



CERTIFICATE OF ANALYSIS

Customer #
607

Order #
1860

Order Status
Order Fulfilled

Report #
1860-CCPF

Date of Report
11th May 2022

Report for: Bernard Carey, Biomass to Biochar Ltd, Derrycon Upper, Mountshannon, Co. Clare, Ireland

Biogas and Biomethane Potential (BMP) - Summary Data

Sample Name	Total Solids (% Wet Basis)	Volatile Solids (% Dry Basis)	Days Digested	Biogas Production (L/kg)			Biomethane Potential (L/kg)			Final Weighted Biogas Composition				
				VS	Dry Mass	Fresh Mass	VS	Dry Mass	Fresh Mass	CH ₄ (%)	CO ₂ (%)	O ₂ (%)	H ₂ S (ppm)	NH ₃ (ppm)
BIOMASS TO BIOCHAR CATTLE SLURRY ^{*a}	9.62	81.33	40	211.7	172.2	16.6	176.4	143.5	13.8	83.4 ^{*b}	16.6 ^{*b}	0.0 ^{*b}	22 ^{*b}	0 ^{*b}
BIOMASS TO BIOCHAR CATTLE SLURRY WITH 10% CHAR ^{*a}	17.43	80.40	40	148.2	119.2	20.8	102.9	82.8	14.4	69.5 ^{*b}	30.5 ^{*b}	0.0 ^{*b}	47 ^{*b}	0 ^{*b}

- Data can also be viewed online at www.celignis.com/output/biogas_list.php?order=1860

- Gas yields are inoculum-subtracted, unless otherwise stated.

- ^{*a} Gas composition not inoculum-subtracted for specific period(s) due to low net gas production. See 'Biogas Composition During Period' table for more information.

- ^{*b} Gas yield and composition data at Day 28 used for calculation of BMP and weighted composition.

Lab Manager Signature:

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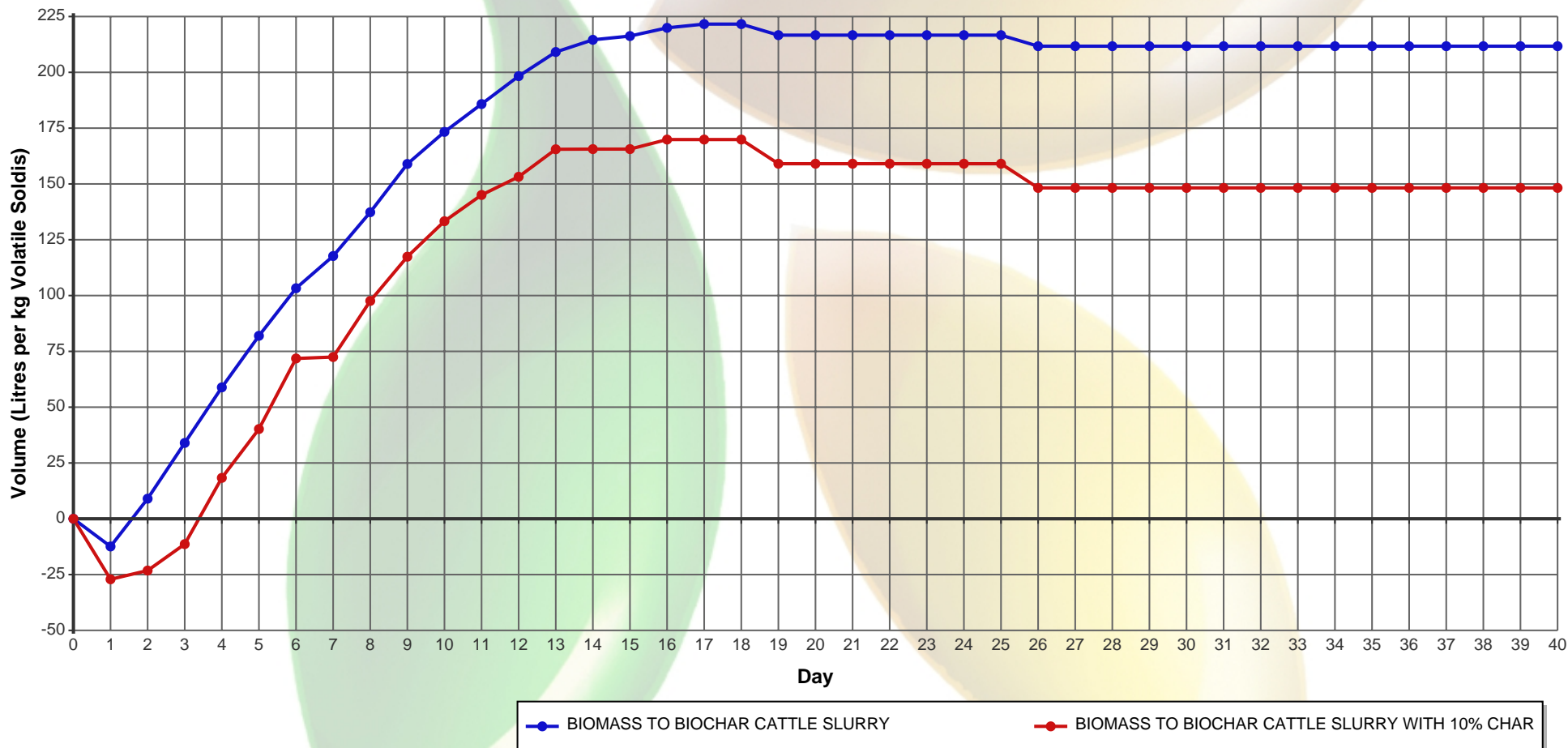
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Biogas Production



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Customer # 607	Order # 1860	Order Status Order Fulfilled	Report # 1860-CCPF
			Date of Report 11th May 2022

Report for: Bernard Carey, Biomass to Biochar Ltd, Derrycon Upper, Mountshannon, Co. Clare, Ireland

Biogas and Biomethane Potential (BMP) - Volatile Solids Basis (Litres per kg VS)

Sample Name	Days Digested	BMP at Day	Biogas Production					Biomethane Potential (BMP)				
			Average	Rep #1	Rep #2	Rep #3	Std. Dev	Average	Rep #1	Rep #2	Rep #3	Std. Dev
BIOMASS TO BIOCHAR CATTLE SLURRY	40	28	211.7	189.3	188.7	257.1	39.3	176.4	158.3	157.6	213.3	31.9
BIOMASS TO BIOCHAR CATTLE SLURRY WITH 10% CHAR	40	28	148.2	176.7	150.0	118.0	29.4	102.9	122.1	104.2	82.5	19.8

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Report for: Bernard Carey, Biomass to Biochar Ltd, Derrycon Upper, Mountshannon, Co. Clare, Ireland

Biogas and Biomethane Potential (BMP) - Dry Mass Basis (Litres per kg Dry Matter)

Sample Name	Days Digested	BMP at Day	Biogas Production					Biomethane Potential (BMP)				
			Average	Rep #1	Rep #2	Rep #3	Std. Dev	Average	Rep #1	Rep #2	Rep #3	Std. Dev
BIOMASS TO BIOCHAR CATTLE SLURRY	40	28	172.2	153.9	153.5	209.1	32.0	143.5	128.7	128.2	173.5	26.0
BIOMASS TO BIOCHAR CATTLE SLURRY WITH 10% CHAR	40	28	119.2	142.0	120.6	94.9	23.6	82.8	98.2	83.7	66.3	15.9

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Biogas and Biomethane Potential (BMP) - Wet Mass Basis (Litres per kg Fresh Matter)

Sample Name	Days Digested	BMP at Day	Biogas Production					Biomethane Potential (BMP)				
			Average	Rep #1	Rep #2	Rep #3	Std. Dev	Average	Rep #1	Rep #2	Rep #3	Std. Dev
BIOMASS TO BIOCHAR CATTLE SLURRY	40	28	16.6	14.8	14.8	20.1	3.1	13.8	12.4	12.3	16.7	2.5
BIOMASS TO BIOCHAR CATTLE SLURRY WITH 10% CHAR	40	28	20.8	24.8	21.0	16.5	4.1	14.4	17.1	14.6	11.6	2.8

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Weighted Biogas Composition (% for CH₄, CO₂ and O₂) (ppm for H₂S and NH₃)

Sample Name	At Day 28					At Day 21				
	CH ₄	CO ₂	O ₂	H ₂ S	NH ₃	CH ₄	CO ₂	O ₂	H ₂ S	NH ₃
BIOMASS TO BIOCHAR CATTLE SLURRY	83.4	16.6	0.0	22	0	83.3	16.7	0.0	22	0
BIOMASS TO BIOCHAR CATTLE SLURRY WITH 10% CHAR	69.5	30.5	0.0	47	0	69.3	30.7	0.0	46	0

- Data can also be viewed online at www.celignis.com/output/biogas_list.php?order=1860

- Composition weighted based on gas volumes over the periods and, unless otherwise stated, inoculum-corrected.

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Weighted Biogas Composition (% for CH₄, CO₂ and O₂) (ppm for H₂S and NH₃)

Sample Name	At Day 14					At Day 7					At Day 3				
	CH ₄	CO ₂	O ₂	H ₂ S	NH ₃	CH ₄	CO ₂	O ₂	H ₂ S	NH ₃	CH ₄	CO ₂	O ₂	H ₂ S	NH ₃
BIOMASS TO BIOCHAR CATTLE SLURRY	83.3	16.7	0.0	22	0	84.1	15.9	0.0	23	0	80.4	19.6	0.0	20	0
BIOMASS TO BIOCHAR CATTLE SLURRY WITH 10% CHAR	69.2	30.8	0.0	46	0	70.9	29.1	0.0	54	0	66.7	33.3	0.0	33	0

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Biogas Composition During Period (% for CH₄, CO₂ and O₂) (ppm for H₂S and NH₃)

Sample Name	Between Days 1 and 3					Between Days 4 and 7					Between Days 8 and 14				
	CH ₄	CO ₂	O ₂	H ₂ S	NH ₃	CH ₄	CO ₂	O ₂	H ₂ S	NH ₃	CH ₄	CO ₂	O ₂	H ₂ S	NH ₃
BIOMASS TO BIOCHAR CATTLE SLURRY	80.4^{*a}	19.6 ^{*a}	0.0 ^{*a}	20 ^{*a}	0 ^{*a}	85.6	14.4	0.0	25	0	82.4	17.6	0.0	22	0
BIOMASS TO BIOCHAR CATTLE SLURRY WITH 10% CHAR	66.7^{*a}	33.3 ^{*a}	0.0 ^{*a}	33 ^{*a}	0 ^{*a}	70.3	29.7	0.0	51	0	67.8	32.2	0.0	39	0

- Data can also be viewed online at www.celignis.com/output/biogas_list.php?order=1860
- Composition is of the gas collected over a given period and, unless otherwise stated, inoculum-corrected.
- ^{*a} Insufficient net gas production for period, biogas composition not inoculum-subtracted.

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Biogas Composition During Period (% for CH₄, CO₂ and O₂) (ppm for H₂S and NH₃)

Sample Name	Between Days 15 and 21					Between Days 22 and 28				
	CH ₄	CO ₂	O ₂	H ₂ S	NH ₃	CH ₄	CO ₂	O ₂	H ₂ S	NH ₃
BIOMASS TO BIOCHAR CATTLE SLURRY	80.4 ^{*a}	19.6 ^{*a}	0.0 ^{*a}	20 ^{*a}	0 ^{*a}	80.4 ^{*a}	19.6 ^{*a}	0.0 ^{*a}	20 ^{*a}	0 ^{*a}
BIOMASS TO BIOCHAR CATTLE SLURRY WITH 10% CHAR	66.7 ^{*a}	33.3 ^{*a}	0.0 ^{*a}	33 ^{*a}	0 ^{*a}	66.7 ^{*a}	33.3 ^{*a}	0.0 ^{*a}	33 ^{*a}	0 ^{*a}

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- ^{*a} Insufficient net gas production for period, biogas composition not inoculum-subtracted.

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Proximate Analysis for Digestion

Sample Name	Dry Matter Basis (% Dry Mass)								As-Received Basis (% Fresh Mass)															
	Ash				Volatile Solids				Moisture Content				Total Solids				Ash				Volatile Solids			
	Av.	R1	R2	SD	Av.	R1	R2	SD	Av.	R1	R2	SD	Av.	R1	R2	SD	Av.	R1	R2	SD	Av.	R1	R2	SD
BIOMASS TO BIOCHAR CATTLE SLURRY	18.67	18.80	18.54	0.18	81.33	81.20	81.46	0.18	90.38	90.38	90.38	0.00	9.62	9.62	9.62	0.00	1.80	1.81	1.78	0.00	7.82	7.81	7.84	0.00
BIOMASS TO BIOCHAR CATTLE SLURRY WITH 10% CHAR	19.60	19.99	19.21	0.56	80.40	80.01	80.79	0.56	82.57	82.14	82.99	0.60	17.43	17.86	17.01	0.60	3.42	3.49	3.35	0.00	14.02	13.95	14.09	0.00

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