Fraunhofer
UMSICHT

FRAUNHOFER INSTITUTE FOR ENVIRONMENTAL, SAFETY, AND ENERGY TECHNOLOGY UMSICHT

BIOCHAR QUALITY MANAGEMENT

Fabian Stenzel[1], Ataullah Khan[2], Don Harfield[2], Bruce Hillen[3], Andreas Hornung[1]
[1]Fraunhofer Institute for Environmental, Safety, and Energy Technology UMSICHT, Institute Branch Sulzbach-Rosenberg, An der Maxhütte 1, 92237 Sulzbach-Rosenberg, Germany, https://www.umsicht-suro.fraunhofer.de
Phone: +49 9661 908-432, E-mail: fabian.stenzel@umsicht.fraunhofer.de
[2]InnoTech Alberta, Thermochemical Processing and Alberta Biochar Initiative, Canada
[3]Susteen Technologies Canada Ltd., Canada

INTRODUCTION

Biochar is a structurally heterogeneous material, which can be obtained from a wide range of feedstocks including forestry, agricultural, livestock manure, and municipal residues. The availability of multiple feedstocks with different quality grades and the wide variation in process conditions employed in biochar production create a quality control challenge. Therefore it is apt to say that "**Not All Biochars are Created Equal**" through proper feedstock selection, pyrolysis process optimization, and selective post-treatment, the desired characteristics/properties can be tailored to suite a particular application of interest.

MATERIAL AND METHODS

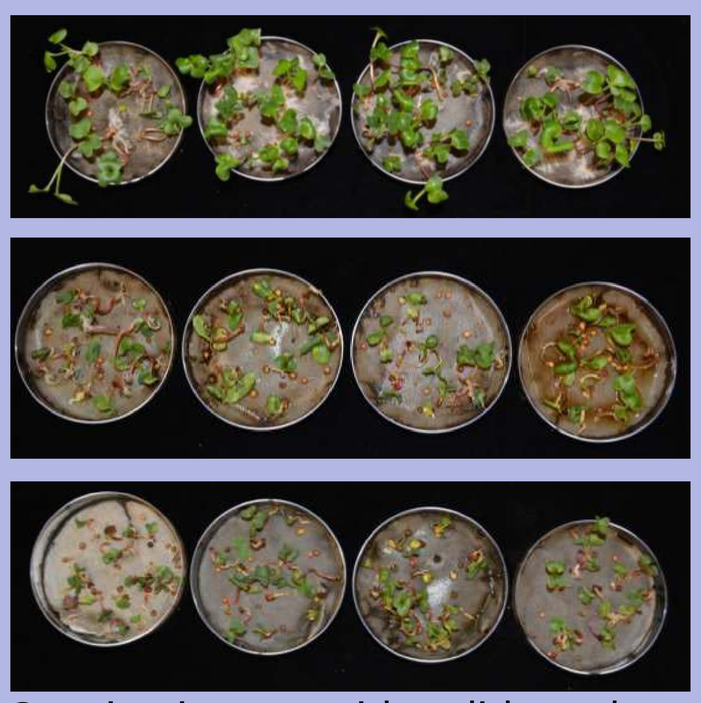
Quality characteristics of wide variety of biochar derived from forestry, agriculture and livestock industry feedstocks will be described. It highlights the importance of developing quality assurance programs over the widely employed quality control programs.
Specific Canadian Food Inspection Agency (CFIA) regulatory guidance for the import or sale of biochar product in Canada have to be considered. Exemplary for biochar from digestate the required parameters for CFIA certification were analyzed.

RESULTS

The results of the analyses of chars from different biogenic residues show the variety of composition. A correlation between carbon, ash content and lower heating value is evident. With an increase of the carbon content the ash content decreases while the lower heating value increases. Regarding the determination of the parameters for the CFIA certification the analyzed values are mostly far below the thresholds. This applies for the heavy metals as well as for the organic pollutants. Furthermore a germination test was carried out. A mixture of 25 wt-% of biochar with different substrates was applied. For the germination of the radish seeds a good shoot growth was observed. For the mixture with compost and soil the root development was not so pronounced.

Composition of biochars from different biogenic residues

Sewage Sludge		Digestate		Brewer Spent Grain		Wood	
C	**22.2 wt.-%**	**C**	**64.0 wt.-%**	**C**	**72.6 wt.-%**	**C**	**89.8 wt.-%**
H	0.9 wt.-%	H	1.0 wt.-%	H	0.1 wt.-%	H	2,2 wt.-%
N	2.0 wt.-%	N	1.4 wt.-%	N	4.6 wt.-%	N	0.3 wt.-%
S	1.0 wt.-%	S	0.5 wt.-%	S	0.4 wt.-%	S	0.1 wt.-%
O	0.0 wt.-%	O	0.7 wt.-%	O	4.9 wt.-%	O	4.5 wt.-%
Ash	**74.4 wt.-%**	**Ash**	**32.0 wt.-%**	**Ash**	**17.5 wt.-%**	**Ash**	**3.1 wt.-%**
LHV 8.2 MJ/kg		LHV 23.0 MJ/kg		LHV 26.0 MJ/kg		LHV 34.4 MJ/kg	



Germination test with radish seeds and TCR® biochar – TChaR® – from digestate

Maximum permissible heavy metal concentration in biosolids for land application in Canada and USA

	Unit	EPA	Ontario	TCR char from digestate
Arsenic	mg/kg DM	75	170	< 0.3
Cadmium	mg/kg DM	85	34	< 0.005
Chromium (total)	mg/kg DM	3000	2800	18
Copper	mg/kg DM	4300	1700	101
Lead	mg/kg DM	840	1100	2.74
Mercury	mg/kg DM	57	11	0.017
Molybdenium	mg/kg DM	75	20	6.44
Nickel	mg/kg DM	420	420	12.1

Limit values for organic pollutants in biochar in accordance to the IBI guidelines

	Unit	IBI	TCR char from digestate
PAH	mg/kg DM	20	0.41
Dioxins	ng/kg DM	9	< 1.8
Furans	ng/kg DM	9	8.1
PCB	mg/kg DM	0.5	0.001

InnoTech ALBERTA

Susteen Technologies sustainable efficient energy