

# Compiled Comments Submitted to International Biochar Initiative at [BiocharGuidelineIBI@gmail.com](mailto:BiocharGuidelineIBI@gmail.com) during Guideline comment period from October 15, 2011 to November 15, 2011

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## **1. Dr Beau Webber \*\*\*\*\***

From: J.B.W.Webber [mailto:J.B.W.Webber@kent.ac.uk]

Sent: 27 October 2011 23:19

To: info@biochar-international.org

Cc: Anna Weston; m.aller@lancs.ac.uk

Subject: RE: Final Notice and Date Correction - IBI Webinar on Biochar Guidelines

Dear Kelpie,

I am attaching a short report that Dr Maria Fernanda Aller (Lancaster University) and I produced as part of a one day KTN meeting on Biochar.

Please check with Fer and Anna that it Ok to use this report.

Cheers,  
Beau

### **Standards and Characterisation of Biochar**

Participants:

Dr Beau Webber (Lab Tools Ltd & University Kent & Heriot-Watt University)

Dr Maria Fernanda Aller (Lancaster University)

#### **Brief Background**

The production and use of biochar can help the UK to meet its carbon dioxide emission targets and help to reduce fertiliser use. Additional benefits of biochar are thought to be the improvement of soil which may lead to an increased productivity of food and fuel from farmed land, ensuring future food stability, and the security and reduction of contamination of groundwater and surface water streams by prevention of contamination by diffuse pollution. In order to aid the commercialisation of biochar the characterisation of the properties of different types of biochar is required. The development of biochar characterisation standards and technologies can be applied internationally to assist with carbon trading.

#### **Programme of Work**

Specific objectives of the project are focused around the characterisation of the physical, chemical and biological properties of biochar samples.

2 parallel processes are suggested:

- The definition of standards and verification of systems
- The characterisation of the physical, chemical and biological properties

The following characteristics of biochar samples will be address by the project:

- Solids yields

Physical property characterisation:

- Total porosity and surface area
- Bulk density
- Pore size distribution, nano to micro; micro to macro (or carbon framework)
- Quantity of mobile organic components
- Mobility of organic components
- Water holding capacity, uptake profile and release profile
- Water drop penetration time
- Adsorption capacity and profile (with pesticides and fertilisers)

Chemical property characterisation:

- pH
- Volatile content
- Ash content
- Electrical conductivity (EC)
- Anion and cation exchange capacity (ACE) (CEC)
- Nutrient content: nitrogen (total N, and mineral nitrogen (amoniacal and nitrate content)), phosphorus (total available), total content of macro and micronutrient including, calcium, magnesium potassium, sulphur boron etc,
- O:C and H:C molar ratios for carbon stability in soils
- Heavy metal content
- Other contaminants: PAHs, other aromatic rings

Biological property characterisation:

- Existing colonisation and capability to colonise
- The release time of nutrients
- Toxicity
- Effects on plant growth
- Effects on plant yield
- Soil microbial diversity, functional diversity, quantity and aggregation
- Degradability
- Germination inhibition
- Earthworm avoidance/attraction

**Impact Statement**

The development of a standard against which a particular biochar may be tested will avoid the need for extensive field trials for every new type of biochar and will help to ensure safety and suitability of its application. The proposed project will provide a necessary step required for the commercialisation of biochar.

The consortium seeks contributions to funding from:

NERC

Defra

Technology Strategy Board

Biochar producing companies

Waste producing companies

Other UK Government

Companies requiring to offset their carbon emissions (such as transport companies and house builders)

EU funding

Water companies

### **Estimated Project Costs and timescale**

Approximately £2K to £3K per sample. Total cost and timescale depends on the number of samples.

Other interested parties:

Andrew Hursthouse (University of the West of Scotland)

Komang Ralebitso-Senior (Teesside University)

David Werner (Newcastle University)

Edward Hodgson (IBERS, Aberystwyth University)

Ruben Sakrabani (Cranfield University)

David Addison (Virgin Earth Challenge - Virgin Group)

Andreas Hornung (European Bioenergy Research Institute-EBRI/ Aston University)

NormaBubier (Pro-Natura UK)

## **2. Jan Mumme \*\*\*\*\***

Dear colleague,

If it's not too late, I would like to comment as an IBI member and in behalf of our biochar research team at ATB Potsdam (Germany) on the draft version Rev. 0.6.

Basically, we think it's good work and we agree on most subjects. In our view, the most important thing to reconsider is the definition of biochar (p 7, L 6). According to Johannes Lehmann's and Stephen Joseph's groundbreaking book "Biochar for environmental and management" biochar "...distinguishes itself from charcoal and similar materials (...) that biochar is produced with the intent to be applied to soil as a means of improving soil productivity, carbon storage, or filtration of percolating soil water." (p 1) . The definition in your draft as a "solid material obtained from carbonization of biomass" (p 7, L 6) apparently contradicts this (old) definition as it includes charcoal and, in addition, a broad variety other materials such as nanoparticles and activated charcoal. In order to be precise and achieve broad acceptance, we recommend the working group to return to the former definition of biochar as a material produced for soil amendment

Keep up the good work!  
Best regards  
Jan

Dr. rer. agr. Jan Mumme  
Leibniz-Institut für Agrartechnik Potsdam-Bornim e.V.  
APECS-Nachwuchsgruppe  
Leibniz Institute for Agricultural Engineering Potsdam-Bornim  
APECS junior research group  
Max-Eyth-Allee 100  
14469 Potsdam  
Tel. +49 (0)331 5699 913  
Fax. +49 (0)331 5699 849  
<http://www.atb-potsdam.de>

### **3. Kari Tiilikkala \*\*\*\*\***

From: Kari Tiilikkala [mailto:kari.tiilikkala@mtt.fi]  
Sent: Tuesday, November 15, 2011 5:59 AM  
To: info@biochar-international.org  
Subject: Re: Final Notice and Date Correction - IBI Webinar on Biochar Guidelines

Dear Kelpie,

One question about the guideline.

Is it possible that biochar producers should measure and present the maximum temperature of the pyrolysis process.

According to our experience it gives a very good estimate for the quality

of biochar.

Actually users of the biochar will know how much of gaseous products and liquids were left in the biochar. All the organic compounds have a certain impact on the soil bioactivity if mixed in soil (suppress soil borne diseases, stimulate soil bioactivity etc.).

- Hide quoted text -

All the Best

Kari Ti

Kari Tiilikkala

Principal Research Scientist

MTT Agrifood Research Finland

Plant Protection

FIN-31600, Jokioinen,

Finland

Phone +358 3 4188 2575

Mobile + 358 400 986 172

Interesting results to read:

<http://www.mtt.fi/met/pdf/met143.pdf>

<http://www.benthamscience.com/open/toasj/articles/V004/SI0085TOASJ/111TOASJ.pdf>

<http://www.intechopen.com/articles/show/title/use-of-botanical-pesticides-in-modern-plant-protection>

and research:

[www.mtt.fi/pesticidelife](http://www.mtt.fi/pesticidelife)

[https://portal.mtt.fi/portal/page/portal/mtt\\_en/sustainableproduction/fromfossilstorenewables/greenbod](https://portal.mtt.fi/portal/page/portal/mtt_en/sustainableproduction/fromfossilstorenewables/greenbod)

#### **4. Scott Scholefield, \*\*\*\*\***

Hello, here are my quick comments on this worthwhile endeavour.

Product labels - unlike nutritional labels, many non-industrial consumers will find the information suggested for biochar product labels new, complex and without meaning or reference. While the intent of your document is not to provide guidance or interpretation, I would suggest that this is required in some form, perhaps on the web.

Testing levels - what mechanisms exist to encourage companies to invest in the highest testing possible or even in participating at all? Rather than the names assigned to the levels, would it not be more appropriate to name the levels by client needs i.e. retail, industrial, R&D? i.e. testing at the advanced level provides no added value to our customers.

Standards/certification - is there an opportunity to tie the IBI standards into existing certification schemes?

Standardization - this will be a huge challenge. In my mind, there needs to be a rating system in addition to the testing and reporting guidelines to provide differentiation and demonstration of excellence not only characterization and standards.

Scott Scholefield, M.Sc., R.P.F.  
Director, Business Development  
Out of Ashes BioEnergy Inc.  
ph/fx: 1.888.201.4106

<http://ca.linkedin.com/in/scottscholefield>

## 5. Dr. Chin-hua Ma \*\*\*\*\*

I am a soil scientist working on application of biochars for vegetable production. Although my experiences are focus more on rice husk biochar, I would like to make a few suggestions regarding with the "Guidelines for specifications of Biochars".

1. The production method and temperature during processing influence greatly on the properties (CEC, pH, EC, water holding capacity, etc) of biochar product. I would like to suggest including the method of production and mean temperature range of processing on the product labeling.
2. EC value is very critical for germination of vegetable seeds when biochars are used as soil amendment or as seedling media. The measurement of EC is relatively simple. It is an important basic property of soil. I suggest including it in Level 1 testing requirement.
3. For the test method of electrical conductivity, EC of 1:5 is commonly used in soil testing. However, biochar has great water holding capacity. Using rice husk biochar as an example, 5-fold volume of water will be completely adsorbed by the biochar and there will be no adequate suspension left for the EC determination. We have tested the ratio for rice husk biochar: water to be 3:50 or 1:20 appropriate for the determination.

I hope these suggestions will be useful.

Thanks and best regards,  
Chin-hua Ma--  
Dr. Chin-hua Ma  
AVRDC – The World Vegetable Center  
Headquarters

P.O. Box 42, Shanhua, Tainan 74199  
Taiwan  
T +886 (0)6 583 7801 Ext. 414  
F +886 (0)6 583 0009  
E <mailto:chin-hua.ma@worldveg.org>  
I <http://www.avrdc.org>

## 6. T R Miles \*\*\*\*\*

T R Miles Comments on IBI Draft Guidelines 11 41 11

### 3. Terms and Definitions:

Biochar. The definition is broad. It appears from the document to pertain both to the carbon and inorganic content of the carbonized biomass. Is carbon in wood ash (1-30%) biochar? Or is the wood carbon and ash only considered biochar after Level 2 analysis if the ash fraction is more than 50%? While wood ash may be applied primarily for its liming effect the carbon content should be characterized and recognized for its biochar quality.

4.2 MSDS. Point to or provide examples of biochar MSDS.

### 5. Biochar Product Testing Categories

#### 5.1 Level 1. Entry Level Testing.

Level 1. Rice husk is an unprocessed feedstock. The char from gasification contains 10-30% carbon, sometimes as high as 50% carbon (40% carbon in Japan). It is not "biochar" due to the 50% maximum ash? (viz., US- Riceland Charsil; Japan Kansai Corporation Kuntan.)

Other feedstock not likely to meet the 50% ash criteria:

1. Urban wood waste (UWW) 5-15% ash. Intrinsic ash in clean urban wood waste, including urban prunings is about 1/2-3%. Foreign matter, or contaminants, would be about 10-12%. The foreign matter is most often sand or dirt from dragging prunings across a street to get to a chipper. UWW would not qualify?
2. Log yard waste. After you have handled logs in the log yard of a sawmill you are left with a mixture of wood fiber, bark and rocks, dirt or other contaminants. As with UWW the contaminants may comprise 10-12% of the total dry matter. Log yard waste would not qualify?
3. Corn stover. The corn stover that I am harvesting this week in the Midwest is about 15%-17% ash on a dry basis. ( I have just taken more than 400 samples for moisture and ash analysis.) Intrinsic ash is about 6%-8% in stover. The rest - 9%-11% - is foreign matter. In this case it is all dirt - clay, and sand. Corn stover from

my harvesting operation, especially the cleanup for the operation, would not qualify even though it contains ready-made components for an organo-mineral complex (in which clays and other inorganic “contaminants” are added to char to make a better performing “biochar”).

Please clarify how the 50% threshold applies to wood ash, rice hull ash, and feedstocks with high foreign matter in the ash such as urban wood waste, log yard waste, or corn stover. These could reduce to 50% ash fuels.

Level 2. Manures are “processed feed stocks”. The guidelines would appear to force all manures to be tested for toxicity. Why?

Each country probably has its own toxicity standards. In the US the EPA’s Toxic Leachate Characteristic Procedure (TCLP) is common. Have the thresholds been developed as a blend of national standards? National standards would seem to apply.

Level 3 Advanced Testing

When is screening for PAH appropriate? It is likely that many low quality chars will contain high levels of PAH and go unmeasured.

7. 1 Sample testing.

This appears to be arbitrary. Is it based on any soil or other bulk product testing protocols?

Testing costs. Have the Level 1 costs been checked out with both public and private laboratories? While the document states that costs have been considered there is no example given of the costs for each level of testing.

Other:

There are references to methods in some of the categories. Laboratories vary widely in their capabilities depending on their normal business. Will IBI develop a list of equivalent standard test methods to include AOAC, ASTM, ANSI, ISO, CEN etc. in many countries?

The guidelines should not preclude the biochar potential of wood ash. Wood ash is a good potential source of carbon for soil amendment. Typical industrial boilers will produce more than 1000 tons of wood ash per month often containing 10-30 tons of carbon. While carbon content is generally low, many fractions of wood ash can have high carbon contents. The guidelines should accommodate and incentivize the use of wood ash, especially with increasing carbon. As far as I can tell the delineation of a 50% ash threshold for biochar is arbitrary and not backed up by data of any kind.

Many thanks,  
Thomas R. Miles  
T.R. Miles, Technical Consultants, Inc.  
1470 SW Woodward Way

Portland, OR 97225  
503-292-0107  
503-780-8185 cel  
503-292-2919 fax  
tmiles@trmiles.com  
www.trmiles.com  
www.biochar.bioenergylists.org

## 7. Kelly Sveinson \*\*\*\*\*

Kelly Sveinson ksveinson@langara.bc.ca to me

Hello IBI

Regarding pH determination:

- 1) The chosen methodology (Ahmedna), does not account for that fact that aqueous solutions thus derived are often very low in ionic strength. It is a known phenomenon that obtaining pH measurements of low ionic strength solutions is difficult, yielding unstable instrument readings. The usual approach is to adjust the ionic strength of the solutions by adding KCl.
- 2) Heating the samples as suggested can cause uncontrolled evaporation, affecting the result. The methodology should specify evaporation control.
- 3) My analysis shows that the pH takes time to stabilize following the treatment. I recommend specifying an amount of time following the heating (e.g. 3 hours) before measurement.
- 4) I have found that pH varies with particle size. Grinding and sieving to a specified particle size should be specified if reproducible results are to be obtained.

Regarding electrical conductivity determination:

- 1) As with the pH measurements, I have found that EC varies with particle size. Grinding and sieving to a specified particle size should be specified if reproducible results are to be obtained.
- 2) The recommended 1:5 w/w biochar:water ratio is cumbersome in practice due to the water adsorbing nature of the biochar. Some chars yield a thick slurry that produces a meaningless EC measurement.

Please feel free to contact me with any follow-up with respect to these technical suggestions.

Thank you for your efforts in this important area.

Kelly Sveinson  
Chemistry Instructor and Researcher  
Langara College

**8. Peter Burgess \*\*\*\*\***

peter burgess peter.burgess@rainbowbeeeater.com.au to me

Thank you for the effort from many contributors to these guidelines.

We support the need for the guidelines.

Rainbow Bee Eater has reviewed the draft and are in general agreement with the content with one exception.

In our view, the fixed frequency of testing proposed needs to be a default that is over ridden if statistical analysis of process and feedstock variation indicates that higher or lower frequency is required.

We expect significantly lower variation in process and feedstock (and resulting biochar analysis) with the continuous, automated RBE System using local wheat straw from one or two very large farms in the Western Australian wheatbelt than the process and feedstock variation that might exist with a batch operation using feedstocks with greater variation in physical and chemical composition.

We request that the guidelines acknowledge this reality.

Please contact me if there are any questions.

Thanks and best wishes

Peter Burgess  
Managing Director  
Rainbow Bee Eater Pty Ltd  
Melbourne. Australia.

**9. Flow Force Technologies \*\*\*\*\***

Flow Force Technologies sales@flowforce.com.au to me

COMMENT ON DRAFT SPECIFICATIONS FOR BIOCHAR.doc  
FROM FORCE FLOW TECHNOLOGIES

**DRAFT SPECIFICATIONS FOR BIOCHAR**

My initial comments on the guidelines are as follows:

1. Definition of biochar: The definition is over simplified, viz: "A solid material obtained from the carbonisation of biomass". I think that any word preceded by the term "bio" suggests that it is of biological origin. Well charcoal made from coal is of biological origin (from fossilised plant matter).

So why the term biochar? I presume that it has been coined to try to discriminate between char from non-fossil sources and char made from fossil sources. The claim that biochar has the potential to be carbon negative by acting to sequester fixed carbon in the soil is relevant to the definition.

If we are going to have a biochar methodology for approving carbon credits then it goes without saying that the process of making biochar must be carbon negative as the calculation of carbon credits would have to be based on the mass of fixed carbon actually sequestered in the biochar less any carbon actually generated and added to the atmosphere as carbon dioxide by the production process.

So I believe that we need to expand the definition of biochar to mean that it only refers to char produced in such a way that it avoids more carbon dioxide than it generates. For example:

"Biochar is a solid material obtained by the carbonisation of biomass in a carbon negative process."

Then it would be good to qualify the term with further definitions that specify the efficiency of its carbon dioxide avoidance.

If we let  $\% \text{ CO}_2 \text{ Avoidance} = (\text{CO}_2 \text{ avoided} - \text{CO}_2 \text{ generated}) / \text{CO}_2 \text{ avoided} \times 100\%$  then the following definition of biochar could apply :

BiocharNNN would be biochar produced with a carbon avoidance efficiency of NNN%. Eg: Biochar100; Biochar80; etc.

I guess I am concerned at the possibility in the future of large industrial processes for making and selling so-called biochar where the biochar has little or no carbon sequestration value. To me that would be a gross misuse of the term biochar as I think it was originally envisaged.

Brian Lewis  
Flow Force Technologies Pty Ltd.  
Adelaide, South Australia.

## **10. Sai Bhaskar Reddy \*\*\*\*\***

Sai Bhaskar Reddy Nakka saibhaskarnakka@gmail.com to me, biochar, biocharindia

Dear Kelpie and All,

It is great that IBI is developing the guidelines for Biochar. When I started my work on Biochar (Terra Preta) about 7 years back, we had little information on how to go about. The bioenergylists on terra preta and the egroup by Tom Miles was a great resource to share and learn. Over a period we have developed about 4 simple methods of biochar compost preparation and application and facilitated to the farmers and used for our own tests.

The sources of biochar, preparation methods of biochar compost and applied quantities are variable. The characteristics of biochar compost are variable. We would like to understand how the following biochar products from GEO would fit into the IBI guidelines. We have never got the samples tested for the various parameters existing in them, in this regard the IBI guidelines being developed are important for tests to be conducted. But the results achieved in the field, growth and yield of various crops are excellent. The Biochar compost prepared by GEO are being called as GEOCHAR.

#### GEOCHAR - 1

Rice husk biochar (50%)

Compost (vermicompost / Farm yard manure) (50%)

Local soil microbes (collected from a locally maintained biodiversity place - no chemical fertilizers / pesticides ever applied in this place.)

Addition of Jaggery / Molasses (20 kgs for every 5 tonnes of compost).

#### GEOCHAR - 2

Biochar (from local crop residue / wood)

Farm yard Manure / vermicompost

Green Manure

Soil microbes (local soil microbes and optional - Trichoderma Viridea / Azotobacter / Azospirillum / Pseudomonas Fluorescence / etc.)

Jaggery / Molasses

#### GEOCHAR - 3

A method adopted for application to alkaline soils

Biochar compost preparation

- Biochar (charcoal is cleaned in running water to remove the ash)
- Vermicompost / farm yard manure
- Soil microbes (Add local soil microbes, addition of Trichoderma Viride, Azospirillum, Azotobacter and Pseudomonas fluorescence, etc., are optional).
- Jaggery / Molasses addition

Field treatment before application of the above biochar compost in alkaline soils  
Farm yard manure and biochar is added to the field (biochar should be cleaned in running water to remove any traces of ash before application)

The soils are tested for the alkalinity and other parameters. Gypsum and sand is added as per the requirement. Other nutrients / trace elements are added as per the requirements.

#### GEOCHAR - 4

Biochar treated in Urine (Animals / Human)

Note: The biochar saturated in urine is dried in shaded conditions is applied to the soil directly.

##### Important points

1. Soil test is important for understanding various other parameters and necessary amendments are made accordingly.
2. Biochar compost application yields immediate results in the field.
3. Application of biochar directly to the field is a slow process of getting the results.
4. The combination of both methods can be chosen. Preference should be given to biochar compost application.
5. The method of preparation of biochar compost is aerobic. There should be enough moisture during the preparation and prepared under normal temperatures in a shady place.
6. The addition of jiggery / molasses / sugars should be done while mixing the biochar compost.
7. Minimum number of days required for preparation of biochar compost are 15 days. The temperature in the biochar compost is around 30 degrees at the end.
8. The field should be wet (or apply after the rains) at the time of application of biochar compost (this helps in easy spread of soil microbes).
9. Other additions in the biochar compost could be based on the availability : pottery shards / fish meal / brick pieces / burnt earth, etc.
10. Silt application is also important along with the biochar for the fields.
11. Biochar compost Application

Point - eg. Horticulture crops – three zones bottom, middle and top as mulch

Spread – Irrigated and rainfed crops

Dr. N. Sai Bhaskar Reddy

## **11. Mike Bishop \*\*\*\*\***

Allison:

During the Webinar I asked a question that I want to reiterate and clarify here.

Most potential consumers of biochar that do not have background in the plant/soil sciences expect biochar to be a fertilizer. My exposure to biochar indicates that it generally is not (unless it is enhanced or charged with nutrients). That is why it is important to convey what biochar is or what it will do as a soil amendment. The ability of biochar to cycle nutrients and thereby reduce the ongoing need for

nutrient additions is likely one of its chief attributes. That is why I recommended a measure of biochar's ability to hold and cycle nutrients, such as Cation exchange capacity to document this. Simply put- we need to tell the consumer what he/she is buying and what benefit can be expected.

During the webinar the speaker responded referencing measurement of conductivity to represent biochar's ability to exchange ions (cycle nutrients). I disagree.

Mike Bishop, Superfund Project Manager  
U.S. EPA, Montana Office  
10 West 15th Street  
Helena, Montana 59626  
Office: (406) 457-5041  
fax -5056  
e-mail bishop.mike@epa.gov

## 12. Andrew Zimmerman

\*\*\*\*\*

Dear 'Characterization Criteria Working Group',

Thank you for your hard work in this important and much needed area of developing standardized criteria. I have done much work in the area of biochar stability and chemical characterization so you can imagine I have a few comments on your draft guidelines. My main concern is that nothing in the recommended guidelines would give much indication of the stability of biochar, or more specifically, biochar C. This is what will be needed as the basis for assignment of C credits in the future. My research shows that the temperature at which the biochar was made is the main determinate factor in biochar stability, as well as the surface chemical functional groups which will control its interaction with soil nutrients and organic matter cycling. I have found the volatile matter content of a biochar to be directly linearly related to its stability (C mineralization rate) as well as to its surface functional group content (thus CEC).

I don't know why inorganic C content makes it onto your list of necessary and important measures to report. Surely this C will dissolve and will not be sequestered soil C.

I also question the draft guideline recommendation of iodine adsorption as a measure of biochar surface area. Although I know that this has been used by the 'carbon black' research folks, it is not at all commonly used in soil science and I know of no research showing it is of relevance to a biochar's performance. I would

recommend the N<sub>2</sub>-BET method because it is commonly used, or the CO<sub>2</sub>-adsorption method because my work has shown it to be of much greater value in predicting biochar performance (high CEC, chemical sorption, etc.).

Lastly, I question the choice of mineral N determination by KCl extraction and available P by formic acid extraction. What is the basis of this choice? My work shows the utility of either weak acid or even water extraction of N and P in showing what would likely be leached by biochar over time.

In summary, I recommend reporting of:

- 1) Biochar maximum or average production temperature (should be easily obtained)
- 2) Biochar volatile matter content (easy to analyze)
- 3) N<sub>2</sub> or CO<sub>2</sub> sorption surface area instead of iodine
- 4) And perhaps weak acid or water extraction of N and P for 'available N and P'.

I'd be happy to provide you with more information on any of these matters.

Thanks again,

Andrew Zimmerman

Andrew R. Zimmerman, Ph.D.

Associate Professor

Department of Geological Sciences

241 Williamson Hall

P.O. Box 112120

University of Florida

Gainesville, FL 32611

Office: (352) 392-0070

Fax: (352) 392-9294

azimmer@ufl.edu

[www.clas.ufl.edu/users/azimmer/index.html](http://www.clas.ufl.edu/users/azimmer/index.html)

### **13. Peter Hirst** \*\*\*\*\*

Subject: Definition

Date: Fri, 28 Oct 2011 08:59:13 -0700

From: Peter Hirst <peter@newenglandbiochar.org>

To: alennie@prasinogroup.com

What is the rationale behind the definition of "biochar" . It seems more like an inclusive description than a definition. There is a lot of stuff that fits the definition that is certainly not biochar. In fact, pure ash seems to fit the definition

#### **14. Noel Leathers \*\*\*\*\***

Subject: Biochar questions  
Date: Sun, 30 Oct 2011 22:17:32 -0400  
From: noel leathers <wleathers1@hotmail.com>  
To: <alennie@prasinogroup.com>

At what temperature will biochar be required to be produced?  
I understand you do not intend to get into this part of production.  
If this is correct it is my humble opinion that you might as well just say put charcoal in the ground.  
And from a monetary and production standpoint 300c will produce charcoal with the largest weight. Of course, in my understanding, this is not optimum carbon nor microbial cavities.

#### **15. Adeniyi Fagbenro \*\*\*\*\***

Adeniyi Fagbenro pastfagbenro@yahoo.com to me

I appreciate the efforts of IBI with respect to the characterization of biochar. I want to suggest the use of Extractable humic substances(EHS) with their fractions -- humic acid(HA) and fulvic acid(FA) as a characterizing property for biochar, using 0.1MNaOH. I found that this property varied among the 10 biochars i produced from 10 different feedstocks. I believe it can tell apart different biochar types. Thank u.

#### **16. Gant Massey \*\*\*\*\***

Gant Massey gmassey\_esg@me.com to me, Mike

Dear Sir or Madam:

I listened with interest to the last part of your webinar on Biochar this Friday, October 28, 2011 and have read through the proposed Guidelines for Specifications of Biochars. My questions pertain to an issue that has arisen with farm-produced compost in the Bitterroot Valley, Montana, United States. Specifically, last year a local producer sold compost that was turned out to be tainted with post-emergent herbicide, which, when incorporated into local gardens, killed the crops. I note in the Level I characteristics and criteria that the biochar labeling calls for tests of Earthworm Avoidance and Germination Inhibition. First, do these tests address the presence of post-emergent herbicide? Second, does the very method of producing biochar, i.e., charring the carbon source, by its very nature address this issue?

Thank you.

Sincerely,

J. Gant Massey, Ph.D.  
Plant Ecologist  
Ecological Solutions Group LLC  
w: 406-777-1881  
c: 406-396-9675

## 17. René Pigeon \*\*\*\*\*

Pigeon, René Rene.Pigeon@nrca-nrcan.gc.ca to me

Regarding page 12:

Should we include a measurement of organic carbon that is pertinent to reporting and evaluating a C:N ratio pertinent to agronomy instead of total organic carbon? This refers to the difference between stable organic carbon (pure biochar) and biodegradable organic carbon (uncarbonized or unburnt biomass which is intentionally or unintentionally left in biochar), and organic carbon that is commonly measured.

A high C:N ratio means that during the decomposition of the organic matter, it is possible that inorganic N would become "immobilized", and thus unavailable for plants to utilize. Immobilization occurs when the amount of C available to soil microorganisms is much greater than the amount of available N (i.e. the C:N ratio is high). (...) It thus becomes necessary to think in terms of a "functional" C:N ratio which would be lower than the actual ratio calculated from the elemental composition.

That is to say:

Would you explain, in the Specification, the choice of H:Corg instead of labile carbon fraction?

René Pigeon

Systèmes bioénergétiques | Bioenergy Systems

CanmetÉNERGIE | CanmetENERGY

Ressources naturelles Canada | Natural Resources Canada

Rene.Pigeon@RNCa-NRCa.gc.ca \* 613 943-8840 \* Skype

## 18. Bathini Madhusree \*\*\*\*\*

Bathini Madhusree mbathini@yahoo.co.uk to me

One question

There are different kinds of biomass. How do we make guide lines to these biomass producing biochar.

Madhusree Bathini

**19. Charles Berkstresser \*\*\*\*\***

Charles Berkstresser charles@tragaluz.us to me

I am listening to the webinar now and have an additional comment for the guidelines. Several times in the presentation it was stated that IBI requires tests to be completed by "certified" test labs. I do not see this requirement listed in the guidelines and it is certainly not a labeled section. I think this is a very important criteria and requirement and should be included as a separate section. What facilities are approved for conducting these tests? What accreditation bodies are recognized for qualifying labs?

Also, in the presentation the term "certification" was used quite often. My understanding is that this document does not establish official certification. I think it is really important to not use the term "certification" until that program is established. The guidelines should make this clear.

Regards,

~~Charles~~

Charles Berkstresser  
Chief Visionary Officer

**20. Michael Harte \*\*\*\*\***

Michael Harte mharte@ibidata.com to me

Alison & Kelpie,

From a producer and marketer perspective, will you be publishing a listing of certified testing labs?

May I use information on the IBI website for promotional purposes? For example, the Guidelines, published studies and graphics.

Thank you,  
H  
IBI Data  
27199 State Hwy 56

Brownsdale, MN 55918  
507-396-4710 ext 248

## 21. Charles Berkstresser

\*\*\*\*\*

Charles Berkstresser charles@tragaluz.us to me

First off, thank you for your wonderful efforts to bring some consistency to the biochar industry. This is a great first step and I appreciate that the process is open and transparent.

My comment is related to the labels of the three levels of standards: Entry, Moderate and Advanced. These terms are relative and subjective terms and by nature are not particularly helpful in providing guidance. I recommend that more discrete terms be used to provide better guidance.

For instance:

Level I - Primary Producers

Level II - Industrial Producers

Level III - Research Source Materials

Other titles may be more appropriate, but I think something like this will provide users better guidance.

Also, I would recommend that a chart of typical use cases for each of the levels be provided to give additional guidance. Under what scenarios are each of the levels recommended? What are the situations that would indicate that a producer should shift from one level to another.

Thank you for your great work.

Regards,

~~Charles~~

--

Charles Berkstresser

Chief Visionary Officer

## 22. Loi Hoang \*\*\*\*\*

loi hoang phuloi.proledbmt@gmail.com to me

This is a very good project to reduce CO2 emissions and improving the dry land.

Open up a new cultivation closed environment to ensure energy and food.  
your job for this program I think it is wonderful.  
thank you.

### 23. Nando Breiter \*\*\*\*\*

Nando d.nando@gmail.com to biochar-policy, me, Tom

Ron,

Thanks for bringing the proposed standard to our attention, and providing an opportunity for me to express a few concerns. While I can relate to your rationale for the 50% ash limit, I think we need to examine the issue from the perspective of the viability of a standard within existing markets, rather than from an idealistic notion that biochar has an intrinsic, recognizable value.

I've read through the proposed standard, and taken a close look at the contributors. I don't see a name I recognize that has had significant exposure to carbon market methodologies, but I don't know everyone. Like Tom, I don't understand the purpose for the maximum levels of ash and H:C ratio in the proposed standard. If it is for "carbon credit" purposes as you indicate, my concern is both that this specification would be irrelevant to carbon markets, and it would exclude perfectly valid use scenarios in agriculture.

As you know, carbon markets don't sell carbon. They sell an absence of anthropogenic emissions as determined from a baseline case. The specification of ash and H:C ratio, and particularly the limits, would be completely irrelevant to the determination in current carbon markets if an anthropogenic emission has been additionally avoided. A power plant burning biomass (and producing only ash, the more the better) that avoids the use of fossil fuels might be eligible for carbon credits, if the scenario is deemed additional - which basically boils down to economically unfeasible without the credits, (or the variant of a technology transfer to a developing country for a limited period of time, before the technology was regionally established).

I don't get how the 2 main criteria for credit within current carbon markets, "avoiding an anthropogenic emission" and "economically unfeasible without the credits" relate to these maximum levels. We might have an ideal, a fantasy about carbon markets paying for carbon, but that's not how it works in the real world.

In the real world, the vast majority of folks interested in biochar, interested enough to consider investing money in it, are interested because of its potential fertility benefits. Excluding low temperature biochar and biochar high in ash content from being certifiable seems inappropriate, especially because both may have significant

fertility benefits in certain soils. And it seems especially inappropriate given that, again, these levels would be irrelevant to current carbon markets.

Stable carbon, whatever the proportion, is stable carbon. If a future market evolves around stable carbon being sequestered in soil, and the credit is determined from the carbon sequestered rather than the emissions avoided, then all we basically need is a simple, practical means of determining (really estimating - avoided emissions are never measured accurately) the amount of stable carbon within a given biochar, and a chain of custody that demonstrates the biochar wound up in soil. Again, such a market doesn't exist, and the emissions market that does exist is on shaky ground, so I'm calling the relevance of these limits in the proposed biochar standard into question.

Directly addressing your concern about ash being sold in the market as biochar, in the real world, if a farmer needs to raise the pH of their soil and decides it is a worthwhile investment, and ash is the most cost effective way forward for them, then they will purchase ash.

The idea that a producer could dupe even one farmer into thinking ash was really biochar using a biochar standard doesn't make sense. Farmers generally aren't that stupid, and producers who go to the trouble and expense of unitizing a standard to enhance trust will tend, rather strongly in my opinion, to value establishing trust as a fundamental business strategy. As long as the amount of ash is indicated on the certificate, the farmer knows what he is getting, and he will also know why he wants it. If he doesn't want that much ash in his substrate, he won't buy it, end of story. If the IBI certification process does not help a producer (and buyer) in a given scenario to establish trust, it will be sidelined.

So I would suggest that rather than setting limits, a guideline within the standard that explains, simply and clearly, the pros and cons of various test values might be much more useful to the purpose of establishing trust between buyer and seller, and much more valuable to both.

I don't think that certifying "biochar" should be like certifying gold, with an "it is or is not" determination, simply because that does not have any value in the marketplace. It's soil fertility, and hence the interpretation of the test results, that is valuable. What the stuff is called doesn't really matter in this market, hence a certification process that essentially determines whether something is biochar risks being irrelevant in the market. If you think you have to set limits, then set them very generously to make sure that a wide range of pyrolysis products that are known to potentially increase soil fertility are included. And certainly don't base these limits on a climate ideal that is not relevant within the marketplace. The purpose of a standard isn't to influence society towards an ideal. Do something else for that. It is to help build trust between buyer and seller. Throwing a societal ideal in the middle of a standard, especially one with no clear economic or regulatory basis, confuses its purpose.

Give me a certification process that will help me work out if biochar is valuable to me to enhance soil fertility, and I will be much more likely to use it as a basis to help establish trust. However, if you give me a certification process that simply answers the question, "Is this really biochar?" according to an arbitrary determination, I will be hard pressed to find any bottom line value in that certificate, because I know that is not what my potential clients need to know to make an investment decision.

I hope that's helpful.  
Kind regards,  
Nando

CarbonZero Project  
Via Rompada 40  
6987 Caslano  
Switzerland  
+41 (0)91 600 9601  
+41 (0)76 303 4477 cell  
www.carbonzero.com  
skype: ariamedia

## **24. EMAIL CHAIN BIOCHAR YAHOO GROUPS \*\*\*\*\***

<rongretlarsen@comcast.net> wrote:

Tom and (now) 2 lists (adding biochar-policy):

This may be the first time I have ever disagreed with you - so I look forward to further dialog, and apologize in advance should I be wrong here below.

I think that there should be a lower limit cut-off - and 50% seems justifiable - based on the way we handle majority voting in a democracy. My main rationale is that, without such a limit, there could be a validity claim for a lot of material coming out of gasifiers that is mostly ash. This refuse will be attempted to be sold as biochar in order to get the maximum price for a product that might otherwise need to pay a tipping fee to get rid of. From a sequestration promotion perspective, I would rather see the gasifiers move towards pyrolysis.

Your last point below on a sliding scale is (I think) going to be mandatory anyway. It will surely be (or at least should be) required to receive a carbon credit. If I am paying for carbon sequestration, I certainly don't want to pay for ash and dirt. In all likelihood that payment will even be low-balled to ensure that the labile component also does not get much/any reward.

I can't think of any biomass input besides rice husks apt to have a problem satisfying a 50% minimum rule. To achieve 50% carbon should be pretty easy - even for rice husks - by merging different chars (if needed). I believe Paul Olivier has already reported that he had a superior flame when mixing rice and coffee husks as the input.

Ron

From: "Tom Miles" <tmiles@trmiles.com>  
To: "Discussion of biomass cooking stoves" <stoves@lists.bioenergylists.org>, crispinpigott@gmail.com  
Sent: Wednesday, October 26, 2011 8:43:11 PM

Subject: Re: [Stoves] [biochar-production] Re: Stoves Digest, Vol 14, Issue 17

Where is the evidence that a Minimum should be established at 50% ash?

IBI guidelines for specification need to recognize that there are different qualities of biochar for different purposes. The draft guidelines do specify a method for analyzing carbon, determining H:C ration, and determining C in carbonates. I do not agree that a threshold should be established for calling a residue a biochar. When does wood ash become biochar? According to the draft guidelines it would not become IBI certified "biochar" until it had less than 50% ash regardless of the amount of stable carbon it would be contributing to the soil for sequestration purposes at more than 50% ash.

I don't think we need to draw a line to call it biochar. A sloped line might be drawn for the carbon sequestration benefit that you would get for decreasing amounts of stable carbon.

Tom

-----Original Message-----

From: stoves-bounces@lists.bioenergylists.org  
[mailto:stoves-bounces@lists.bioenergylists.org] On Behalf Of Frank Shields  
Sent: Wednesday, October 26, 2011 3:55 PM  
To: crispinpigott@gmail.com; 'Discussion of biomass cooking stoves'

Subject: Re: [Stoves] [biochar-production] Re: Stoves Digest, Vol 14, Issue 17

Dear Crispin, Tom,

I think we need to define a minimum \*carbon\* content for a material to be called \*biochar\*. We can't call something a biochar if it has less than 1% carbon for example. So where do we draw the line? We need to include all natural biomass made into biochar like rice hulls. The material needs to

have enough carbon to be useful. So I say 50% carbon a minimum to be 'excellent' biochar knowing that most all natural, clean biomass will produce a biochar with greater than 70% carbon. But open to other values to make a scale. This makes it a product with enough value for a grower to purchase and spread.

I think the product should have the carbon content defined for quality (not DAF). We should not include the oxygen and hydrogen and ash. We should calculate the percent carbon content on the biochar sample dry weight (200 deg C). If we base quality on percent fixed matter (C-H-O) after subtracting the ash I think there is a mistake. Because we 'make' more ash when we change the cations into carbonates (increasing weight) during the process. More cations from vegetative matter the more the problem. And this quantity of ash is not what we are spreading on the field. Also the carbon trapped in the ash (as CO<sub>3</sub>) is not included in the fixed carbon fraction - it should be because it comes from the organic carbon in the raw sample. These are just details and perhaps not that important. To do what I think is needed we must determine the carbon using a Leco CHN analyzer. More work with expensive equipment. But if we want to get carbon credits in the future we need to start off accurately measuring the potential CO<sub>2</sub> we are fixing. When money is involved these details need to be addressed. Now is the time or we will be back here again at a later time.

Just because the carbon content is 0.1% and the ash is 99.9% doesn't mean the product is not beneficial for an ag field. But I don't think we should call it biochar even if someone did add a spoonful into a soil mix. This rating has nothing to do with benefit to a field. That is site specific. It has something to do with label on the bag (or may in the future).

Regards  
Frank

Vegatative plant material is 10 to 20 percent. We test a lot for nutrients. It is very hard to get the customer to bring us a clean sample as it takes so very little dust and dirt to bring the ash concentration up. I think harvesting biomass for biofuel and one will not be careful to harvest clean samples.

If you have 15% ash in a dry organic material. Loose 60% of the organic fraction during pyrolysis you have something like 20+ percent ash. And, as you point out, there can be biomass with much greater than 20% ash.

I suggested the 50% thinking this would be high enough to include most all biomass that is made into biochar. Thinking we need some limit that if there is less than 50% carbon

Frank Shields  
Control Laboratories, Inc.  
42 Hangar Way  
Watsonville, CA 95076  
(831) 724-5422 tel  
(831) 724-3188 fax  
frank@compostlab.com  
www.compostlab.com

-----Original Message-----

From: stoves-bounces@lists.bioenergylists.org  
[mailto:stoves-bounces@lists.bioenergylists.org] On Behalf Of Crispin  
Pemberton-Pigott  
Sent: Wednesday, October 26, 2011 12:42 PM

To: Discussion of biomass cooking stoves  
Subject: Re: [Stoves] [biochar-production] Re: Stoves Digest, Vol 14, Issue  
17

Dear Frank

Apart from the special case of rice hull, how could you get a 50% ash level  
in char? Trees are about 0.5% ash. There is not much left of the fuel if  
the char is 1% of the initial mass.

Regards  
Crispin

Frank,

I see the ash/carbon content as a sliding scale with relative changing  
benefits rather than a threshold level. If biochar has less carbon than ash  
is there still an agronomic benefit?

It is not clear how the IBI guidelines will be used. The guidelines should  
list those components that should be measured. The recommended levels of  
those components for different purposes could be separate recommendations  
from IBI to a certification agency.

If the purpose is stability and carbon sequestration why limit counting  
recalcitrant carbon even if it is 0.1% carbon or, 99.9% ash?

Tom

## 25. Nando Breiter \*\*\*\*\*

Nando d.nando@gmail.com to biochar-policy, Tom, Kelpie, biochar, biochar-policy, me

Ron,

The simple fact of the matter is that a standard will not prevent anyone from using the term 'biochar' in whatever way they want. A standard does not directly exert control over how a term is used in a commercial context.

A trademark might be possible in some jurisdictions, (not in America tho', 'biochar' alone would certainly be judged 'merely descriptive', disqualifying the term from being trademarked). But control of the use of the term biochar via a trademark would not prevent the entity that registered it from using it to sell whatever product they want to use it for. Control over the use of a term, and a standard, are not necessarily related, unless the body that owns the standard also owns the trademark to a term (and has the financial wherewithall to defend it!)

I also don't understand the sand argument, especially in light of the fact that biochar will likely be sold as part of a substrate. Are you saying that mixing biochar with compost would render the biochar component uncertifiable under the proposed standard? Why is ash any different? Or sand for that matter? I certainly could envision a propagation medium being created out of sand and biochar. Tom's example of a substrate of ash and biochar seems even more likely, as soil acidity is a major problem impacting fertility worldwide. If the pyrolysis process used delivers ash in the right proportion for a certian acidic soil, why would the standard insist that this product could not be certified?

I'd be wary of imposing an irrelavent ideal between buyers and sellers within the standard. Food can be certified as BIO, but that doesn't mean that all producers have to be BIO and all consumers need to purchase BIO. A different level of certification is available for producers that use commercial fertilizers.

GLOBAL GAP is a standard used in agriculture. It's a modular system with a concept of "scopes". Biochar can be viewed as 2 very different products, a fertility enhancement product and a carbon sequestration product. I think a biochar standard should separate these different products into separate scopes or modules, especially in that different buyers and sellers will have different concerns.

Kind regards,  
Nando

**26. Zubin Xie \*\*\*\*\***

zubin xie zbxie@issas.ac.cn to BiocharGuideli., me

Dear Sirs/Madems:

The comments are as follows:

1. The guideline is well prepared for comments.
2. Biochar has many usages except from amendment in soil, so biochar can be labelled different grades according to its usage.
3. Page 7, line 6. Biochar: A solid material obtained from the pyrolysis of biomass under little oxygen. Or maybe biochar is a byproduct of bioenergy industry. It is better to consult the expert from energy department and collect more opinions on the definition.
4. Page 7, line 7. The characteristics are too limited to soil amendment.

Best wishes.  
Zubin Xie

Prof. Dr Zubin Xie  
State Key Lab of Soil and Sustainable Agriculture  
Institute of Soil Science  
Chinese Academy of Sciences  
Nanjing, 210008, China  
Email: zubin@issas.ac.cn  
Tel: 86-25-86881105  
Fax: 86-25-86881000

**27. Clement Aigbogun \*\*\*\*\***

Clement Aigbogun revicaig@yahoo.com to me

My submission would revolve around the need for the international guidelines to address biochar's standardization along these lines

1. Biochar's material safety data sheet. To determine toxicity of biochar to human and livestock
2. Guideline on biochar' feed stock. To determine the appropriate content for pyrolysis and gasification or types of biomass materials forbidden from carbonization based on actual research studies into the consequences of use of certain feed stock.

3. End users application methods. This should also compare practices such as bush burning as means for preparing farmlands
4. Resultant effect of biochar for soil sequestration. Highlighting successes from use
5. Pelletization and Storage. Because of the volume that may be generated.

Clement Ilenre Aigbogun  
NiCan Environmental Technologies.  
15 Adesina Street  
Ikeja,  
Lagos State,  
Nigeria(WA)  
Tel- +2348033374769

## **28. Teresa Howard\*\*\*\*\***

L Howard glhoward@newulmtel.net to me

Hello,  
My name is Teresa Howard and I am an 8th grader in New Ulm, MN. I am conducting a science fair project on the effects of biochar on the root growth of corn and soybeans. I was wondering if you would recommend a particular type of biochar that is most commonly used that I can use in my experiment.  
Thank you for your time!  
Sincerely,  
Teresa Howard

## **29. Judith Hodges\*\*\*\*\***

From: Judith Hodges <judith@charbiological.com>  
Date: Wed, Oct 26, 2011 at 8:50 PM  
Subject: 2 Questions  
To: alennie@prasinogroup.com  
Alison Lennie,

Question 1

If a feedstock is 100% unprocessed hardwood is the final product still considered biochar if it is created as lump charcoal in the traditional way (burning with emissions) but accepted in the community as being within the range of local ordinances and EPA guidelines? In other words it is a lump charcoal manufacturing business that uses unprocessed hardwood making a level 1 grade of biochar?

Question 2

In the process of listing a biochar product with WSDA or OMRI as an organic input, the question of whether or not it is a synthetic or non-synthetic comes up. I am not clear on the correct answer because of the considerations below. Could you speak to this?

1) A non-synthetic is when a biological process is not changed to create a new product.

2) A synthetic is created when there is a change in the biological processing to manufacture a new and significantly different product.

The biological process of burning a feedstock is quite controlled and significantly altered when the smoke and oils are removed in the making of certain higher grades of biochar. Would that control and resulting change of product quality be enough to call biochar a synthetic?

I hope not, but so far discussion with OMRI and WSDA is limited and I do not see biochar as a product that has been listed organic. That makes me think there are issues that need to be overcome. Any illumination regarding this topic is helpful.

Appreciate,  
Judith

Judith Hodges  
President, CharBiological, Inc  
www.charbiological.com  
615.699.0160

### **30. Bruce Angier \*\*\*\*\***

Bruce Angier angier.bruce.215@gmail.com to me

Suggestion 1: Insert the last paragraph in the Scope section (lines 27 - 30) between the current first and second paragraphs (between lines 9 and 10). The logic is it gets "Who are the potential users?" nearer the top of the section, though your prose probably flows better as it stands.

Suggestion 2: Use words something like "This document is intended to establish testing, measurement, reporting methods, and labeling guidelines for the physical and chemical properties of biochar. Issued by the International Biochar Initiative (IBI) and based on international consultation, the intended audiences for these biochar specification guidelines include producers, users, regulators, researchers

and marketers of biochar, as well as other organizations in the biochar community," somewhere near the front of the document as a high-level summary.

Both these suggestions probably come from the last 17 years of my career that were spent in administrative, rather than research, activities. There you don't think, you just do; and it is easier to justify reading for content if you feel the answers are likely to be in the text. For me, these suggestions would give more immediate visibility to key points and encourage further reading.

Thank you for your consideration of these suggestions...

Bruce Angier

### **31. Prof Dr Farid Nasir Ani\*\*\*\*\***

farid@fkm.utm.my to me

Dear Sir

How about hydrophilic property ~ the ability to absorb and store water from the soil. Some compounds in biochar have an affinity to water and are usually charged or have polar side groups to their structure that will attract water. This will give some qualities on the type of biochar from different sources.

Thanks.

--

Prof Dr Farid Nasir Ani  
Faculty of Mechanical Engineering  
Universiti Teknologi Malaysia  
81310 UTM Skudai, Johor D.T.  
Malaysia

### **32. Gustan Pari\*\*\*\*\***

From: Gustan Pari [mailto:gustanp@yahoo.com]  
Sent: Tuesday, October 25, 2011 9:00 PM  
To: info@biochar-international.org  
Subject: Re: IBI Guidelines Need Your Suggestions and Comments

Dear Kelpie Wilson  
IBI Project Development Director

Thank you very much for your email.. I want to suggest that in carbonization process it should be include to collect wood vinegar (smoke condensation) not only biochar so it can be reduce the smoke pollution. The wood vinegar can be used as biofertilizer and biopestice also carbon content is high.

Best regards  
Gustan Pari

### 33. Adam O'Toole \*\*\*\*\*

Hei

Adam O'Toole from Norway.

I have read through the draft and my only comment is the heavy metal limits in the USA seem quite generous compared to here in Norway, and I would assume Europe too.

Here is the table for allowable limits in Norway

#### 1. Tungmetaller

Følgende maksimumsgrenser for tillatt innhold av tungmetaller angitt i mg/kg tørrstoff (totalinnhold) gjelder:

<b>Kvalitetsklasser:</b>	<b>0</b>	<b>I</b>	<b>II</b>	<b>III</b>
	<b>mg/kg tørrstoff</b>			
Kadmium (Cd)	0,4	0,8	2	5
Bly (Pb)	40	60	80	200
Kvikksølv (Hg)	0,2	0,6	3	5
Nikkel (Ni)	20	30	50	80
Sink (Zn)	150	400	800	1500
Kobber (Cu)	50	150	650	1000
Krom (Cr)	50	60	100	150

Mattilsynet kan sette strengere krav til dyrkingsmedier framstilt av råvarer listet opp i vedlegg 4.

#### 2. Organiske miljøgifter, plantevermidler o.a.

Class 0 is the highest quality and it goes down to a class 3. Most of the values written in your draft would place the standardized biochar between class 1 and 2. The ramifications of this is that if it is classed as 2 you can only spread out no more than 20 tonnes / hectare every 10 years. Class 3 you can't put it on food soil, but only in parks and under grass.

You might want to write into the drafts that the level 2 requirements depend upon the legal limits of the market where the biochar is to enter into and be used.

There is no point importing a biochar to a country where it can not be legally used, even if it passes US standards.

Kind regards

Adam O'Toole  
Researcher  
Bioforsk - The Norwegian Institute for Agricultural and Environmental Research  
Saghellinga A, Frederik A. Dahls vei, 20  
1432 Ås (Aas)  
Norway  
Phone: [\(+47\) 92 01 98 05](tel:+4792019805)  
Fax: [\(+47\) 63 00 94 10](tel:+4763009410)  
Email: [adam.otoole@bioforsk.no](mailto:adam.otoole@bioforsk.no)

Få tilsendt den elektroniske nyhetsavisen *Jord og miljø Info!* gratis ved å klikke [her](#).

### 34. Wayne Lerrigo \*\*\*\*\*

Wayne Lerrigo [wlerrigo@gmail.com](mailto:wlerrigo@gmail.com) to me  
IBI,

We are concerned that poor countries will export their biomass to richer countries without proper balancing. This is happening in Africa and other nations. I have seen villages deforest their property and export the charcoal to Europe. Thus, these standards should consider raw material supply and use, such as ISO14000. For ISO9000 we had to visit all of our suppliers processes to assure they were up to standard.

We only accept freshly cut trees, etc., if we are assured that the material was not cut illegally, but for an offsetting land use that was legal, especially a sustainable project that would benefit the community. Most of our material comes from the many burnt over land here, forest waste, and waste from ag, industrial, and other processes, and waste not suitable for composting.

Wayne Lerrigo [wlerrigo@gmail.com](mailto:wlerrigo@gmail.com) to me  
IBI,

My concern is that poor countries will be sending their biomass to the wealthy countries. This is already happening in Africa and several other countries that are deforesting their villages to sell the charcoal overseas. Certifications needs to cover supply and usage as ISO14000. For ISO 9000 we had to be concerned about our suppliers to assure we could meet our quality goals.

Our operation does not accept freshly cut trees unless we can look into the reason they were cut. Most of our biomass comes from previously burned off forests, dead branches, waste products from ag and other processes, plus suitable garbage that we cannot compost.

--

TF Wayne Lerrigo  
wayne@lerrigo.com  
Diamond River Ranch(tm)  
Komplex Rungan Sari, Jl Tjilik Riwut Km 36,3, Palangka Raya, Kalimantan  
Tengah 73225, Indonesia  
Telp:+62-21-7690382  
Cell: +62-81-3141-30041 (main)  
\*This message is for you only.

### **35. Ulrich Suer\*\*\*\*\***

Ulrich.Suer Suer\_@t-online.de to me  
Dear Kelpie Wilson

Thank you for your e-mail. Please excuse my bad English. I think that the certification of biochar is very important. It's good that so many people are involved. You make a very good job! My comment to the biochar declaration is, that there is no distinction between ash and sand. Currently all produce biochar from wood chips. There is the amount of sand is no problem. I hope, in the future there will be a use after use after use. For example a cow eats grass with 3% sand. Maybe then the excrement have a sand content of 6%. These excrements are placed in a biogas plant. The solids from the biogas plant will have maybe a sand content of 40%. If these solids are carbonised the biochar has more than 50% sand and ashes. The biochar is still good. In my view, the method is also good. But according to the certification is that no biochar (Level 1). The same problem will also occur in sewage sludge. I think there are other possibilities in future, of which we currently have no idea. The biochar certification should be take that into account. We are just beginning.

Best regards  
Ulrich Suer  
BioMaCon GmbH  
Schmiedestraße 2  
D-31547 Rehburg/Germany  
Phone: +49(5023)9000-254  
Fax: +49(5023)9000-256  
E-Mail: US@BioMaCon.com  
www.BioMaCon.com

### **36. Steve Poole \*\*\*\*\***

Steve Poole steve.poole@orange.fr to me

Dear Sirs,  
May I suggest :

Dupont de Nemours extracted wood for charcoal from most of the 'Côte d'Or' county of France, using the charcoal as feedstock for making nylon. The forests were also managed for high quality timber, wood pulp etc, the remaining trees being used for charcoal making. There are fairly detailed records of this activity which I have supplied to EPRIDA and which I can send you if you wish. (I have collaborated with EPRIDA since the outset).

Biochar production would require good forest husbandry : Traditionally, charcoal was the sole source of fuel for the pre-industrial revolution iron industry, and there are records for this too which I can supply, but in french of course. That is to say that forests were pollarded periodically. Therefore the rooting system of the trees were sustained, they regrew with increased vigour, and biodiversity was therefor maintained.

As part of biochar policy is carbon sequestration, it should be pointed out to critics that only excess CO2 in the air will be removed, that is that originating from fossil fuels. So the forests can produce humus in between branch harvesting. In a nutshell, the forestry side of biochar production was based on sustainable methods for centuries without adverse effects.

I will be subscribing to the IBI shortly.  
Yours Sincerely,  
Stephen Poole.  
Environmental Technician, (retired).

### **37. Tom Miles\*\*\*\*\***

RE: [biochar] Re: IBI Draft Guidleines for Biochar Specifications  
Kelpie,  
Thanks for the reply.

An explanation of why methods were chosen would be far more useful than a compilation of all the reference documents. I doubt that any of us has the time between now and the end of the comment period to consult everything of interest.

The distinction between processed and unprocessed feedstock was not clear from my reading. It still doesn't make a lot of sense.

The purpose of the standard is not clearly stated. For example, the "maximum" levels in Level 1 - 50% ash and 0.7 H:C - appear to relate to stability of carbon or carbon sequestration and not "agricultural purposes" as you indicate below. If you remove the maximums you would have a list of analyses that would be useful without specifying levels for certification. Levels (maximum, minimum or a scale) for certification by IBI for a specific use (e.g. carbon sequestration payments) should be in a separate code or standard.

To quote the Standards of the American Society of Agricultural and Biological Engineers (ASABE):  
Standards, Engineering Practices, and Data (hereafter referred to collectively as standards) are normally generated for one or more of the following reasons:

- To provide interchangeability between similarly functional products and systems manufactured by two or more organizations, thus improving compatibility, safety and performance for users;
- To reduce the variety of components required to serve an industry, thus improving availability and economy;
- To improve personal safety during operation of equipment and application of products and materials;
- To establish performance criteria for products, materials, or systems;
- To provide a common basis for testing, analyzing, describing, or informing regarding the performance and characteristics of products, methods, materials, or systems;
- To provide design data in readily available form;
- To develop a sound basis for codes, education, and legislation; and to promote uniformity of practice;
- To provide a technical basis for international standardization;
- To increase efficiency of engineering effort in design, development, and production.

Standards are engineering requirements (specifications) prepared to define materials, products, processes, tests, testing procedures and performance criteria in an effort to achieve certain specified purposes. They are developed and adopted because of a need for action on a common problem. Their effectiveness is dependent upon voluntary compliance with the standards adopted. Standards must accurately

and specifically define the properties required without unnecessary, restrictive specifications that thwart originality or progress.

<http://www.asabe.org/standards.aspx>

Tom Miles

### **38. Josh Frye \*\*\*\*\***

Date: Sun, 23 Oct 2011 09:44:47 -0400  
From: Josh Frye <fryepoultry@frontiernet.net>  
To: <alennie@prasinogroup.com>

Alennie,

I am still confused, and have not been able to find any info on the feedstock's which are in question as to whether they will meet standard. I have not found any info on criteria in regards to the standards, which must be met in order to be a biochar ie. ash/carbon content. I have looked for it on the IBI sight and can find nothing to answer these questions and wonder if I am just missing it.

I would like to make a correction to a comment I made during a webinar. I am not ok with adding wood chips to the poultry litter in order to increase the carbon content, until I know more about the standards as to whether a fuel or charred residue is considered a biochar. This to me, is like classifying a living organism with regard to the amount of oxygen it requires to be living. I do agree if it is 90% ash it would be difficult to say it is biochar.

I need clarification this.

Respectively

JSF

Joshua S. Frye

P.O. Box 218

Wardensville WV

26851

304-874-4099

### **39. Nikolaus Foidl \*\*\*\*\***

nikolaus foidl nikolausfoidl02@gmail.com to me

Dear All!

There is not sufficient body of proof to define a good quality bio-char for agricultural/ horticultural use yet. At the moment, as i see it, we can only exclude what should not be in a char but not what should be in a char. As well there is not sufficient scientific evidence and proof regarding the physical and chemical composition of char or the temperature, residence time at defined temperature during charring to guide kiln designers towards a optimized kiln design or process design. We only, in general, know what we don't want but we have little clue what we want. As the economic arguments and the agronomic value plus possible value added products will mainly decide if bio-char for soil enhancement will get mainstream, it seems too early to set standards or guidelines. Wouldn't it be more effective at this stage to define at the same level of experts what still has to be done to get a better and more convincing body of proof?

If you do the numbers in the area of water retention, CEC increase, nutrient intake, hiding place for microbes etc. you very fast find out that those values/influences are very marginal compared to what the soil-plant environment needs. As some reports and my own experience show much higher but not always reproduce able effects which can not be explained by the fore mentioned physical and chemical changes, at the moment we can not put the finger on to what causes those positive( and sometimes negative ) effects.

So we are all in a very odd situation, the economic defence argumentation has no base yet and the technical base ( kiln designer/process designer) have no guide or direction where to go.  
with my best regards Nikolaus Foidl

#### **40. Renel Anderson \*\*\*\*\***

Subject: IBI Webinar  
Date: Wed, 19 Oct 2011 16:24:30 -0700 (PDT)  
From: Renel Anderson <renelinvan@yahoo.com>

I appreciated the webinar very much. We are producers and hope to go into commercial production. We plan to make an additional gift to IBI to support your valuable work before the end of the year. We thought we had our house sold and would have the funds by now....but there was trouble on the buyers end. So, as a result we are running lean right now, but plan to show greater support soon as well as to add a few friends as members.

My question is about the earthworm adersion testing. Can you recommend a US Lab. I currently am having our biochar retested by Dave in Watsonville, CA, the lab Kelpie mentioned, but he doesn't do the worm testing, in fact, he said that he thinks the test wouldn't mean much because earthworms are always going to prefer the

environment where they were born to biochar, or banana peels to biochar....etc....and I think now it's a viability test, can they survive it rather than prefer a different environment. Is that correct. In any case, where can a person get such a test run? We are anxious to have all the testing done and ready to submit to you for as high a Level of Certification as possible.

Again, thank you for your work and for the webinar. I hope you can refer me to a USA lab for these more complex tests for Level III, and it would be helpful to know how much an individual will have to pay for these tests. Dave thought some of the tests would be very expensive. We have an opportunity to market many thousand tons a day, but if we have to repeat very expensive tests repeatedly, even though the feedstock and machinery doesn't change, then, the cost to the consumer would go up as well, and the large ag operators are quite keen on cost control. Mainly, I need the name of a lab that is concerned with the advanced testing and is familiar with IBI's guidelines and testing methods particularly for the Level III testing.

Thank You.  
Renel Anderson

#### **41. Josiah Hunt \*\*\*\*\***

From: josiah hunt <josiahhunt@me.com>  
Date: Mon, Oct 17, 2011 at 10:13 PM  
Subject: level 1 characteristics comment  
To: alennie@prasinogroup.com

Alison Lennie,

The language of "organic" and "Inorganic" carbon used in the level 1 characteristics may be very misleading to non-science types who have connected the words to the organic foods and fertilizers. Perhaps other words may be used such as resident vs mobile, fixed v.s labile, charred v.s uncharred.

Thanks,  
Josiah

#### **42. James Joyce \*\*\*\*\***

James james@bigchar.com.au to me

Total Ash guideline

The guidelines refer to Total ash in the following way:

Total Ash 50% (Maximum) % of total mass

Method: Apply loss on ignition (ASTM D1762-84) to ascertain total non-carbonate ash, then add back inorganic carbon as carbonate.

Our comments are:

1. ASTM D1762 does not include the means to determine inorganic carbon as carbonate. How is it proposed that this is determined? Is it ASTM D6316? For the bulk of plant and animal derived materials this correction will be small relative to the natural variation in total ash, however the impost in terms of analytical demand will be significant. In addition given that carbon as carbonate achieves the same carbon capture/stabilisation objective as is usually sought for biochars, it seems unnecessary to exclude this from the total carbon content of the biochar. This is not to say that this measure is not useful for research purposes, however it appears to add an unnecessary analytical impost for production purposes.

2. A total ash limit of 50% effectively excludes the chars generated from any feedstock with an inorganic content of more than 12-15%, depending on the production process used and the associated yield. This includes many biomass sources that are currently used for biochar production, including rice husk (18-24% ash), rice straw (15-20% ash), sugar cane, corn, wheat and maize harvesting residues (10-15% ash .. incl field soil contamination), timber harvesting residues (5 – 12% incl. field soil contamination) and urban greenwaste (15 – 25% ash ... incl. soil contamination). We would contend that even the chars used in the creation of Terra Pretta soils would not have been less than 50% total ash, given the known inclusion of bone and clay materials in the char pits.

There is a large body of evidence to support the claim that biochar from the above sources exhibits all of the key features of biochar with respect to soil benefits and carbon recalcitrance. Hence we propose that a total ash limit of 60% be used, to avoid the exclusion of chars from feedstocks that already have a long history of use as a char type soil amendment. Based on a 60% total ash the nominal total carbon can be expected to be ~35%. At this level it can still be clearly demonstrated that the remaining carbon (a) retains the morphological features of the feedstock material (b) provides most of the effective surface area and porosity present within the respective biochar and (c) is still effective at minimising mineral and nutrient leaching from the resultant product. Hence all of the key features of a biochar remain. The proposed ash content to 60% retains a clear distinction from ash products, both visually and chemically. Ash can be clearly distinguished from a 60% ash biochar in that ash products typically have a total inorganic content of 75-95%, do not retain many of morphological properties of the feedstock, have a much greater lime equivalent than biochars, have much lower nutrient availability and visually vary from a grey to white appearance rather than the characteristic black colour of biochars.

Hence we propose that:

1. the reference to carbonate correction to total ash be deleted
2. the guideline for total ash be amended to 60% on a oven dry basis.

Regards,  
Dr. James Joyce BE Chem (Hons) PhD  
Principal Engineer  
Black is Green Pty Ltd  
Queensland  
Australia  
www.bigchar.com.au  
0417 035 412

### 43. Stephen Rhodes

\*\*\*\*\*

From: Stephen Rhodes <srhodes@dld-international.com>  
Date: Fri, Oct 14, 2011 at 7:54 AM  
Subject: Biochar webinar  
To: alennie@prasinogroup.com  
Cc: Todd Smith <tsmith@specialtydough.com>

Hi Guys,

I only lasted about 25 minutes. It was a classic case of "Death by Power Point"

I can read from slides as well as anyone. It would have been more productive to send a document ahead and open the floor for discussion sooner.

That said, I do appreciate the work being done and you can count on my support in the future.

Best Regards,  
Steve  
Stephen Rhodes  
211 Reservoir Rd.  
Plymouth, NH 03264  
TEL: 603-236-7045  
CELL: 360-961-2258  
FAX: 866-830-5719  
SKYPE: hwam.na

**44. Steve Poole \*\*\*\*\***

Steve Poole [steve.poole@orange.fr](mailto:steve.poole@orange.fr) to me

Dear Sirs,

The incorporation of biochar on its own into into soil does not produce Terra Preta soils.

While awaiting full research proofs, it would do no harm to recommend concurrent planting of leguminous crops to fix soil nitrogen compounds on biochar.

Chilli beans are such crops. I am undertaking trials with lupins here in northern France, but will not have results until the end of 2012.

On its own biochar here does not increase yields, but it does favour survival during drought of plants growing in biochar-added arable soils.

Yours Sincerely,

Stephen Poole.

Environmental Technician, (retired)

Institute for the Promotion of Industry,

French National Chamber of Commerce & Industry,

University of Strasbourg.

**45. Ron Larson \*\*\*\*\***

Alison Lennie [alennie@leadingcarbon.com](mailto:alennie@leadingcarbon.com) to [rongretlarson](mailto:rongretlarson), me

Hello Ron,

Thank you for your comments and questions, we really appreciate the feedback. We will address your questions over the next week or so, and get back to you with some more detailed answers.

In the short term, my initial responses are as follows:

1 & 2) We are still in the midst of contacting labs regarding the cost of the analyses we've required. I had intended to conduct these lab surveys concurrently, but had to prioritize to completing the document and webinars in time for an October public posting and December balloting period. Information on the cost of analysis, once collected, will be shared as part of the FAQs posted on the IBI website.

3) This question, like the question asked in the webinar today about how biochar additives or inoculants are likely to be addressed in subsequent revisions of the document. it does raise an important question about the potential (altered) state of the biochar beyond what is reported under the various test level categories.

4) Like sustainable feedstock production and responsible carbonization practices, my interpretation of the use of pyrolysis gases is that they will likely need to be addressed under a separate document or process beyond the scope of the biochar quality specifications described in our Guideline document.

I hope these questions have helped to answer your questions. Please address any future questions to the BiocharGuidelineIBI@gmail.com address, as we are seeking to ensure that an adequate paper trail is maintained throughout this public commenting period. Thank you once again for attending the webinar and for providing feedback. We really appreciate the comments.

Best Regards,  
Alison

On 12/10/2011 11:30 AM, rongretlarsen@comcast.net wrote:

> Alison:

>

> I thought your event went pretty well today. Congratulations.

>

> I decided as an afterthought to try attending and was successful in hearing all of it. But, I tried using an I-pad, without yet obtaining the message below. Somehow without knowing any secret personal numbers I found myself waiting for the Webinar to start - after instructions on downloading an App.

>

> I have lots of problems with the I-Pad meshing with programs like that which was recommended. But nothing ever showed up on the App showing me how to signal to you. Next time I probably will not use the I-Pad - and I will know whether to (and how to) make a phone contact. So this is just a statement that I found the App less than perfect. Probably the connection to ordinary laptops (not Apple products) will work fine.

>

> The other thing was that I had not known the right e-mail to which I should address questions. My following four, sent 10 minutes before the ending, were therefore not known to you. Next time, I will know. But others may make the same mistake - and so you might look at the general IBI site to which I sent them.

>

> Thanks for your good work.

>

> Ron

>

> 1. Any idea on expected costs for getting each of the three levels?

>

> 2. Anybody doing that now?

>

> 3. Could a statement be required saying how the char was handled after carbonization? Was it quenched?

>  
> 4. Could a statement be allowed as to whether the pyrolysis gases were  
productively used?  
>  
> Ron

rongretlarsen@comcast.net to me

1. Any idea on expected costs for getting each of the three levels?
2. Anybody doing that now?
3. Could a statement be required saying how the char was handled after carbonization? Was it quenched?
4. Could a statement be allowed as to whether the pyrolysis gases were productively used?

Ron

#### **46. David Andersson \*\*\*\*\***

David Andersson david.andersson@ecoera.se to me

Dear Kelpie,

First, I would on behalf of EcoEra thank you for the work done for working towards a biochar standard and guidelines.

I have followed the progress of the specifications work and have noticed a change in the document that I want to confirm or at least give my input to. It is regarding pelletizing of biochar feedstock.

We have been in the project management for a €5 million LIFE Environment Project and have recently been awarded by the European Commission as being a "Best of the Best" type of project. (See PDF.)

Our project is now realized as a complete facility for agroenergy based on agriresidues and we are creating pellets for different uses. Some of our formulas, we are using to create our Bioagrochar biochar product. We have done large-scale (+tonne scale) field applications have resulted in very exciting results. (See the attached biochar yield abstract)

Our reason for pelletizing the biomass is to have a more uniform pyrolysis process, but also to lower any storage or transportation costs. A third reason is to get the

biochar in a uniform structure for ease of field application. (See image: Ecoera Bioagrochar Field Med.jpg)

My point: I have seen that the guidelines regarding physical alteration of the biochar substrate has been removed from the specification document and we think it is a wise move and fully support this. :-)

Keep up the Good work!

Very Best Regards

David

David Andersson

CEO

Ecoera AB

+46-703805410

Ecoera provides knowledge and tools for a sustainable agriculture - using biochar technology for soil carbon capture and bioenergy from biomass waste.

The BIOAGRO Energy System: Storgatan 1 27293 Tommarp, Sweden

[www.bioagroenergy.com](http://www.bioagroenergy.com)

Ecoera is a WWF GlobalFOCUS Climate Entrepreneur company. Learn more at:[www.climatesolver.org](http://www.climatesolver.org)

Member of the Scandinavian Cleantech Export Association.

[www.scandinaviancleantechexport.org](http://www.scandinaviancleantechexport.org)

## **47. SUBMISSION FROM SARAN SOHI AND UKBRC \*\*\*\*\***

Dear IBI

I have pooled some thoughts from colleagues in our Centre.

Given the time available, this is not an official, complete or representative compilation of all views of UKBRC.

(Something we could remedy given a little longer to respond)

Nevertheless, I hope they are of use to you in the development of these important guidelines.

Best wishes,

Dr Saran Sohi

Leader: Soil Science

UK Biochar Research Centre

University of Edinburgh

Crew Building, Rm 119

The King's Buildings

West Mains Road

Edinburgh EH9 3JN

## **COMMENTS ON DRAFT IBI GUIDELINES ON BIOCHAR SPECIFICATION**

**15<sup>th</sup> Nov 2011 compiled by S Sohi**

**Contributions from: Abbie Clare, Rodrigo Ibarrola, Simon Shackley, Andrew Cross, Juan Turrion-Gomez, Ondrej Masek**

1. If the definition of biochar precludes non-biomass feedstock – this precludes any other product meeting the "material specification" for biochar even if it fulfils the same functions or displays the same material requirements – so does this then defeat the 'material standard' point?
2. Some aspects of the definitions for processed and no-processed feedstock appear not to be mutually exclusive
3. The document needs a an 'indicative costs' for meeting each higher level so as to help us understand the commitment / implications associated with each - relevant to our assessment of their utility
4. It is proposed that PAH analysis is required only at the third level / tier of testing. Level 1 is only for virgin feedstock – but bad practice can pyrolyse clean biomass and still create biochar with high PAH levels: is reliance on earthworms / germination tests really adequate for picking up toxicity from this source, given the need for 'standard soils' and so on? Analysis of PAH should be mandatory at least at Level 2
5. In analysis of PAH, there should be a distinction between high and low molecular weight components, since naphthalene is not viewed in the same way as benzopyrene. This fits with soil screening methods being developed by US EPA and UK EA for other soil amendments
6. The limits for metals look arbitrary in the sense they come from one system. There are many systems in place – for some EU states the thresholds look much too relaxed. Given that biochar may not / never be applied on its own or even as a major ingredient, is using limits applied to a raw amendment such as compost the best material from which to select existing limits? One option would be a declaration rather than a threshold (though some risks wit this approach well appreciated)
7. It is recognised that an efficient extraction method for total elemental content that works for all biochar is needed. The modified dry ashing (with a nitric acid digestion and hydrogen peroxide oxidation step) looks promising but may not have been available (in print) to all contributors to the consultation
8. The relationship between formic acid extractable P and plant availability is for high-ash biochar and coarse textured soil and is also (as yet) unpublished and not freely available for inspection during consultation
9. Inorganic C – since some chemists disagree on whether biochar is “organic” it seems wise to “say carbonate carbon” or “carbon bearing minerals” rather than “inorganic carbon”

10. In terms of frequency of biochar assessment – it needs to be explicit as to what constitutes a 'change in feedstock', especially where the feedstock is a blend of two contrasting feedstock (if the ratio changes, has the feedstock 'changed'?)

11. Related, who defines a 'significant change in feedstock'? We know that changing from pine to spruce to large chip changes biochar composition, but what if the feedstock is described as 'coniferous wood' – that technically has not changed in such switch. We think that species is minimum level of specification, but what about processed feedstock?

12. Specification of acceptable variation in process time should perhaps be expressed as a proportion of mean process time. A 10 min variation on a 20 min processing time would have a large bearing on product, in a batch process of a day or more it would be an unimportant factor that may be impractical to adhere to

12. A statement required on permissible post-mixing / blending to meet threshold values for element / compound / characteristic (this came up in the second Nanjing conference). Under EU rules, such practice would likely fall foul of the regulators.

## 48. SUBMISSION FROM PETER SLAVICH AND UNSW-DPI

peter.slavich@industry.nsw.gov.au to me, lukas.van.zwie., Annette, Bhupinderpal, malem.mcleod, warwick.doughe., simon.eldridge, mark.whatmuff, mark.conyers, justine.cox, john.friend, david.waters, georgik, rob.young

Attached is a submission developed with input from soil scientists working within the New South Wales Department of Primary Industries

regards

Dr Peter Slavich  
Research Leader, Soils and Organics Research  
Director, Wollongbar Primary Industries Institute  
Primary Industries NSW Science and Research  
Director, Coastal Agricultural Landscapes Centre, Southern Cross University  
Address  
Wollongbar Primary Industries Institute  
1243 Bruxner Highway  
Wollongbar NSW 2477, Australia  
Ph: 61 2 6626 1352  
Fx: 61 2 6628 1744  
Mobile +61427 201 830  
peter.slavich@industry.nsw.gov.au

14 November, 2011.

## **New South Wales Department of Primary Industries Submission to the International Biochar Research Initiative on “Guidelines for Specifications of Biochars” revision 0.6**

This submission provides comment on the document “Guidelines for Specifications of Biochars” revision 0.6 released by The International Biochar Initiative for public comment.

This submission has been developed with input from scientists working within the New South Wales Department of Primary Industries and provides recommendations to address 7 issues of primary concern. Our comments are designed to strengthen the guideline and we trust they will be considered by the IBI working groups and members as the guideline is revised.

### **Issue 1**

The guideline does not specify a minimum organic carbon % in Table 1, p12.

#### **Discussion**

The guideline will allow any carbonised biomass that has less than 50% total ash regardless of its organic carbon %. Whilst setting a maximum ash will pose a lower limit to the C% this seems a very indirect way of achieving this. It will also make it harder to communicate what level of carbon must be present in biochar to distinguish it from ash.

The intention of the guideline is that the specification should not exclude biochars made from carbonisation of high mineral biomass feedstocks (eg manures, rice husk and sugar cane trash) yet it is appropriate to exclude low-carbon high-ash material produced from uncontrolled burning of high-carbon feed stocks.

We suggest the following solution to discern between these two types of materials: add a specification for the minimum carbon recovery % (CR%) to table 1 on p12.

The carbon recovery (CR) is defined as

$$CR = (\text{Organic C \% of biochar}) \times (\text{biochar yield}) / (\text{Organic C \% of feed stock})$$

Where (biochar yield) is (dry mass biochar)/(dry mass of feed stock)

The guideline could then specify a minimum CR of say 0.2 or 20% if expressed as a percentage. This would force higher ash feed stocks to require higher biochar yields.

This means the maximum ash criteria could be increased to say 70 % (which would pick up most manures and high silica biomass) or be deleted from the specification altogether.

The communication implication is that biochar must retain at least say 20% of the feed stock carbon in a carbonised form.

A labelling of carbon recovery on biochars will also assist carbon accounting assessments.

### **Recommendation 1**

Add to table 1 a minimum carbon recovery of 20% from the original feedstock.

This means the biochar yield and organic carbon content of the feed stock should also be declared in this table as this data will be required to calculate carbon recovery.

## Issue 2

The types of tests required for Level 2 and Level 3 testing include tests which either aim to reduce the risk of adverse impacts of biochars (ie the toxicity tests) or those tests which aim to indicate the potential of the biochar to enhance soil properties (ie the soil enhancement properties). However, the reasons for the two types of testing are very different.

The need for toxicity testing will be determined by regulators and/or advisors and based on the quality of the feedstock and how it is carbonised. The need for more advanced data on soil enhancement properties will be driven more by the consumers and/or advisors based on how the biochar is to be used. There is no logical reason to increase the level of toxicity testing and soil enhancement property testing together.

There would be advantages of grouping testing for soil enhancement properties separately from toxicity testing. This would enable risks associated with different feedstocks to be managed more clearly.

## Recommendation 2

Redefine the testing groups to reflect purpose

Basic biochar characterisation testing (ie minimum testing requirement for unprocessed feedstock and also required for processed feedstocks and MSW feedstocks) - (leave as existing Level 1 tests)

Soil Enhancement property testing (optional for any feedstock)

Level 1 – Basic soil enhancement properties

Level 2- Advanced soil enhancement properties

Toxicity testing (required for specific feedstocks)

Level 1 – Basic soil toxicity (required for processed feedstocks (ie manures, biosolids) and MSW feedstocks)

Level 2 – Advanced soil toxicity properties (required for large scale processed feedstocks, e.g. biosolids and MSW feedstocks)

## Issue 3

There is a contradiction inherent in the document around municipal solid waste (MSW). The document states on p8 under the MSW definition that MSW containing hazardous materials or wastes are “not an eligible feed stock”. However there is a reasonable risk that some components of MSW will contain some level of hazardous waste material eg many materials in MSW contain some level of heavy metals. The level 2 and 3 toxicity testing exist partly because of the land contamination risk associated with hazardous waste material in feed stocks that may end up in the biochar. For this reason any biochar made from MSW should be required to have Level 3 testing.

## Recommendation 3

MSW needs to be added to line 4 on p12

Ie “Biochar from processed feedstocks and MSW must be characterised by Level 2 or higher category tests”.

Add section 5.2 and 5.3

“Biochar made from MSW must be characterised by Level 2 and Level 3 category tests”.

Note- this recommendation is not required if recommendation 2 is accepted

## **Issue 4**

The document does not specify maximum physical contamination limits for biochar. It only states on p9 that the feedstock should not exceed “2% by dry weight of these contaminants (following Brinton 2000)”.

Contaminants as defined by the proposed guideline as stated on p7 could include “fossil fuels and fossil-fuel-derived chemical compounds, glass and metal objects”.

### **Discussion**

We assume that term “fossil-fuel-derived chemical compounds” refers to plastics and if that is the case, suggest the term be replaced as “plastics”.

MSW will have some degree of physical contaminants such as glass, metals and plastics. This is the current situation with MSW based composts. Whilst plastics will carbonise, metals and glass will not and so could end up concentrating in the biochar product. Hence, the guideline needs to provide a specification for maximum concentrations of glass and metals in biochar.

The Brinton reference on p9 refers to physical contaminants (glass, metals, plastics) in compost and not feed stock and so is not an appropriate reference and should be removed from the document. The reference compares physical contamination limits across different compost standards. These are quite variable ranging from zero for organic standards to 3% (Italy) and refer to different combinations of glass, metals or plastics. Compost standards have amalgamated these 3 types of physical contaminants because they are considered “visible contaminants” which may affect the degree to which consumers accept the appearance of the product.

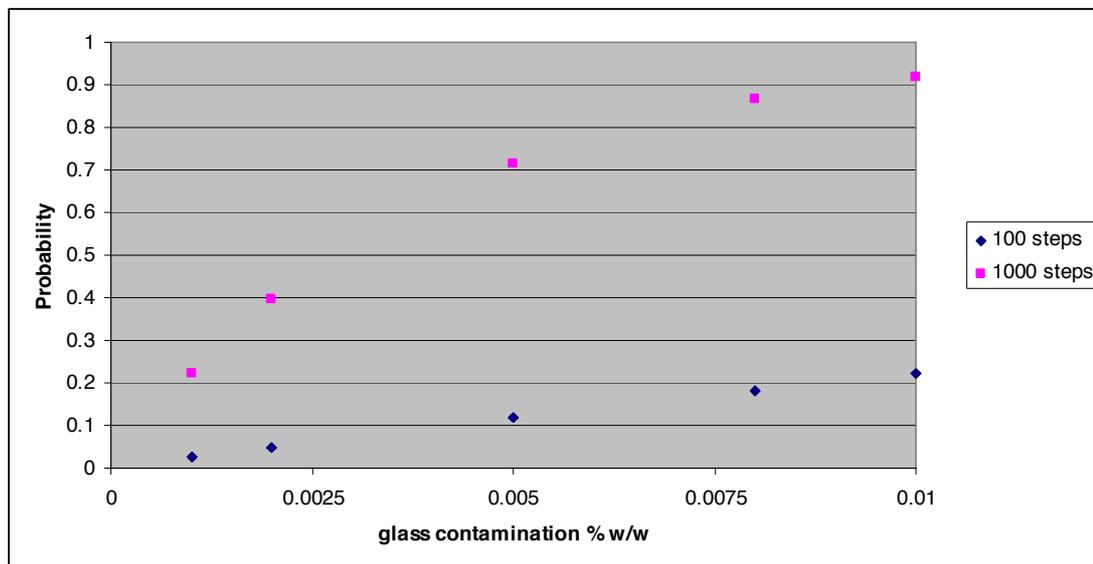
Compost standards have not assessed how the glass content of compost affects the risks to people handling compost or walking on land where glass contaminated compost has been applied. Glass fragments in compost are usually sharp and have the potential to injure skin if glass-skin contact is made. This is also likely to be the case for glass that may end up in biochar. We have recently calculated the probability of a person stepping on a piece of glass for different compost contamination levels, application rates, depth of incorporation and number of foot steps taken. A background paper describing the probability model is available on request. This is an analysis of exposure risk to a potential harmful contaminant for a person walking bare foot across land that has received glass contaminated amendment. The analysis does not consider the harm caused to the person stepping on the glass, rather it calculates the potential for harm to occur. These calculations will apply equally well to biochar.

We conducted a probability analysis for a total biochar loading rate of 50 t/ha and assuming glass particles were 2 mm size (ie average of 0.02 g per particle). The analysis also assumed the biochar was cultivated evenly into the soil to a depth of 15 cm. The analysis was conducted assuming either 100 or 1000 foot steps are taken to represent different potential levels of exposure. These potential exposure levels are arbitrary and are likely to represent relatively low levels of land use in the long term.

The analysis (Figure 1) indicates that the risk of a person stepping on glass are not insignificant for contamination levels of 0.005% w/w glass and are high at 0.01% w/w. These contamination values are much lower than most compost standards allow. For example the Australian Standard for compost currently allows up to 0.5% w/w of glass, metal and plastics.

A separate maximum physical contamination level 2 specification for pieces of metal also needs to be set. The specification should include a maximum size limit. These metal fragments could include visible pieces iron and iron-alloys, aluminium, copper or zinc. These fragments are likely to be less hazardous if contacted. An upper limit on copper and zinc levels is provided for if

whole samples are used for level 2 testing. Upper limits for iron and other iron-alloy fragments should be set at a level which low enough to encourages their recovery and recycling. We suggest that the maximum size of visible metal fragments be less than 2 mm and the total amount of visible metal fragments be less than 0.05 % w/w to encourage metal recovery and recycling.



**Figure 1 Probability of stepping on a piece of glass for biochars with different levels of glass contamination. Assumptions : glass particles average size 2 mm, biochar applied at 50 t/ha and cultivated to 15 cm. Probabilities calculated for two levels of exposure ie after 100 and 1000 foot steps.**

#### Recommendation 4

Whilst biochar ideally should be glass free, this may not be achievable in settings where commercial scale quantities of MSW feedstock are processed into biochar.

The guideline needs to provide a level 2 specification for maximum concentrations of glass in biochar. The maximum glass contamination level should be set at less than 0.001% w/w to reduce risk of exposing land users to contact with glass fragments. The maximum fragment size for glass should be set as 2 mm to further reduce risk hazard.

The maximum size of visible metal fragments be less than 2 mm and the total amount of visible metal fragments be less than 0.05 % w/w to encourage metal recovery and recycling.

If the phrase “fossil-fuel-derived chemical compounds” refers to plastics then we recommend the phrase be replaced by the word “plastics”.

#### Issue 5

The guideline needs further consideration of dioxin thresholds

##### Discussion

Generally dioxin thresholds are expressed as a toxic equivalency factor (specifically TEQ compared to 2,3,7,8 TCDD). This TEQ is a sum and standardisation of a wide range of dioxins, furans and dioxin-like PCBs. The guideline currently has separate thresholds for dioxin and furan, and does not specify whether this is a TEQ, or maximum for an individual congener.

If we assume that the 0.5 ng/kg ( $\text{pg g}^{-1}$ ) stated in the guidelines is a TEQ value, this value is lower than the typical target value for soil of 5  $\text{pg TEQ g}^{-1}$  dm as described by the German derived target value (<http://www.environment.gov.au/settlements/publications/chemicals/dioxins/report-5/index.html>). Further, a food safety standard of 6  $\text{pg TEQ g}^{-1}$  dm is often employed. Therefore, an unrealistically low threshold value has been expressed (assuming this is a TEQ). If the threshold is set at 5  $\text{pg TEQ g}^{-1}$  dm, then biochar could make up 100% of the soil matrix, and still not activate the target threshold. The limit of detection for dioxins is usually 0.05  $\text{pg TEQ g}^{-1}$  for soil. As biochar is usually added at 1-5% soil at a maximum concentration, there would be undetectable changes in soil dioxin TEQ if the biochar contained 5  $\text{pg TEQ g}^{-1}$ .

#### **Recommendation 5.**

The guidelines combine dioxin and furan thresholds, and express as TEQ for dioxins, furans and dioxin-like PCBs. The threshold value be set at 5  $\text{pg TEQ g}^{-1}$  dm.

### **Issue 6**

The maximum allowed threshold of toxicity elements and compounds are uncertain and need to be qualified as “interim criteria” and to be used in conjunction with guidelines developed for specific uses.

#### **Discussion**

Maximum allowable threshold levels of potentially toxic components in biochar are based on levels developed for organic amendments such as composts and biosolids. Maximum levels of potentially hazardous contaminants in organic soil amendments vary widely across jurisdictions. This is partly because the actual hazard caused by use of these contaminants depends on a range of soil properties (but particularly soil pH and clay content), amendment properties, application rates, landuse and crop management.

It is likely that the use of biochars will be unregulated in most jurisdictions. For this reason contaminant risk management criteria in the “Guideline for Specification of Biochars” needs to be conservative so that it not likely to cause harm in the most sensitive uses. Given that little research has been conducted on the bioavailability and fate of contaminants in biochars these criteria should be identified as “interim criteria”.

Actual hazards associated with contaminants in organic amendments are best managed within guidelines developed for more specific use of the amendment. Whilst such guidelines have not yet been developed for biochars, it would be good practice to acknowledge that the maximum thresholds identified in the specification guideline need to be used in conjunction with other guidelines which have been developed for more specific uses of biochars. It may be that the thresholds identified in “Guidelines for specification of biochars” may be too restrictive or too lenient for specific uses.

#### **Recommendation 6**

For toxicity tests - Change “Criteria” in Table 2 and 3 to “Interim Criteria” and add footnote to each table “Maximum thresholds are subject to research and may change as further information becomes available. They should be considered in conjunction with guidelines developed for specific uses of biochars as they become available”.

### **Issue 7**

Title of document

#### **Discussion**

These guidelines are applicable to biochar used as a soil amendment, for carbon sequestration and enhancement of soil properties. However carbonised biomass can have other uses, such as in water treatment. There has been debate over whether the term biochar is applicable to such uses.

For example, it has been proposed that the definition of biochar should include the requirement that it be applied as a soil amendment. On the other hand, there is criticism that these guidelines are not relevant for the full range of applications envisaged for carbonised biomass. This debate will not be easily resolved. The suggested solution is to specify in the title that these guidelines are for biochar intended as a soil amendment. There will then be potential for future guidelines to address other uses of biochar, should it be agreed that other applications are acceptable under the term biochar.

### **Recommendation 7**

Alter the document title to “Guidelines for Specifications of Biochars intended as a soil amendment”

This submission was developed by Dr Peter Slavich, (NSW DPI Research Leader, Soils and Organics Research) with input and/or endorsement from  
Dr Lukas Van Zwieten, Principal Research Scientist  
Prof. Annette Cowie, Director of Rural Climate Solutions.  
Dr Bhupinder Pal Singh, Senior Research Scientist  
Dr Malem McLeod, Research Hydrologist  
Dr Wawick Dougherty, Research Scientist  
Simon Eldridge, Soil Scientists  
Mark Whatmuff, Research Chemist  
Dr Mark Conyers, Principal Research Scientist  
Justine Cox, Soil Health Scientist  
John Friend, Manager Natural Resources Advisory Service  
David Waters, Soil Scientist.

For further information contact

Dr Peter Slavich  
Research Leader, Soils and Organics Research  
Wollongbar Primary Industries Institute  
1243 Bruxner Highway  
Wollongbar NSW 2477, Australia  
Ph: 61 2 6626 1352  
Fx: 61 2 6628 1744  
Mobile +61427 201 830  
[peter.slavich@industry.nsw.gov.au](mailto:peter.slavich@industry.nsw.gov.au)

## 49. James Amonette \*\*\*\*\*

Amonette, James E jim.amonette@pnnl.gov to Kelpie, me

Kelpie,

I think Spokas' approach (i.e., H:C molar ratio < 0.7) is a good one. It's simple, straightforward, and eliminates raw biomass, lignite, and "hydrothermal carbonization" products. If you want to put it in terms of a mass ratio, then the cut-off limit would be H:C mass ratio < 0.06). This might also be listed in the table.

I just noticed that in the labeling example in Appendix 1, the H:C molar ratio is 0.8, which is outside the limit, so might want to change it to 0.5 . . .

The only other method for assessing stability would be resistance to thermal oxidation--this would involve thermogravimetric analysis using O<sub>2</sub> as a carrier gas and would assess the temperature at which biochar oxidizes under controlled conditions. Ultimately, I think this will be the gold standard, but more work is needed before it can be adopted. I have seen several presentations that go this route and it looks promising, since it would account for some other things (physical state, particle size, etc.) that are not accounted for by the H:C ratio.

Here's a van Krevelen plot using mass ratios that shows the limit clearly.

Jim

Using Mass Ratios . . . red line shows upper limit for adequate stability.

