

Full Report Set

ASAP 2020 V3.01 H

Unit 1

Serial #: 336

Page 1

Sample: 20161016_Black Spcuce Biochar
Operator: Shida
Submitter: Amir
File: C:\...\AMIRME~1\000-377.SMP

Started: 2016-10-17 6:03:21PM	Analysis Adsorptive: N2
Completed: 2016-10-18 1:16:32AM	Analysis Bath Temp.: -195.927 °C
Report Time: 2016-10-20 12:48:05PM	Thermal Correction: No
Sample Mass: 0.1718 g	Warm Free Space: 27.6569 cm ³ Measured
Cold Free Space: 85.1597 cm ³	Equilibration Interval: 10 s
Low Pressure Dose: None	Automatic Degas: Yes

Summary Report

Surface Area

Single point surface area at $p/p^\circ = 0.250887534$: 90.3055 m²/g

BET Surface Area: 91.2855 m²/g

Langmuir Surface Area: 129.8156 m²/g

t-Plot Micropore Area: 64.6061 m²/g

t-Plot External Surface Area: 26.6794 m²/g

BJH Adsorption cumulative surface area of pores
between 1.7000 nm and 300.0000 nm diameter: 12.010 m²/g

Pore Volume

Single point adsorption total pore volume of pores
less than 209.2741 nm diameter at $p/p^\circ = 0.990679558$: 0.051454 cm³/g

t-Plot micropore volume: 0.030438 cm³/g

BJH Adsorption cumulative volume of pores
between 1.7000 nm and 300.0000 nm diameter: 0.014620 cm³/g

Pore Size

Adsorption average pore width (4V/A by BET): 2.25466 nm

BJH Adsorption average pore diameter (4V/A): 4.8690 nm

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Isotherm Tabular Report

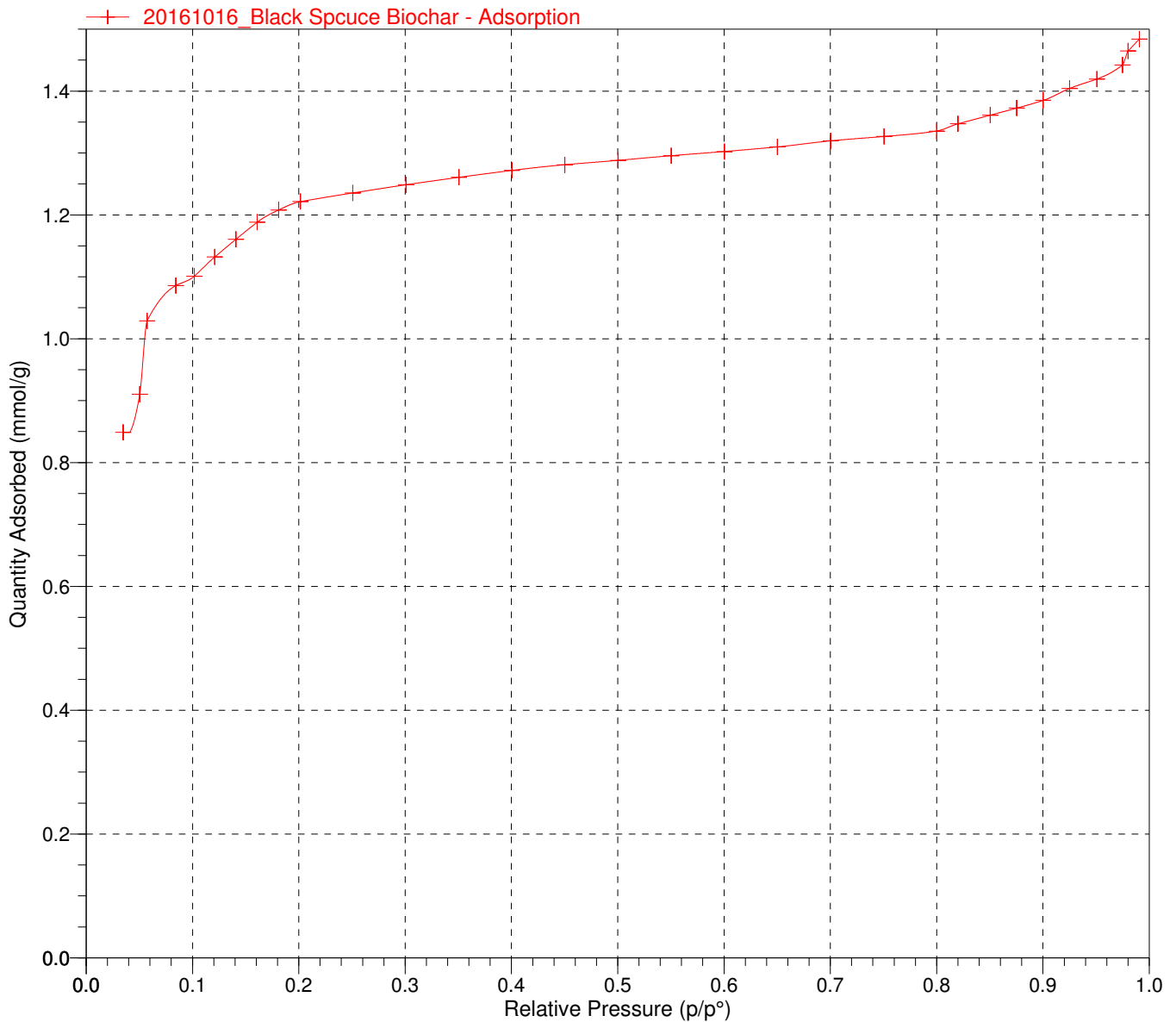
Relative Pressure (p/p°)	Absolute Pressure (kPa)	Quantity Adsorbed (mmol/g)	Elapsed Time (h:min)	Saturation Pressure (kPa)
			03:40	99.7555238
0.034621308	3.4537423	0.84886	03:43	
0.050353911	5.0239604	0.91031	04:04	
0.057228818	5.7119731	1.02894	04:54	
0.084171503	8.4023312	1.08589	05:14	
0.101672664	10.1496620	1.10107	05:18	
0.120914747	12.0713306	1.13199	05:27	
0.140853170	14.0627740	1.16062	05:36	
0.160704331	16.0456487	1.18810	05:44	
			05:46	99.8472318
0.181068572	18.0791957	1.20800	05:50	
0.201411257	20.1103564	1.22143	05:54	
0.250887534	25.0504258	1.23548	05:58	
0.300769121	30.0309642	1.24870	06:01	
0.350684510	35.0148776	1.26071	06:04	
0.400305324	39.9693785	1.27183	06:07	
0.450334281	44.9646313	1.28110	06:10	
0.500286792	49.9522512	1.28813	06:12	
0.550184006	54.9343500	1.29565	06:14	
0.600248822	59.9331832	1.30239	06:17	
0.650142654	64.9149443	1.30984	06:19	
0.700271079	69.9201287	1.31965	06:21	
0.750461890	74.9315423	1.32667	06:24	
0.800171700	79.8949292	1.33542	06:26	
0.819985829	81.8733151	1.34711	06:28	
0.850381011	84.9081900	1.36107	06:31	
0.875194964	87.3857944	1.37248	06:33	
0.900138090	89.8762965	1.38491	06:35	
0.925074697	92.3661477	1.40425	06:38	
0.950622295	94.9170046	1.41948	06:41	
0.974886135	97.3396819	1.44207	06:43	
0.980018800	97.8521643	1.46462	06:47	
0.990679558	98.9166115	1.48411	06:49	

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Isotherm Linear Plot

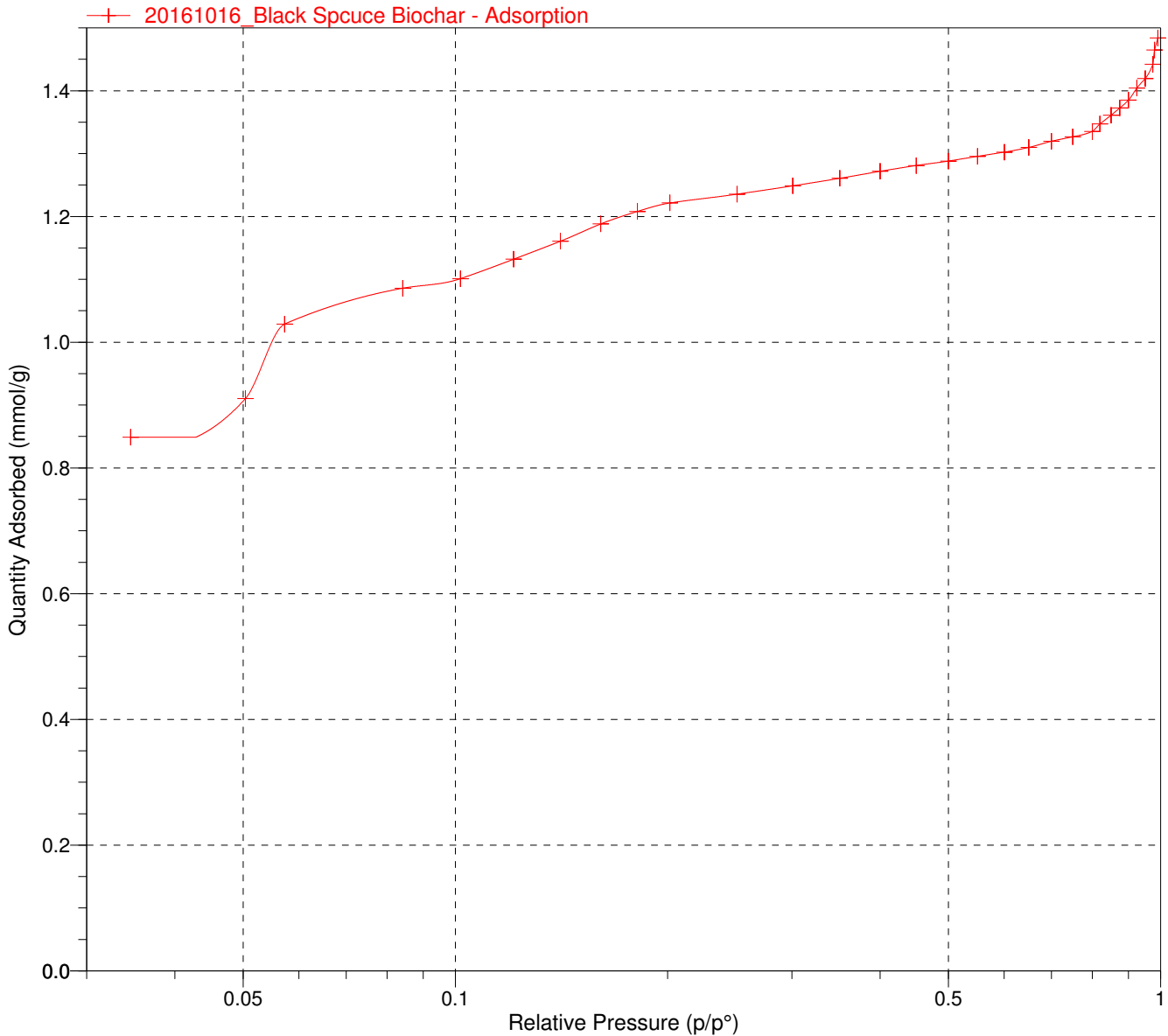


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Isotherm Log Plot



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BET Surface Area Report

BET Surface Area: 91.2855 ± 2.3539 m²/g
 Slope: 1.076335 ± 0.027235 g/mmol
 Y-Intercept: -0.007457 ± 0.004232 g/mmol
 C: -143.331946
 Qm: 0.93556 mmol/g
 Correlation Coefficient: 0.9977665
 Molecular Cross-Sectional Area: 0.1620 nm²

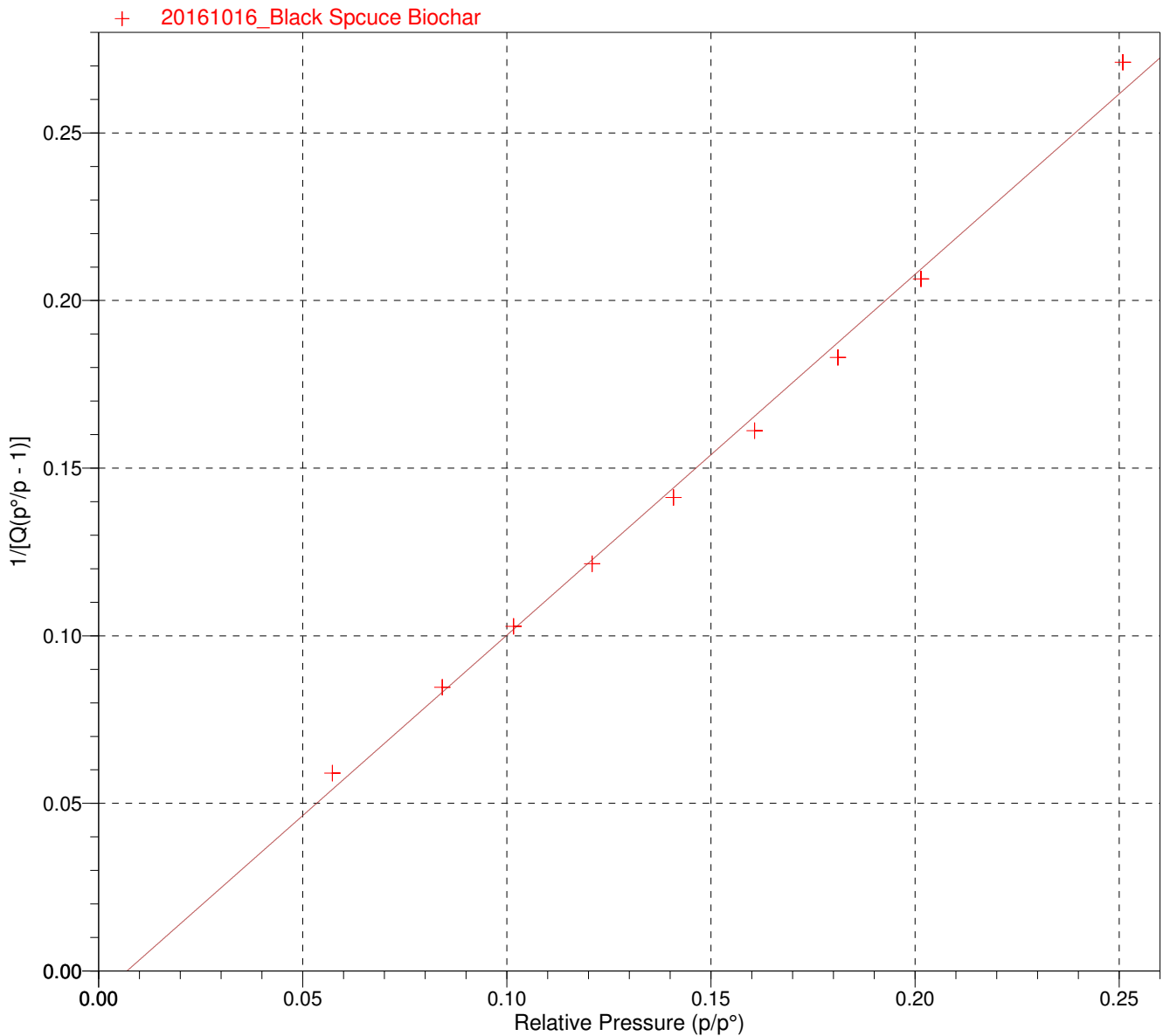
Relative Pressure (p/p ^o)	Quantity Adsorbed (mmol/g)	1/[Q(p ^o /p - 1)]
0.057228818	1.02894	0.05900
0.084171503	1.08589	0.08464
0.101672664	1.10107	0.10279
0.120914747	1.13199	0.12151
0.140853170	1.16062	0.14126
0.160704331	1.18810	0.16116
0.181068572	1.20800	0.18303
0.201411257	1.22143	0.20649
0.250887534	1.23548	0.27108

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BET Surface Area Plot



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 Automatic Degas: Yes

Langmuir Surface Area Report

Langmuir Surface Area: 129.8156 ± 1.2064 m²/g
 Slope: 0.751628 ± 0.006985 g/mmol
 Y-Intercept: 1.447289 ± 0.108364 kPa·g/mmol
 b: 0.519335 1/kPa
 Qm: 1.33045 mmol/g
 Correlation Coefficient: 0.999698
 Molecular Cross-Sectional Area: 0.1620 nm²

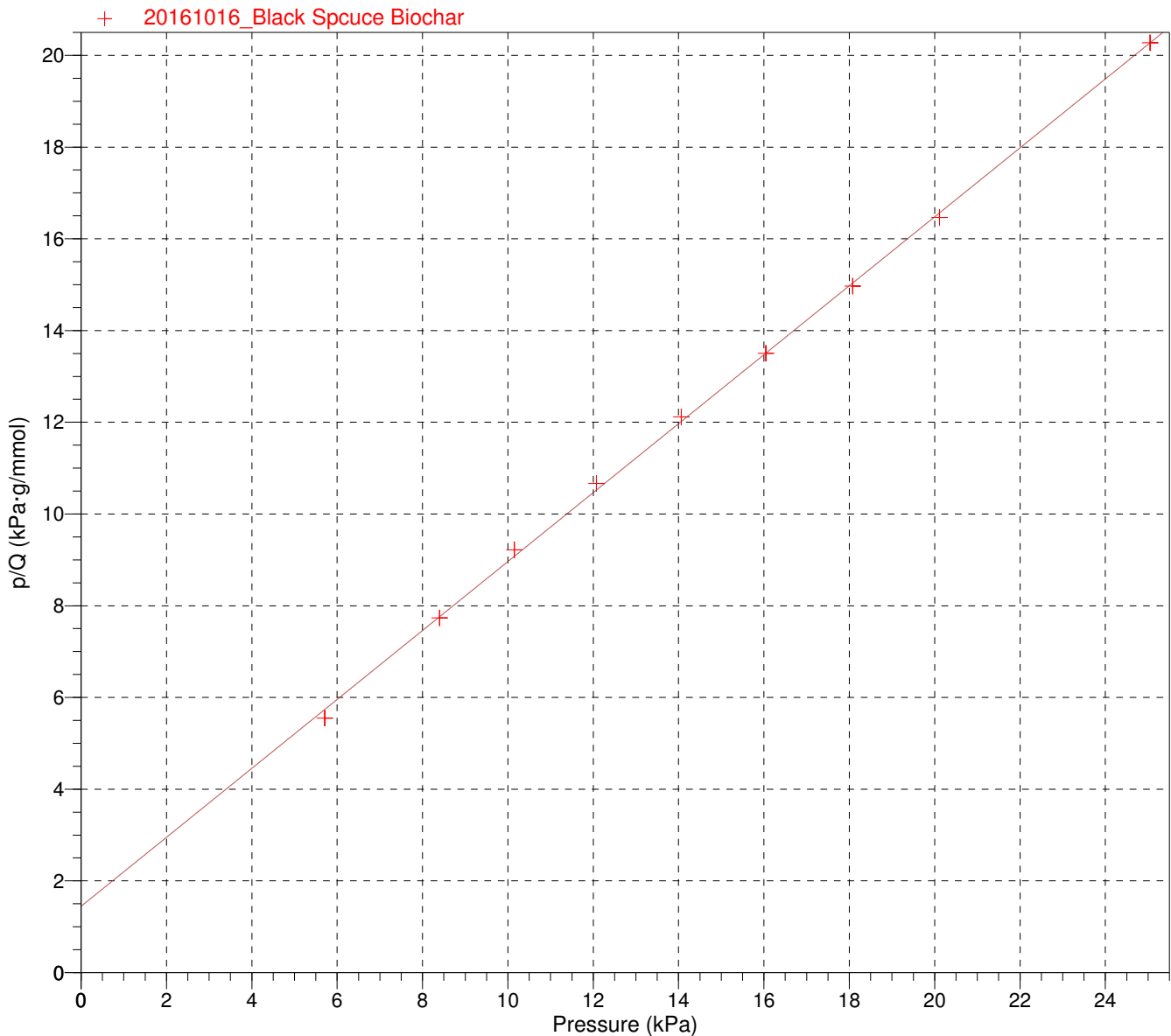
Pressure (kPa)	Quantity Adsorbed (mmol/g)	p/Q (kPa·g/mmol)
5.7119731	1.02894	5.551
8.4023312	1.08589	7.738
10.1496620	1.10107	9.218
12.0713306	1.13199	10.664
14.0627740	1.16062	12.117
16.0456487	1.18810	13.505
18.0791957	1.20800	14.966
20.1103564	1.22143	16.465
25.0504258	1.23548	20.276

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Langmuir Surface Area Plot



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t-Plot Report

Micropore Volume: 0.030438 cm³/g
 Micropore Area: 64.6061 m²/g
 External Surface Area: 26.6794 m²/g
 Slope: 0.769520 ± 0.168650 mmol/g·nm
 Y-Intercept: 0.877942 ± 0.073579 mmol/g
 Correlation Coefficient: 0.955173
 Surface Area Correction Factor: 1.000
 Density Conversion Factor: 0.0015468
 Total Surface Area (BET): 91.2855 m²/g
 Thickness Range: 0.35000 nm to 0.50000 nm
 Thickness Equation: Harkins and Jura

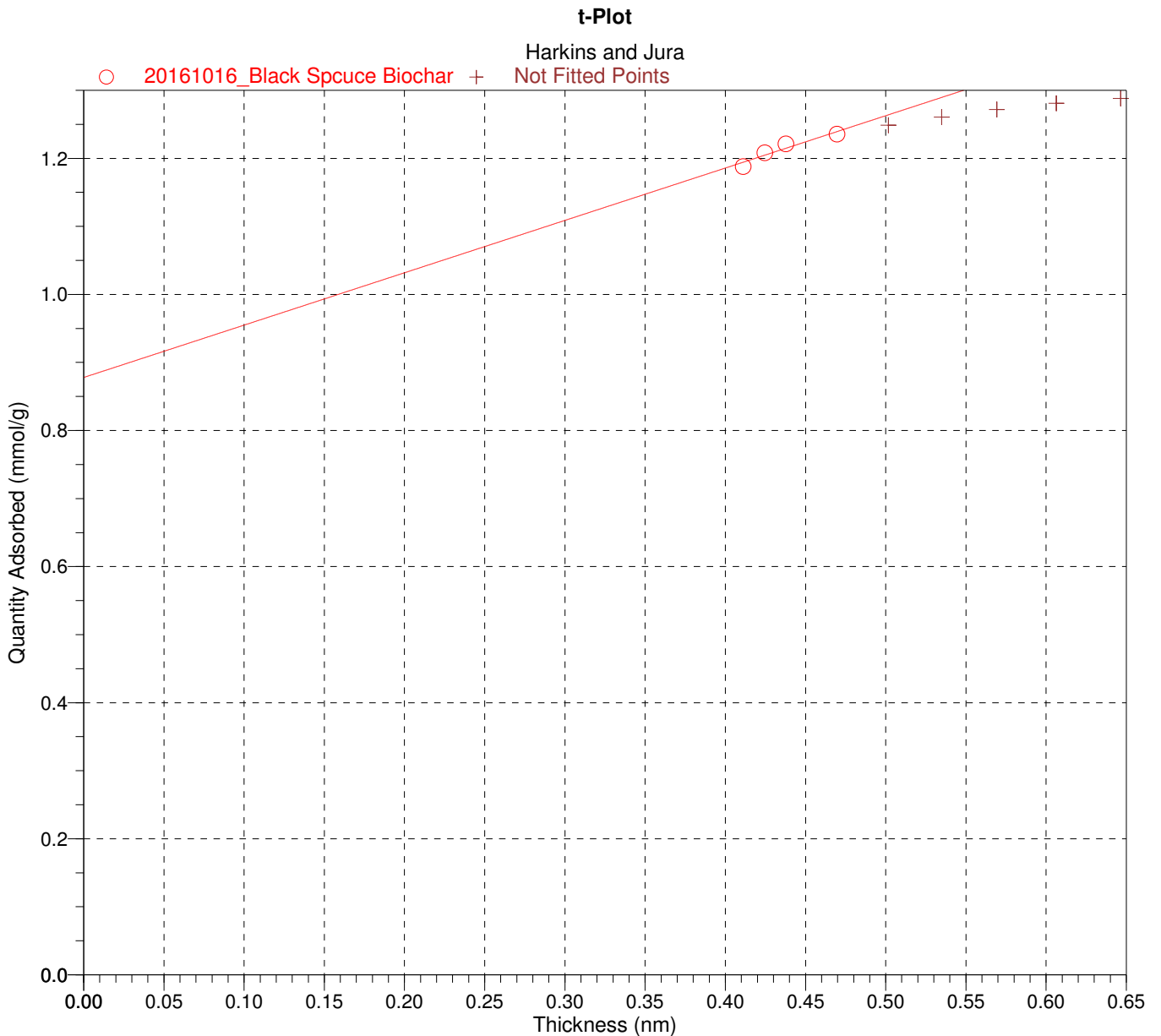
$$t = [13.99 / (0.034 - \log(p/p^\circ))] ^{0.5}$$

Relative Pressure (p/p°)	Statistical Thickness (nm)	Quantity Adsorbed (mmol/g)
0.160704331	0.41106	1.18810
0.181068572	0.42456	1.20800
0.201411257	0.43780	1.22143
0.250887534	0.46955	1.23548
0.300769121	0.50172	1.24870
0.350684510	0.53483	1.26071
0.400305324	0.56933	1.27183
0.450334281	0.60639	1.28110
0.500286792	0.64644	1.28813

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BJH Adsorption Pore Distribution Report

Faas Correction

Halsey

$$t = 3.54 [-5 / \ln(p/p^0)] ^ 0.333$$

Diameter Range: 1.7000 nm to 300.0000 nm

Adsorbate Property Factor: 0.95300 nm

Density Conversion Factor: 0.0015468

Fraction of Pores Open at Both Ends: 0.00

Pore Diameter Range (nm)	Average Diameter (nm)	Incremental Pore Volume (cm ³ /g)	Cumulative Pore Volume (cm ³ /g)	Incremental Pore Area (m ² /g)	Cumulative Pore Area (m ² /g)
209.3 - 98.9	118.5	0.000729	0.000729	0.025	0.025
98.9 - 79.0	86.7	0.000857	0.001587	0.040	0.064
79.0 - 40.9	48.6	0.000870	0.002457	0.072	0.136
40.9 - 27.3	31.4	0.000604	0.003061	0.077	0.213
27.3 - 20.7	23.0	0.000815	0.003876	0.142	0.354
20.7 - 16.7	18.2	0.000527	0.004403	0.116	0.470
16.7 - 14.0	15.1	0.000499	0.004902	0.133	0.603
14.0 - 11.7	12.6	0.000637	0.005539	0.202	0.805
11.7 - 10.5	11.0	0.000561	0.006101	0.203	1.008
10.5 - 8.5	9.3	0.000360	0.006460	0.155	1.164
8.5 - 7.1	7.6	0.000296	0.006756	0.155	1.319
7.1 - 6.0	6.4	0.000495	0.007252	0.307	1.627
6.0 - 5.2	5.6	0.000370	0.007622	0.266	1.892
5.2 - 4.6	4.9	0.000344	0.007966	0.281	2.173
4.6 - 4.1	4.3	0.000422	0.008388	0.389	2.563
4.1 - 3.7	3.9	0.000403	0.008791	0.416	2.979
3.7 - 3.3	3.5	0.000607	0.009399	0.697	3.676
3.3 - 3.0	3.1	0.000793	0.010192	1.008	4.684
3.0 - 2.7	2.8	0.000893	0.011085	1.254	5.938
2.7 - 2.5	2.6	0.001029	0.012114	1.597	7.535
2.5 - 2.2	2.3	0.001124	0.013239	1.933	9.468
2.2 - 2.1	2.2	0.001381	0.014620	2.543	12.010

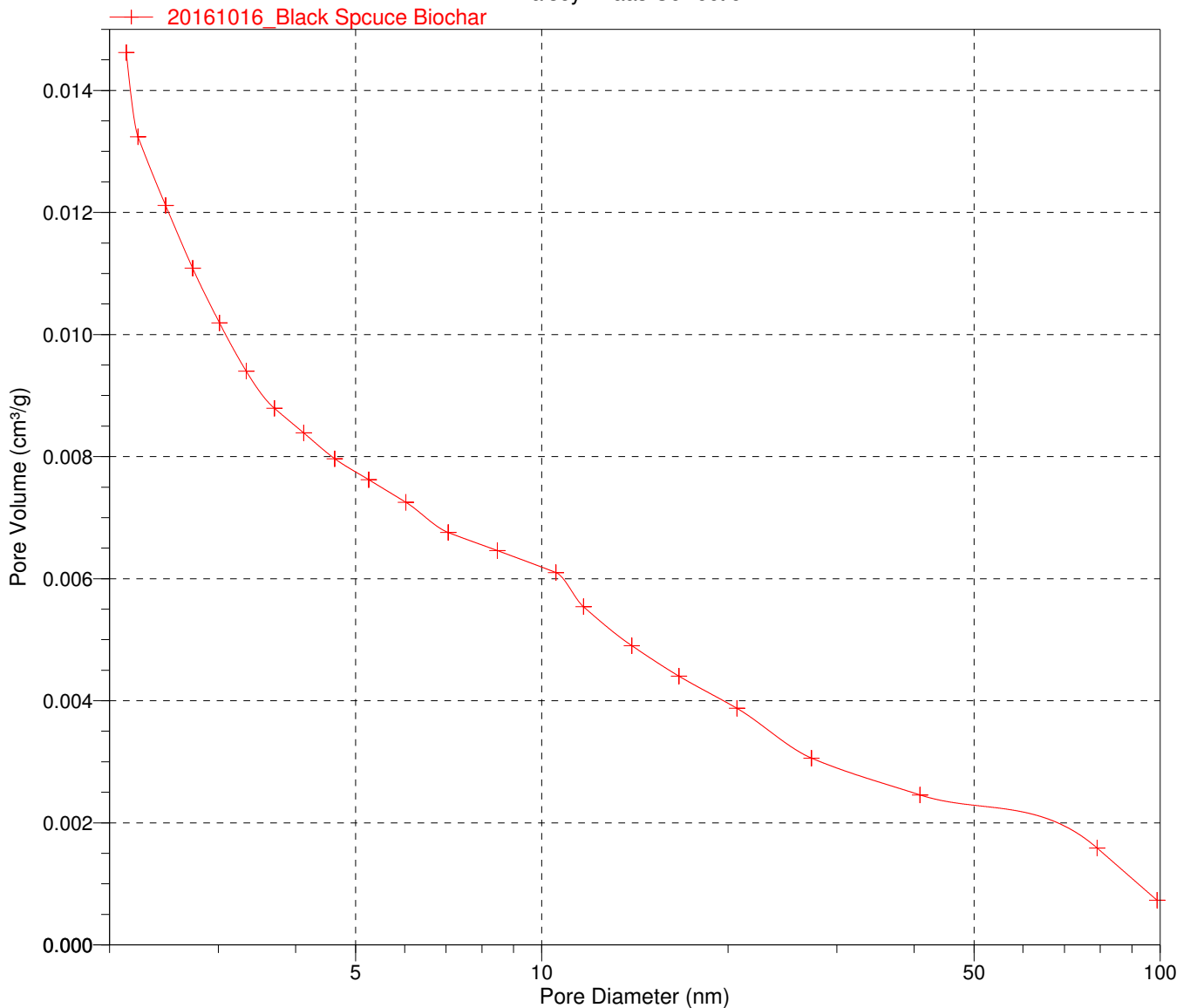
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BJH Adsorption Cumulative Pore Volume

Halsey : Faas Correction



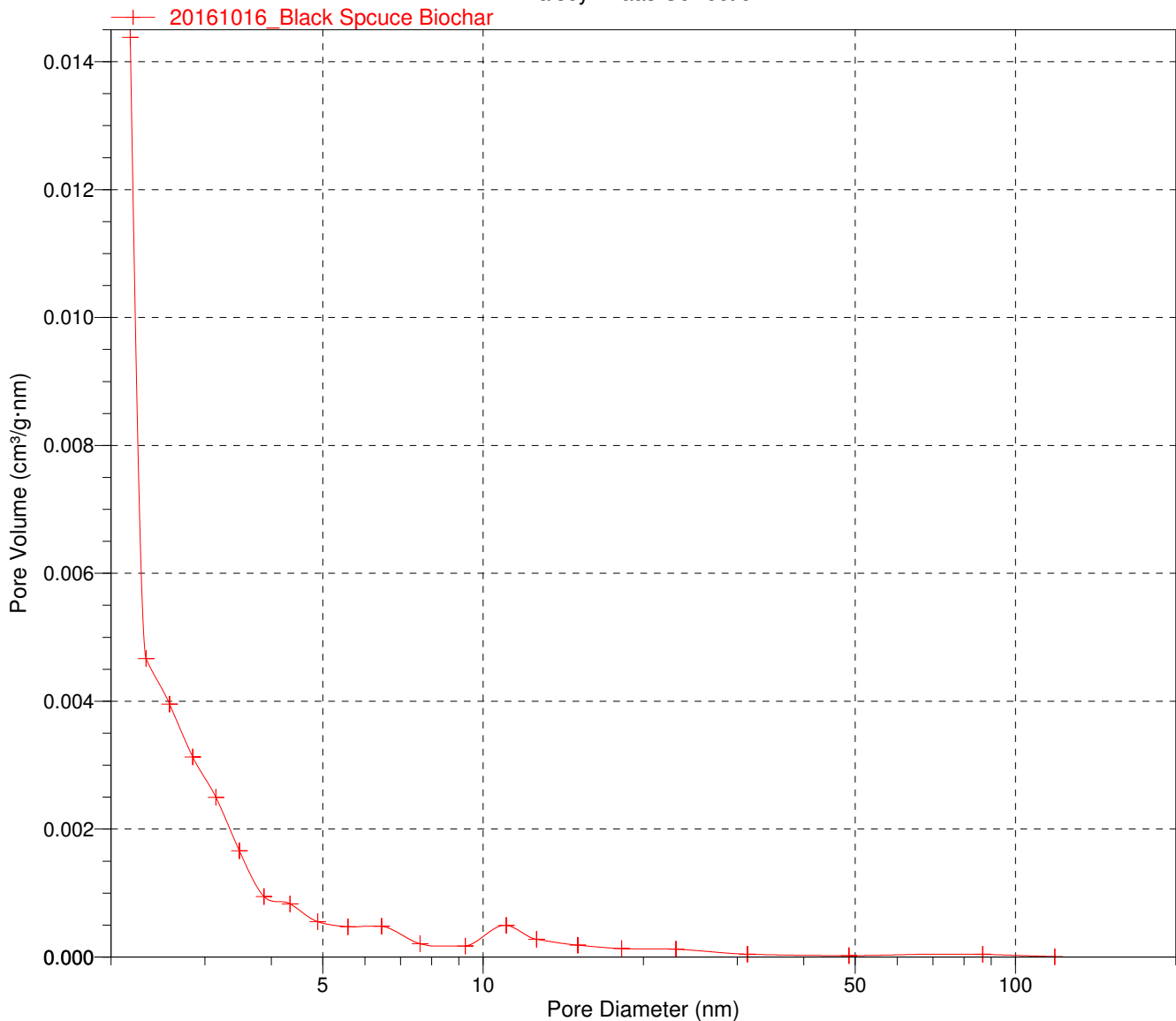
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BJH Adsorption dV/dD Pore Volume

Halsey : Faas Correction



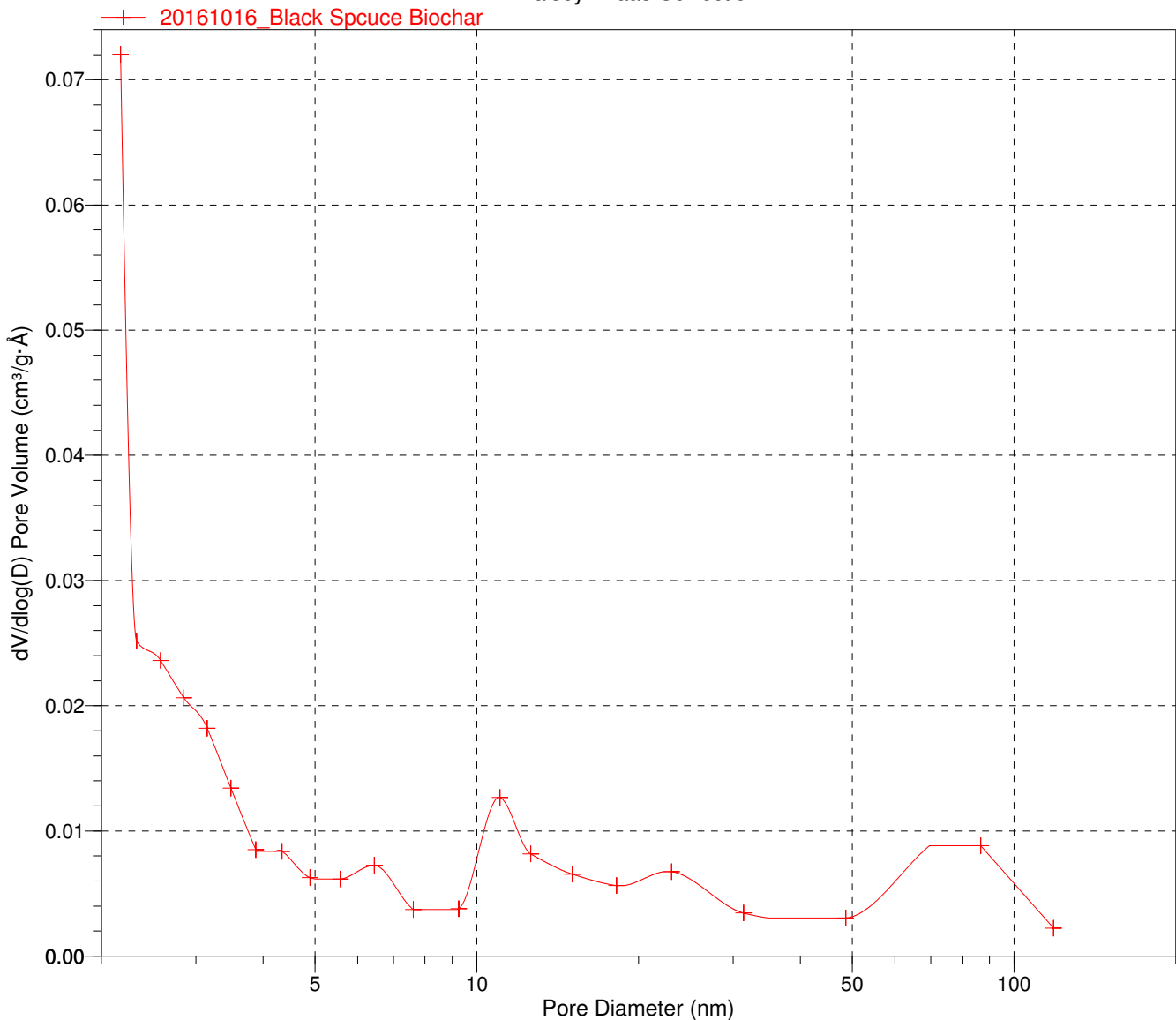
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BJH Adsorption dV/dlog(D) Pore Volume

Halsey : Faas Correction



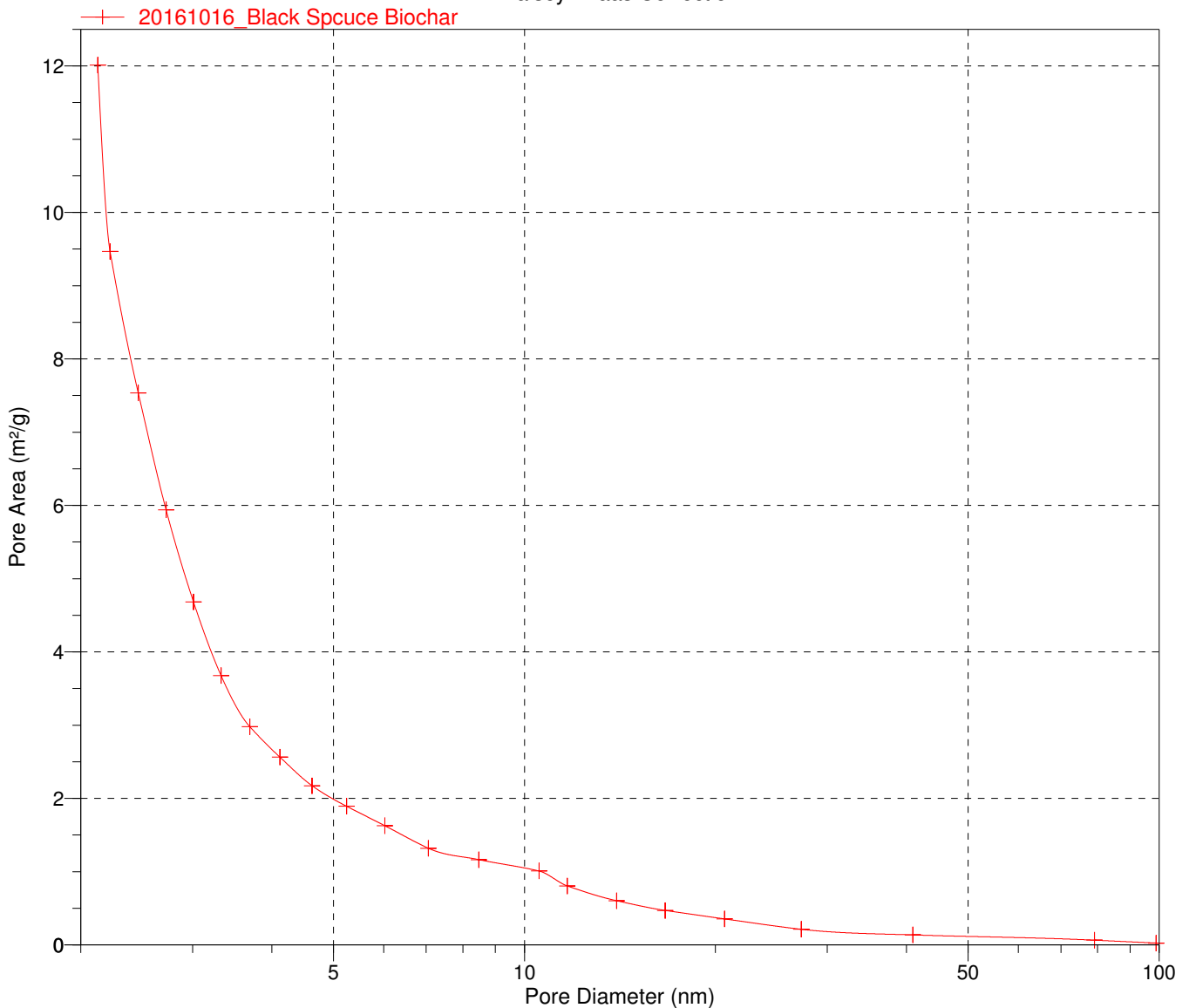
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BJH Adsorption Cumulative Pore Area

Halsey : Faas Correction



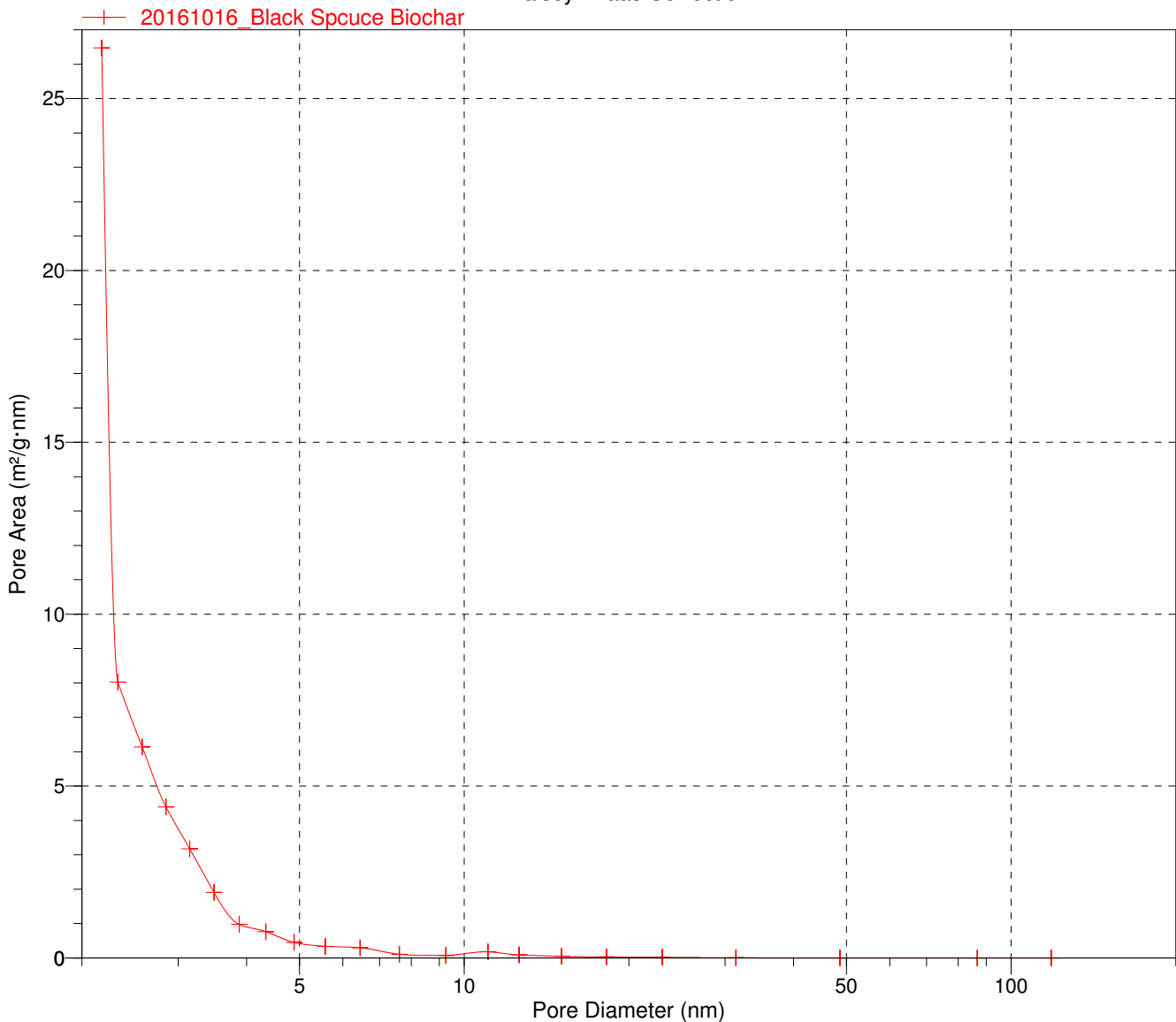
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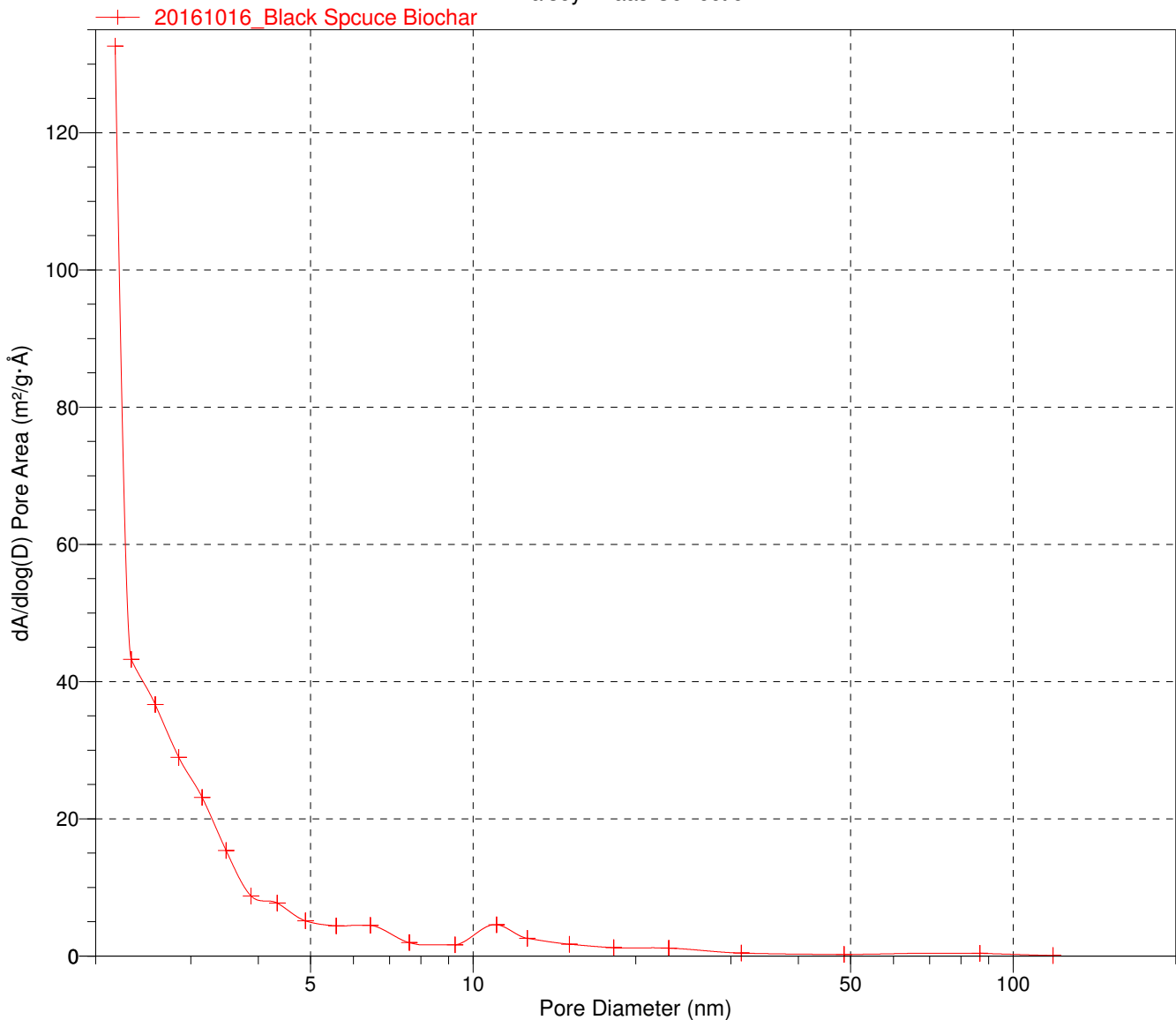


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BJH Adsorption dA/dlog(D) Pore Area

Halsey : Faas Correction



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BJH Desorption Reports

Primary Data

1045- Fewer than 2 points available for BJH Desorption calculations.
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Options Report

Sample Tube

Warm freespace: 1.0000 cm³
Cold freespace: 1.0000 cm³
Non-ideality factor: 0.0000620
Use Isothermal Jacket: Yes
Use Filler Rod: No
Vacuum seal type: Seal Frit

Analysis Conditions

Preparation

Fast evacuation: No
Unrestricted evacuation from: 0.67 kPa
Vacuum setpoint: 1.3 Pa
Evacuation time: 0.10 h
Leak test: No
Use TransSeal: No

Free Space

Free-space type: Measured
Lower dewar for evacuation: Yes
Evacuation time: 0.10 h
Outgas test: No

p° and Temperature

p° and T type: Measure p° at intervals during analysis. Calculate the
Analysis Bath Temperature from these values.
Measurement interval: 120 min

Dosing

Use first pressure fixed dose: No
Use maximum volume increment: No
Target tolerance: 5.0% or 0.6666 kPa
Low pressure dosing: No

Equilibration

Equilibration time (p/p° = 1.000000000): 10 s
Minimum equilibration delay at p/p° >= 0.995: 600 s

Sample Backfill

Backfill at start of analysis: Yes
Backfill at end of analysis: Yes
Backfill gas: N2

Adsorptive Properties

Adsorptive: Nitrogen @ 77.35 K
Maximum manifold pressure: 123.323 kPa
Non-ideality factor: 0.0000620

Sample: 20161016_Black Spcuce Biochar
Operator: Shida
Submitter: Amir
File: C:\...\AMIRME~1\000-377.SMP

Started: 2016-10-17 6:03:21PM	Analysis Adsorptive: N2
Completed: 2016-10-18 1:16:32AM	Analysis Bath Temp.: -195.927 °C
Report Time: 2016-10-20 12:48:05PM	Thermal Correction: No
Sample Mass: 0.1718 g	Warm Free Space: 27.6569 cm ³ Measured
Cold Free Space: 85.1597 cm ³	Equilibration Interval: 10 s
Low Pressure Dose: None	Automatic Degas: Yes

Adsorptive Properties

Density conversion factor: 0.0015468
Therm. tran. hard-sphere diameter: 0.386 nm
Molecular cross-sectional area: 0.162 nm²
Inside diameter of sample tube: 9.53 mm