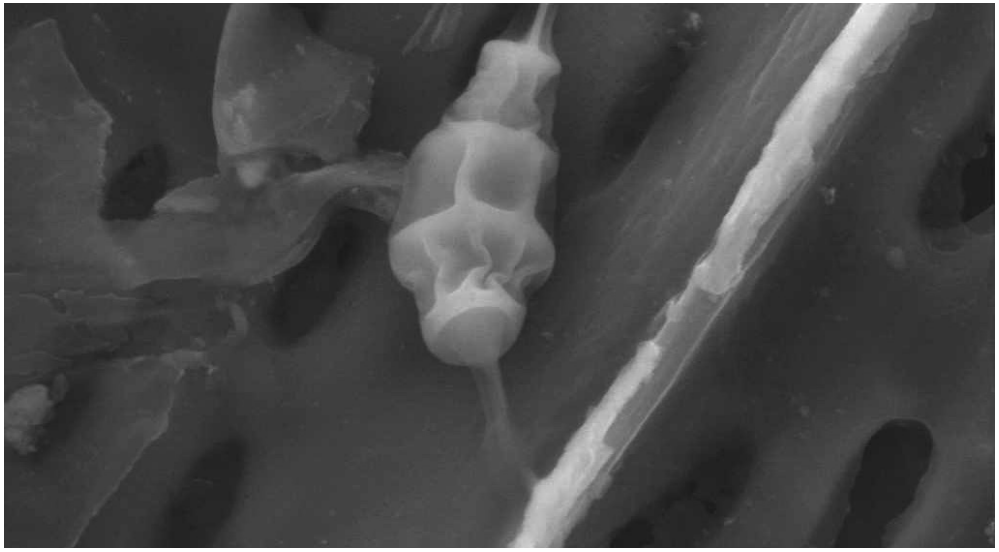
Questions from the Audience?





- Questions or clarifications can be sent to: BiocharGuidelineIBI@gmail.com
- Background documents and process documentation are found at: http://www.biochar-international.org/characterizationstandard

Photos courtesy of Stephen Joseph.

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