



## MSP700

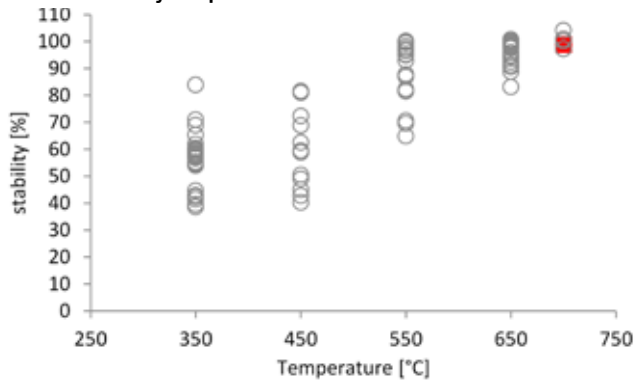
Standard biochar specification sheet – Version 1.0 | November 2014

**Feedstock:** Miscanthus Straw Pellets | **Production:** Pilot-scale rotary kiln pyrolysis unit, nominal peak temperature 700°C

**Key features:** • Reproducible • Extensively characterised • Readily available



Biochar C stability compared to a set of 92 biochar



Basic Utility Properties		Mean	Run-to-Run Variation, SD(n)
Moisture <sup>(a)</sup>	wt% (a.r.)	2.23	0.06 (2)
C <sub>tot</sub>	wt% (d.b.)	79.18	0.07 (2)
H	wt% (d.b.)	1.26	0.12 (2)
O (by difference)	wt% (d.b.)	6.99	0.19 (2)
H:C <sub>tot</sub>	Molar ratio	0.19	0.02 (4)
O:C <sub>tot</sub>	Molar ratio	0.07	0.00 (2)
C <sub>org</sub>	wt% (d.b.)	tbd	tbd
H:C <sub>org</sub>	Molar ratio	tbd	tbd
Total ash <sup>(a)</sup>	wt% (d.b.)	11.55	0.17 (2)
Total N	wt% (d.b.)	1.03	0.03 (2)
pH	[-]	9.72	0.30 (4)
Electric conductivity	dS/m	1.91	0.27 (4)
Liming (if pH above 7)	% CaCO <sub>3</sub>	tbd	tbd
Biochar C stability <sup>(b)</sup>	% C-basis	98.93	0.14 (3)

Production parameters		Mean	Run-to-Run Variation, SD(n)
Nominal HTT	°C	700	- (1)
Reactor wall temp.	°C	700	- (1)
Max. char HTT	°C	tbd	tbd
Heating rate	°C/min	80	- (1)
Kiln residence time	min	12	- (1)
Mean time at HTT	min	tbd	tbd
Biochar yield	wt% (d.b.)	21.07	0.11 (2)
Pyrolysis liquid yield	wt% (d.b.)	33.69	- (1)
Pyrolysis gas yield	wt% (d.b.)	44.29	- (1)
Pyrolysis liquid HHV	MJ/kg	2.29	- (1)
Pyrolysis gas HHV	MJ/kg	12.42	- (1)

Advanced Analysis & Soil Enhancement Properties		Mean	Run-to-Run Variation, SD(n)
Mineral N (ammonium & nitrate)	mg/kg (d.b.)	<3	- (2)
Total P <sup>(c)</sup>	wt% (d.b.)	0.76	0.45 (4)
Total K <sup>(c)</sup>	wt% (d.b.)	2.60	0.75 (4)
Available P	mg/kg (d.b.)	tbd	tbd
Volatile Matter <sup>(a)</sup>	wt% (d.b.)	7.71	0.10 (2)
Total Surface Area	m <sup>2</sup> /g (d.b.)	37.2	- (1)
External Surface Area	m <sup>2</sup> /g (d.b.)	tbd	tbd

Toxicant Reporting - Total Content		Mean	Run-to-Run Variation, SD(n)	comparison vs. recommended standard thresholds+	IBI	EBC (premium)	BQM (high grade)
Germination Inhibition Assay	pass/fail	tbd	tbd		6-20	4	20
Polycyclic Aromatic Hydrocarbons (EPA16) <sup>(d)</sup>	mg/kg dry wt	0.12	0.01 (2)		9	20	20
Dioxin/ Furan (PCDD/ Fs) <sup>(e)</sup>	ng/kg dry wt	3.90	- (1)		0.2-0.5	0.2	0.50
Polychlorinated Biphenyls (PCBs) <sup>(f)</sup>	ng/kg dry wt	0.00	- (1)		12-100	n/a	10
As	mg/kg dry wt	1.60	1.41 (3)		1.4-39	1	3
Cd	mg/kg dry wt	4.58	7.67 (3)		64-1200	80	15
Cr	mg/kg dry wt	36.14	9.99 (3)		40-150	n/a	n/a
Cu	mg/kg dry wt	5.88	0.79 (3)		63-1500	100	40
Pb	mg/kg dry wt	bdl	- (3)		70-500	120	60
Hg	mg/kg dry wt	bdl	- (3)	1-17	1	1	
Mo	mg/kg dry wt	22.63	14.97 (3)	5-20	n/a	10	
Ni	mg/kg dry wt	30.40	3.86 (3)	47-600	30	10	
Se	mg/kg dry wt	bdl	- (3)	1-36	n/a	5	
Zn	mg/kg dry wt	44.53	16.61 (3)	200-7000	400	150	

Notes: HTT=highest treatment temperature, HHV = higher heating value, tbd = to be defined in next version, bdl. = below detection limit, SD = standard deviation (refers to run-to-run consistency, not analytical error) + available standards related to biochar (IBI = International Biochar Initiative, EBC = European Biochar Standard, BQM = Biochar Quality Mandate), \* as TEQ (toxic equivalent) values were bdl, total (tetra to octa chlorinated) dioxin/furan content is reported instead.

(a) TGA, (b) Cross A, Sohi SP (2013), (c) Aqua Regia digestion followed by ICP, (d) Soxhlet extraction (toluene, 6h) determination by GCMS, (e) US EPA 1613, (f) AES O84 (based on US EPA 1668)