



CERTIFICATE OF ANALYSIS

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Order #

Order Status

Report #

Date of Report

1484

Order Fulfilled

1484-11591-ICPF

5th April 2021

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

Sample Name - Hazel Mix Woodchip

Thermal Analysis - Summary Data

Test	Method Reference	Units	As-Received	Dry Mass Basis	Dry Ash-Free Basis
Moisture	EN 14774-1:2009	%	26.27	-	-
Total Solids	Calculated	%	73.73	-	-
Ash	EN 14775:2009	%	3.14	4.26	-
Volatile Solids	Calculated	%	70.59	95.74	-
Carbon	EN 15104:2011	%	36.18	49.08	51.26
Hydrogen	EN 15104:2011	%	4.17	5.65	5.90
Nitrogen	EN 15104:2011	%	1.04	1.41	1.48
Sulphur	EN 15289:2011	%	0.02	0.03	0.03
Chlorine	EN 15289:2011	%	0.0430	0.0583	0.0609
Oxygen	By Difference	%	29.17	39.57	41.33
Volatile Matter	EN 15148:2009	%	56.60	76.77	80.19
Fixed Carbon	By Difference	%	13.98	18.97	19.81
Gross Calorific Value	EN 14918:2009	MJ/kg	14.8834	20.1869	21.0849
Net Calorific Value	EN 14918:2009	MJ/kg	13.3337	18.9555	19.7987

- Data at www.celignis.com/output/analytical_customer_view.php?editid1=28517
- Data converted to different bases according to EN 15296:2011.

Lab Manager Signature:

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Unit 11 Holland Road, Plassey
Tech. Park, Limerick, Ireland

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info@celignis.com

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

Sample Name - Hazel Mix Woodchip

Proximate Analysis - Replicate Data

Dry Matter Basis (% Dry Mass)

Test	Method Reference	Units	Average	Replicate 1	Replicate 2	Standard Deviation
Volatile Solids	EN 14775:2009	%	95.74	95.81	95.67	0.10
Ash	EN 14775:2009	%	4.26	4.19	4.33	0.10
Volatile Matter	EN 15148:2009	%	76.77	76.59	76.96	0.26
Fixed Carbon	By Difference	%	18.97	19.15	18.78	0.26

As-Received Basis (% Wet Mass)

Test	Method Reference	Units	Average	Replicate 1	Replicate 2	Standard Deviation
Moisture Content	EN 14774-1:2009	% wb	26.27	26.67	25.88	0.56
Total Solids	Calculated	% wb	73.73	73.33	74.12	0.56
Volatile Solids	Calculated	% wb	70.59	70.64	70.54	0.07
Ash	Calculated	% wb	3.14	3.09	3.19	0.07
Volatile Matter	Calculated	% wb	56.60	56.47	56.74	0.19
Fixed Carbon	Calculated	% wb	13.98	14.12	13.85	0.19

Dry Ash-Free Basis (% DAF Mass)

Test	Method Reference	Units	Average	Replicate 1	Replicate 2	Standard Deviation
Volatile Matter	Calculated	%	80.19	80.00	80.38	0.27
Fixed Carbon	Calculated	%	19.81	20.00	19.62	0.27

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- Data corrected to different bases according to EN 15296:2011 and EN 14918:2009.

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

Sample Name - Hazel Mix Woodchip
Ultimate Analysis - Replicate Data

Test	Method Reference	Average	Replicate 1	Replicate 2	Standard Deviation
Dry Matter Basis (% Dry Mass)					
Carbon	EN 15104:2011	49.08	49.27	48.88	0.28
Hydrogen	EN 15104:2011	5.65	5.50	5.80	0.22
Nitrogen	EN 15104:2011	1.41	1.44	1.39	0.04
Sulphur	EN 15289:2011	0.03	0.03	0.03	0.00
Chlorine	EN 15289:2011	0.06	0.06	0.06	0.00
Oxygen	Calculated	39.57	39.50	39.64	0.10
As-Received Basis (% Wet Mass)					
Carbon	Calculated	36.18	36.33	36.04	0.20
Hydrogen	Calculated	4.17	4.05	4.28	0.16
Nitrogen	Calculated	1.04	1.06	1.02	0.03
Sulphur	Calculated	0.02	0.02	0.02	0.00
Chlorine	Calculated	0.04	0.04	0.04	0.00
Oxygen	Calculated	29.17	29.12	29.23	0.07
Dry Ash-Free Basis (% DAF)					
Carbon	Calculated	51.26	51.47	51.05	0.29
Hydrogen	Calculated	5.90	5.74	6.06	0.23
Nitrogen	Calculated	1.48	1.51	1.45	0.04
Sulphur	Calculated	0.03	0.03	0.03	0.00
Chlorine	Calculated	0.06	0.06	0.06	0.00
Oxygen	Calculated	41.33	41.26	41.40	0.10

 - Data at www.celignis.com/output/analytical_customer_view.php?editid1=28517

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

Sample Name - Hazel Mix Woodchip

Stoichiometric Methane Potential (SMP)

Volatile Solids Basis (L per kg VS)

	Biogas	Methane	Carbon Dioxide	% Methane
Calculated from Buswell Equation	956	488	468	51.1

Dry Mass Basis (L per kg Dry Matter)

	Biogas	Methane	Carbon Dioxide	% Volatile Solids
Calculated from Buswell Equation	915	468	448	

As-Received Basis (L per kg Fresh Matter)

	Biogas	Methane	Carbon Dioxide	% Total Solids
Calculated from Buswell Equation	675	345	330	

- Data at www.celignis.com/output/analytical_customer_view.php?editid1=28517
- For Buswell Equation see www.celignis.com/anaerobic-digestion.php#buswell

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Sample Name - Hazel Mix Woodchip

Calorific Value - Replicate Data

Dry Matter Basis (MJ/kg)

Test	Method Reference	Units	Average	Replicate 1	Replicate 2	Standard Deviation
Gross Calorific Value	EN 14918:2009	MJ/kg	20.1869	20.2288	20.1450	0.0592
Net Calorific Value	EN 14918:2009	MJ/kg	18.9555	18.9974	18.9136	0.0592

As-Received Basis

Test	Method Reference	Units	Average	Replicate 1	Replicate 2	Standard Deviation
Moisture Content	EN 14774-1:2009	% wb	26.27	26.67	25.88	0.56
Gross Calorific Value	Calculated	MJ/kg	14.8834	14.9143	14.8525	0.0437
Net Calorific Value	Calculated	MJ/kg	13.3337	13.3646	13.3028	0.0437

Dry Ash-Free Basis

Test	Method Reference	Units	Average	Replicate 1	Replicate 2	Standard Deviation
Gross Calorific Value	Calculated	MJ/kg	21.0849	21.1286	21.0411	0.0619
Net Calorific Value	Calculated	MJ/kg	19.7987	19.8424	19.7549	0.0619

- Data at www.celignis.com/output/analytical_customer_view.php?editid1=28517
- The Gross Calorific Value is also known as the Higher Heating Value (HHV).
- The Net Calorific Value is also known as the Lower Heating Value (LHV).
- Data corrected to different bases according to EN 15296:2011 and EN 14918:2009.

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