



CERTIFICATE OF ANALYSIS

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Order #

Order Status

Report #

Date of Report

1383

Order Fulfilled

1383-10953-ICPF

21st December 2020

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

Sample Name - Juncus Sample

Thermal Analysis - Summary Data

Test	Method Reference	Units	As-Received	Dry Mass Basis	Dry Ash-Free Basis
Moisture	EN 14774-1:2009	%	17.43	-	-
Total Solids	Calculated	%	82.57	-	-
Ash	EN 14775:2009	%	2.63	3.18	-
Volatile Solids	Calculated	%	79.94	96.82	-
Carbon	EN 15104:2011	%	40.24	48.74	50.34
Hydrogen	EN 15104:2011	%	5.00	6.06	6.26
Nitrogen	EN 15104:2011	%	1.17	1.42	1.47
Sulphur	EN 15289:2011	%	0.05	0.06	0.06
Chlorine	EN 15289:2011	%	0.2804	0.3396	0.3508
Oxygen	By Difference	%	33.47	40.54	41.87
Volatile Matter	EN 15148:2009	%	64.51	78.13	80.70
Fixed Carbon	By Difference	%	15.43	18.69	19.30
Gross Calorific Value	EN 14918:2009	MJ/kg	15.8546	19.2023	19.8328
Net Calorific Value	EN 14918:2009	MJ/kg	14.3397	17.8833	18.4705

- Data at www.celignis.com/output/analytical_customer_view.php?editid1=27884
- Data converted to different bases according to EN 15296:2011.

Lab Manager Signature:

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

Sample Name - Juncus Sample

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	%	96.82	96.76	96.88	0.09
Ash	EN 14775:2009	%	3.18	3.24	3.12	0.09
Volatile Matter	EN 15148:2009	%	78.13	78.07	78.19	0.09
Fixed Carbon	By Difference	%	18.69	18.75	18.63	0.09

As-Received Basis (% Wet Mass)

Test	Method Reference	Units	Average	Replicate 1	Replicate 2	Standard Deviation
Moisture Content	EN 14774-1:2009	% wb	17.43	17.59	17.28	0.22
Total Solids	Calculated	% wb	82.57	82.41	82.72	0.22
Volatile Solids	Calculated	% wb	79.94	79.89	79.99	0.07
Ash	Calculated	% wb	2.63	2.68	2.58	0.07
Volatile Matter	Calculated	% wb	64.51	64.46	64.56	0.07
Fixed Carbon	Calculated	% wb	15.43	15.48	15.38	0.07

Dry Ash-Free Basis (% DAF Mass)

Test	Method Reference	Units	Average	Replicate 1	Replicate 2	Standard Deviation
Volatile Matter	Calculated	%	80.70	80.63	80.76	0.09
Fixed Carbon	Calculated	%	19.30	19.37	19.24	0.09

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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 - Juncus Sample**Ultimate Analysis - Replicate Data**

Test	Method Reference	Average	Replicate 1	Replicate 2	Standard Deviation
Dry Matter Basis (% Dry Mass)					
Carbon	EN 15104:2011	48.74	48.62	48.86	0.18
Hydrogen	EN 15104:2011	6.06	6.05	6.07	0.01
Nitrogen	EN 15104:2011	1.42	1.44	1.40	0.02
Sulphur	EN 15289:2011	0.06	0.07	0.05	0.01
Chlorine	EN 15289:2011	0.34	0.33	0.34	0.01
Oxygen	Calculated	40.54	40.65	40.43	0.15
As-Received Basis (% Wet Mass)					
Carbon	Calculated	40.24	40.14	40.35	0.14
Hydrogen	Calculated	5.00	4.99	5.01	0.01
Nitrogen	Calculated	1.17	1.19	1.16	0.02
Sulphur	Calculated	0.05	0.06	0.04	0.01
Chlorine	Calculated	0.28	0.28	0.28	0.01
Oxygen	Calculated	33.47	33.56	33.38	0.13
Dry Ash-Free Basis (% DAF)					
Carbon	Calculated	50.34	50.21	50.47	0.18
Hydrogen	Calculated	6.26	6.25	6.27	0.01
Nitrogen	Calculated	1.47	1.49	1.45	0.03
Sulphur	Calculated	0.06	0.07	0.05	0.01
Chlorine	Calculated	0.35	0.35	0.36	0.01
Oxygen	Calculated	41.87	41.98	41.76	0.16

- Data at www.celignis.com/output/analytical_customer_view.php?editid1=27884

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

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Order # 1383 Order Status Order Fulfilled Report # 1383-10953-ICPF Date of Report 21st December 2020

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

Sample Name - Juncus Sample

Stoichiometric Methane Potential (SMP)

Volatile Solids Basis (L per kg VS)

	Biogas	Methane	Carbon Dioxide	% Methane
Calculated from Buswell Equation	939	488	451	52.0

Dry Mass Basis (L per kg Dry Matter)

	Biogas	Methane	Carbon Dioxide	% Volatile Solids
Calculated from Buswell Equation	909	472	437	

As-Received Basis (L per kg Fresh Matter)

	Biogas	Methane	Carbon Dioxide	% Total Solids
Calculated from Buswell Equation	751	390	361	

- Data at www.celignis.com/output/analytical_customer_view.php?editid1=27884
- For Buswell Equation see www.celignis.com/anaerobic-digestion.php#buswell

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

Sample Name - Juncus Sample

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	19.2023	19.2273	19.1772	0.0354
Net Calorific Value	EN 14918:2009	MJ/kg	17.8833	17.9083	17.8583	0.0354

As-Received Basis

Test	Method Reference	Units	Average	Replicate 1	Replicate 2	Standard Deviation
Moisture Content	EN 14774-1:2009	% wb	17.43	17.59	17.28	0.22
Gross Calorific Value	Calculated	MJ/kg	15.8546	15.8753	15.8340	0.0292
Net Calorific Value	Calculated	MJ/kg	14.3397	14.3604	14.3190	0.0292

Dry Ash-Free Basis

Test	Method Reference	Units	Average	Replicate 1	Replicate 2	Standard Deviation
Gross Calorific Value	Calculated	MJ/kg	19.8328	19.8586	19.8070	0.0366
Net Calorific Value	Calculated	MJ/kg	18.4705	18.4964	18.4447	0.0366

- Data at www.celignis.com/output/analytical_customer_view.php?editid1=27884
- 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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