

March 11th 2025

Graphene synthesis project update for previous week

Objective 1: Production of 300 g of biochar

MRa398A+B

Objective: 1:1.5 test with increasing batch sizes

Experiment details

57.2 g biochar (MB3016/3018/3020 combined, KFT 4.6%) milled (Blendtec, 2x45 sec) with 85.8 g KOH, unloaded in glove box -> 140.2 g dark brown powder, color change from light brown to dark brown during milling (consequence of excessive heating?), no further change in appearance during bottling

A: Rotating oven, 800 °C, 1 h, 3 °C/min, 64.1 g powder used, 12.6 g (110 ml) output

B: Rotating oven, 800 °C, 1 h, 3 °C/min, 76.0 g powder used, 14.2 g (90 ml) output

Result: Normal yield (49%, 47%), mostly species 1, lower amount of atypical structures or species 2 compared to earlier experiments without color change

Conclusion: Quality acceptable, batch size increase for milling leading to color change (due to excessive heating?; beneficial?), reaction batch size unproblematic and further scale-up possible

Recommended action: Continue scale increase, investigate cause and effect of color change

MB3055

Objective: 1:1.5 test with increasing batch sizes

Experiment details

87.2 g biochar (various combined lab batches, KFT 4.7%) milled (Blendtec, 2x45 sec) with 130.8 g KOH, unloaded in glove box -> 214.2 g dark brown powder, color change from light brown to dark brown during milling (consequence of excessive heating?), no further change in appearance during bottling

Rotating oven, 800 °C, 1 h, 3 °C/min, 101.6 g powder used, 19.4 g (105 ml) output

Result: Normal yield (48%), mostly species 1, lower amount of atypical structures or species 2 compared to earlier experiments without color change

Conclusion: Quality acceptable, batch size increase for milling leading to color change (due to excessive heating?; beneficial?), reaction batch size unproblematic and further scale-up possible

Recommended action: Continue scale increase, investigate cause and effect of color change

MRa399

Objective: 1:1.5 test with optimal batch size and increased cooling

Experiment details

50.0 g biochar (various combined lab batches, KFT 4.7%) milled (Blendtec, 3x30 sec) with 75.0 g KOH, unloaded in glove box -> 121.4 g light brown powder, no color change

Rotating oven, 800 °C, 1 h, 3 °C/min, 119.8 g powder used, 21.7 g (125 ml) output

Result: Normal yield (46%), (mostly) species 1, comparable to previous experiments

Conclusion: Batch size feasible without color change during milling, quality unaffected

Recommended action: Continue with same cooling regime, increase batch size stepwise

MRa401

Objective: 1:1.5 test with pilot plant material

Experiment details

50.0 g biochar (pilot plant batch #1, KFT 3.6%) milled (Blendtec, 3x30 sec) with 75.1 g KOH, unloaded in glove box -> 122.3 g light brown powder, no color change

Rotating oven, 800 °C, 1 h, 3 °C/min, 121.8 g powder used, 23.9 g (125 ml) output

Result: Normal yield (49%), (mostly) species 1, comparable to previous experiments

Conclusion: Pilot plant material performs without noticeable difference to lab material

Recommended action: Continue production

MRa402

Objective: 1:1.5 test with pilot plant material with moisture adjusted to 5%

Experiment details

50.0 g biochar (pilot plant batch #1, KFT 3.6%) milled (Blendtec, 10 sec) with 0.7 g water, then milled (Blendtec, 3x30 sec) with 75.0 g KOH, unloaded in glove box -> 122.7 g light brown powder, no color change

Rotating oven, 800 °C, 1 h, 3 °C/min, 122.1 g powder used, 23.6 g (110 ml) output

Result: Normal yield (48%), (mostly) species 1, comparable to previous experiments

Conclusion: No noticeable effect of water addition

Recommended action: Continue production without water addition

MRa403

Objective: Conversion of milled biochar/KOH from MB3055

Experiment details

Milling/Bottling: See MB3055

Rotating oven, 800 °C, 1 h, 3 °C/min, 112.3 g powder used, 21.4 g (120 ml) output

Result: Normal yield (48%), (mostly) species 1, comparable to previous experiments

Conclusion: batch size increase over MB3055 has no impact on outcome

Recommended action: Continue production

Overall status

- 21 rotating oven batches completed, total 190 g (mostly pure) and 42 g (less pure, mixtures) product
- max batch size not reached
- Performance of 1:1 experiments on large scale unsatisfactory
- product quality consistency moderate, blender performance and biochar lot variability suspected cause for quality and consistency deficits
- product density variable (8-15 ml/g), down to 5 ml/g for 1:1 ratio
- current frequency is four batches (approx. 90 g product) per week, further increase in batch size being tested
- step 1 production on lab scale stopped, 2/2 pilot plant batches finished

- So far, most products only characterized by SEM, MRa389A and C also by conductivity measurement (results below)

Objective 2: Testing/Optimization on small scale

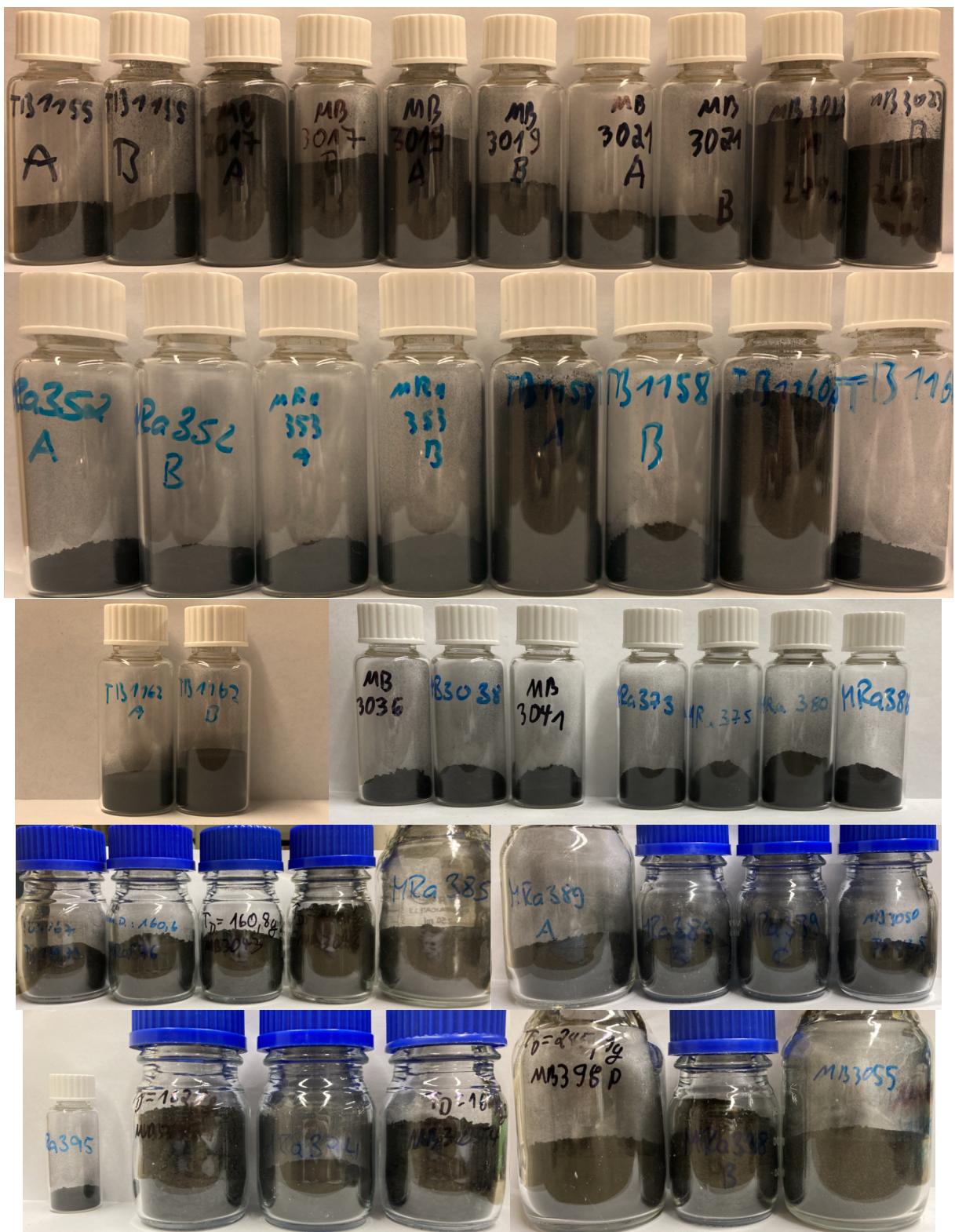
No new experiments on small scale were done this week

Overall status

- Latest changes (increased water content, 1:1 ratio biochar/KOH) not suitable or beneficial

Product pictures







Analytical data

- SEM (and partially Raman) results available on sharepoint for
 - TB1133, MB2946A, MB2947D, TB1135-1, TB1135-2, MB2952B, MB2952C, MB2952C2, MB2955A, MB2955A2, TB1136, MB2962A/B, MB2963A/B, TB1137-1/2/3 (step 2 products), MB2965B, MB2965B2, MB2966A/B, MB2967A/B, MB2970A/B, MB2971A/B, MB2972A/B, MB2973A/B, MB2974A/B, MB2975A/B, MB2976A/B, MB2979A/B, MB2980A/B/C/D, KJo-0165A/B, KJo-0166A/B, KJo-0167A/B, KJo-0168A/B, KJo-0169, KJo-0170, KJo-0171A/B, KJo-0172A/B, KJo-0175, KJo-0176, KJo-0177, KJo-0178, KJo-0171A GR, MB2981A, TB1138, MB2984, MRa320, TB1139, TB1140A, TB1140B, MB2988, MRa323, TB1141, MRa326, MRa327, MRa328, MB2990A, MB2990B, MRa329, MRa331A, MRa331B, MRa333A, MRa333B, MRa334A, MRa334B, MRa2993A, MRa2993B, MB2995A, MB2995B, MB2997A, MB2997B, TB1144A, MB1144B, MB2999A, MB2999B, TB1146, TB1147, MB3001A, MB3001B, MB3003A, MB3003B, MB3004A, MB3004B, TB1151A, TB1151B, MB3007A, MB3007B, MB3009, MB3013A, MB3013B, MB3015A, MB3015B, MRa340A, MRa340B, MB3017A, MB3017B, MB3019A, MB3019B, MB3021A, MB3021B, MB3023A, MB3023B, MRa352A, MRa352B, MRa353A, MRa353B, TB1158A, TB1158B, TB1142, TB1160A, TB1160B, TB1162A, TB1162B, MB3026, MB3027, MB3028, MB3030, TB1165, TB1166, MB3036, MB3038, MRa373, TB1167, MRa375, MB3041, MRa376, MB3043, MRa380, MRa385, MRa386, MB3046, MRa389A, MRa389B, MRa389C, MB3050, MB3051, MB3054, MRa394, MRa395, MRa398A, MRa398B, MB3055, MRa399, MRa401, MRa402, MRa403 (step 2 products)
 - 900561-500MG, 2 lots (Sigma-Aldrich reference)
 - 924458-500MG (Sigma-Aldrich reference "Single-layer graphene sheets for battery, Bio-sourced")
 - Graphene oxide
- TEM results available for
 - MB2955A2 (step 2 product)
 - MB2976A (step 2 product)
 - TB1137-1 (step 2 product)

- BET results

Sample	Multipoint BET Area [m^2/g]	Langmuir Surface Area [m^2/g]	Species
MB2976A	1.88 x 10^3	2.55 x 10^3	mostly 1
MRa329	1.76 x 10^3	2.39 x 10^3	2
MRa333A	2.09 x 10^3	5.74 x 10^3	2
MRa334A	1.86 x 10^3	2.50 x 10^3	mostly 2
MB3001A	1.613 x 10^3	7.763 x 10^3	mostly 2
MB3004A	1.491 x 10^3	2.032 x 10^3	mostly 2
MB3001A/3004A	1.471 x 10^3	1.983 x 10^3	mostly 2
924458-500MG	1.112 x 10^3	1.421 x 10^3	n.a.
900561-500MG	1.942 x 10^1	2.442 x 10^1	n.a.
TB1142	1.257 x 10^3	1.684 x 10^3	1
TB1160B	1.240 x 10^3	1.677 x 10^3	1
TB1165	1.520 x 10^3	2.020 x 10^3	1

- Conductivity results

Material	Species	Data file	Conductivity (S/cm)				Comment
			1 kN	8 kN	12 kN	20 kN	
Species 1 (combined batches, "Coffee grinder"/pellet press/quartz tube oven)	1	TB1142-1	1.4	4.5	5.6	7.2	As sent to Maxwell Technologies and Dr Chris
		TB1142-2	1.4	4.6	5.7	7.4	
Mostly species 2 ("Coffee grinder"/pellet press/quartz tube oven) Lot MB3001A/3004A	Mostly 2	350645-1	5.0	14.5	17.5	22.5	
		350645-2	5.0	13.4	16.1	20.2	
"Single-layer graphene sheets for battery, Bio-sourced, avg. no. of layers, 1" according to Sigma-Aldrich	n.a.	924458-500MG-1	0.1	0.4	0.5	0.7	
"Graphene, powder, electrical conductivity >10^3 S/m, avg. no. of layers, < 3" according to Sigma-Aldrich	n.a.	924458-500MG-2	0.1	0.4	0.5	0.7	
Norit Supac	n.a.	TB1159A-1	2.5	8.0	9.7	12.5	sample sent by Dr Li November 2024
		TB1159A-2	2.5	8.0	9.8	12.5	
Graphite	n.a.	TB1159B-1	51.3	205.8	256.2	329.3	sample sent by Dr Li November 2024
		TB1159B-2	51.0	201.4	251.6	322.7	
Species 1 (Blender/Rotating oven) Lot MRa389A	1	MRa389-A1	4.2	12.1	14.6	18.4	
		MRa389-A2	3.6	10.8	13.3	16.9	
Species 1 (Blender/Rotating oven) Lot MRa389C	1	MRa389-C1	4.1	11.9	14.5	18.4	
		MRa389-C2	4.2	12.2	14.8	18.8	

Experiment overview – Step 1

Experiment	Reactor	Raw material			Acid		T	t	pressure		Wash	Output	
MB2928	AV1	6.0 g	BAFA neu Hemp Fibre VF	100.0 g	0.19%	0.02 M	Sulfuric acid	180 °C	22.5 h	8.7 bar	->	10.4 bar	742 g Water 2.6 g
Comment	Fibres not completely covered by liquid												
MB2933	AV1	6.1 g	BAFA neu Hemp Fibre VF	174.0 g	0.19%	0.02 M	Sulfuric acid	180 °C	24 h	8.7 bar	->	9.5 bar	647 g Water 1.2 g
Comment	dark crusts on glassware, metal and liquid surface removed before filtration												
MB2935	AV1	6.0 g	BAFA neu Hemp Fibre VF	172.9 g	0.19%	0.02 M	Sulfuric acid	180 °C	23 h	8.8 bar	->	9.5 bar	500 g Water 1.3 g
Comment	dark crusts on glassware, metal and liquid surface removed before filtration												
MB2936	AV1	6.0 g	BAFA neu Hemp Fibre VF	172.4 g	0.96%	0.10 M	Sulfuric acid	180 °C	23 h	8.8 bar	->	10.6 bar	589 g Water 0.8 g
Comment	dark crusts on glassware, metal and liquid surface removed before filtration												
MRa225	AV1	6.0 g	BAFA neu Hemp Fibre VF	153.8 g	0.96%	0.10 M	Sulfuric acid	180 °C	24 h	?	->	10.5 bar	500 g Water 0.9 g
Comment	dark crusts on glassware, metal and liquid surface removed before filtration												
MRa228	AV1	6.3 g	BAFA neu Hemp Fibre VF	154.0 g	0.96%	0.10 M	Sulfuric acid	180 °C	22.5 h	8.7 bar	->	11.0 bar	500 g Water 0.9 g
Comment	dark crusts on glassware, metal and liquid surface removed before filtration												
MRa231	AV1	6.1 g	BAFA neu Hemp Fibre VF	168.8 g	0.96%	0.10 M	Sulfuric acid	180 °C	23.5 h	8.0 bar	->	10.5 bar	500 g Water 0.8 g
Comment	dark crusts on glassware, metal and liquid surface removed before filtration												
MB2937	AV1	9.4 g	Canadian Rockies Hemp	179.3 g	0.96%	0.10 M	Sulfuric acid	180 °C	24 h	8.6 bar	->	10.9 bar	569 g Water 1.6 g
Comment	very low amount of foreign material observed and removed during filtration												
MB2938	AV1	8.9 g	Canadian Rockies Hemp	175.0 g	0.96%	0.10 M	Sulfuric acid	180 °C	23.5 h	9.2 bar	->	13.2 bar	577 g Water 1.4 g
Comment	very low amount of foreign material observed and removed during filtration												
MB2940	AV1	9.2 g	Canadian Rockies Hemp	177.1 g	0.96%	0.10 M	Sulfuric acid	180 °C	22.5 h	8.7 bar	->	10.6 bar	555 g Water 1.5 g
Comment	very low amount of foreign material observed and removed during filtration												
MB2942	AV1	8.9 g	Canadian Rockies Hemp	177.6 g	0.96%	0.10 M	Sulfuric acid	180 °C	23 h	8.3 bar	->	13.5 bar	578 g Water 1.6 g
Comment	low amount of foreign material observed and removed during filtration												
MB2943	AV1	9.8 g	Canadian Rockies Hemp	178.2 g	0.96%	0.10 M	Sulfuric acid	180 °C	24 h	8.3 bar	->	12.7 bar	611 g Water 1.7 g
Comment	low amount of foreign material observed and removed during filtration												
MB2944	AV1	9.0 g	Canadian Rockies Hemp	178.4 g	0.96%	0.10 M	Sulfuric acid	180 °C	24 h	8.4 bar	->	9.7 bar	593 g Water 1.8 g
Comment	low amount of foreign material observed and removed during filtration												
MB2945	AV1	9.1 g	Canadian Rockies Hemp	177.7 g	0.96%	0.10 M	Sulfuric acid	180 °C	24 h	8.7 bar	->	9.8 bar	6 g Water 1.6 g
Comment	low amount of foreign material observed and removed during filtration												
MB2948	AV1	9.4 g	Canadian Rockies Hemp	175.1 g	0.96%	0.10 M	Sulfuric acid	180 °C	25 h	9.0 bar	->	12.6 bar	475 g Water 1.7 g
Comment	low amount of foreign material observed and removed during filtration												

Experiment	Reactor	Raw material			Acid		T	t	pressure		Wash	Output	Drying	KFT		
MB2949	AV1	9.2 g	Canadian Rockies Hemp		174.3 g	0.96%	0.10 M	Sulfuric acid	180 °C	23.5 h	8.4 bar	->	10.2 bar	538 g	Water	1.8 g
Comment	low amount of foreign material observed and removed during filtration															
MB2950	AV1	9.1 g	Canadian Rockies Hemp		170.5 g	0.96%	0.10 M	Sulfuric acid	180 °C	23 h		->	11.1 bar	534 g	Water	1.6 g
Comment	low amount of foreign material observed and removed during filtration															
MB2951	AV1	9.3 g	Canadian Rockies Hemp		178.5 g	0.96%	0.10 M	Sulfuric acid	180 °C	24 h	9.1 bar	->	11.2 bar	575 g	Water	1.8 g
Comment	low amount of foreign material observed and removed during filtration															
MRa255	AV1	9.2 g	Canadian Rockies Hemp		170.8 g	0.96%	0.10 M	Sulfuric acid	180 °C	23.5 h	8.1 bar	->	12.8 bar	488 g	Water	1.7 g
Comment	some foreign material observed and removed during filtration															
MB2953	AV1	9.7 g	Canadian Rockies Hemp		177.1 g	0.96%	0.10 M	Sulfuric acid	180 °C	23.5 h	9.1 bar	->	10.4 bar	558 g	Water	1.8 g
Comment	low amount of foreign material observed and removed during filtration															
MB2956	AV1	9.8 g	Canadian Rockies Hemp		172.0 g	0.96%	0.10 M	Sulfuric acid	180 °C	24 h	8.6 bar	->	12.5 bar	548 g	Water	1.9 g
Comment	low amount of foreign material observed and removed during filtration															
MB2957	AV1	9.1 g	Canadian Rockies Hemp		176.8 g	1.50%	0.15 M	Sulfuric acid	180 °C	23.5 h	8.8 bar	->	8.5 bar	589 g	Water	1.5 g
Comment																
MB2958	AV1	9.3 g	Canadian Rockies Hemp		177.0 g	2.00%	0.20 M	Sulfuric acid	180 °C	24 h	8.9 bar	->	8.7 bar	562 g	Water	1.8 g
Comment																
MB2959	AV5	76.0 g	Canadian Rockies Hemp		953.0 g	1.00%	0.10 M	Sulfuric acid	180 °C	25 h				3957 g	Water	14.9 g
Comment	low amount of foreign material observed and removed during filtration															
MB2960	AV1	3.8 g	Canadian Rockies Hemp (cut)		151.0 g	1.00%	0.10 M	Sulfuric acid	180 °C	24 h	8.8 bar	->	10.5 bar	300 g	Water	0.6 g
Comment	Reaction performed with stirring															
MB2961	AV1	9.9 g	Canadian Rockies Hemp		172.0 g	5.00%	0.51 M	Sulfuric acid	180 °C	24 h	10.1 bar	->	16.1 bar	563 g	Water	1.7 g
Comment	low amount of foreign material observed and removed during filtration															
MB2964	AV1	9.0 g	Canadian Rockies Hemp		211.0 g + 140.8 g	1.00%	0.10 M	Sulfuric acid	180 °C	24 h	8.6 bar	->	8.8 bar	310 g + 603 g	Water	1.3 g
Comment	Hemp boiled with 1% H ₂ SO ₄ at 95 °C, filtered and washed, then heated in Autoclave with fresh acid															
MB2978	AV5	76.3 g	Canadian Rockies Hemp		822.0 g	1.00%	0.10 M	Sulfuric acid	180 °C	22 h				4112 g	Water	15.4 g
Comment																
KJo-0173	AV5	77.1 g	Canadian Rockies Hemp		942.1 g	1.00%	0.10 M	Sulfuric acid	185 °C	24 h				4283 g	Water	16.5 g
Comment																
KJo-0174	AV5	77.1 g	Canadian Rockies Hemp		945.0 g	1.00%	0.10 M	Sulfuric acid	190 °C	24 h				4384 g	Water	15.8 g
Comment																
MB2982	AV5	77.1 g	Canadian Rockies Hemp		999.5 g	1.00%	0.10 M	Sulfuric acid	190 °C	24 h				4258 g	Water	14.9 g
Comment																
MB2983	AV5	80.5 g	Canadian Rockies Hemp		999.8 g	1.00%	0.10 M	Sulfuric acid	190 °C	24 h				4232 g	Water	16.6 g
Comment																

Experiment	Reactor	Raw material			Acid		T	t	pressure	Wash	Output	Drying	KFT			
MB2985	AV5	79.5 g	Canadian Rockies Hemp		999.7 g	1.00%	0.10 M	Sulfuric acid	200 °C	24 h		4241 g	Water	15.4 g	40 °C	3.7%
Comment														100 °C	1.9%	
MB2986	AV5	79.9 g	Canadian Rockies Hemp		999.9 g	1.00%	0.10 M	Sulfuric acid	180 °C	24 h		4128 g	Water	16.0 g	60 °C	2.7%
Comment														100 °C	1.7%	
MB2989	AV5	80.2 g	Canadian Rockies Hemp		999.3 g	1.00%	0.10 M	Sulfuric acid	180 °C	23 h		4314 g	Water	18.2 g	40 °C	5.9%
Comment																
MB2991	AV5	81.3 g	Canadian Rockies Hemp		999.3 g	1.00%	0.10 M	Sulfuric acid	180 °C	24 h		4223 g	Water	19.1 g	40 °C	5.7%
Comment																
MB2992	AV5	81.5 g	Canadian Rockies Hemp		999.7 g	1.00%	0.10 M	Sulfuric acid	160 °C	23.5 h		4262 g	Water	19.5 g	40 °C	6.2%
Comment																
MB2994	AV5	80.8 g	Canadian Rockies Hemp		999.8 g	1.00%	0.10 M	Sulfuric acid	180 °C	24 h		4159 g	Water	20.2 g	40 °C	5.2%
Comment																
MB2996	AV5	82.7 g	Canadian Rockies Hemp		999.7 g	1.00%	0.10 M	Sulfuric acid	180 °C	24 h		4210 g	Water	20.0 g	40 °C	4.6%
Comment																
MB2998	AV5	84.0 g	Canadian Rockies Hemp		999.6 g	1.00%	0.10 M	Sulfuric acid	180 °C	22 h		4263 g	Water	19.8 g	40 °C	5.0%
Comment	Included nickel and steel material samples for corrosion/cleaning tests															
MB3000	AV5	82.5 g	Canadian Rockies Hemp		1000.0 g	1.00%	0.10 M	Sulfuric acid	180 °C	24 h		4431 g	Water	19.8 g	40 °C	5.0%
Comment																
MB3002	AV5	80.0 g	Canadian Rockies Hemp		999.9 g	1.00%	0.10 M	Sulfuric acid	190 °C	25 h		4245 g	Water	18.5 g	40 °C	2.0%
Comment																
MB3005	AV5	81.4 g	Canadian Rockies Hemp		999.4 g	1.00%	0.10 M	Sulfuric acid	200 °C	24 h		4280 g	Water	19.0 g	40 °C	2.0%
Comment																
MB3006	AV5	80.8 g	Canadian Rockies Hemp		1000.1 g	1.00%	0.10 M	Sulfuric acid	190 °C	23 h		4182 g	Water	17.4 g	40 °C	2.1%
Comment																
MB3008	AV5	82.2 g	Canadian Rockies Hemp		1000.2 g	1.00%	0.10 M	Sulfuric acid	180 °C	24 h		4238 g	Water	18.0 g	40 °C	2.6%
Comment																
MB3010	AV5	81.3 g	Canadian Rockies Hemp		1000.0 g	1.00%	0.10 M	Sulfuric acid	180 °C	24 h		4235 g	Water	18.9 g	40 °C	2.0%
Comment																
MB3011	AV5	82.4 g	Canadian Rockies Hemp		999.4 g	1.00%	0.10 M	Sulfuric acid	160 °C	24 h		4244 g	Water	23.5 g	40 °C	2.2%
Comment																
MB3014	AV5	82.8 g	Canadian Rockies Hemp		999.8 g	1.00%	0.10 M	Sulfuric acid	160 °C	23 h		1460 g	Water	23.6 g	40 °C	1.3%
Comment																
MRa341	AV5	82.3 g	Canadian Rockies Hemp		1000.4 g	1.00%	0.10 M	Sulfuric acid	180 °C	24 h		1232 g	Water	19.2 g	40 °C	2.1%
Comment																

Experiment	Reactor	Raw material			Acid			T	t	pressure	Wash	Output	Drying	KFT	
MB3016	AV5	81.7 g	Canadian Rockies Hemp		999.7 g	1.00%	0.10 M	Sulfuric acid	185 °C	21 h		4232 g	Water	19.7 g	40 °C 2.1%
Comment															
MB3018	AV5	81.2 g	Canadian Rockies Hemp		1000.1 g	1.00%	0.10 M	Sulfuric acid	195 °C	22 h		4266 g	Water	19.0 g	40 °C 2.1%
Comment															
MB3020	AV5	81.1 g	Canadian Rockies Hemp		1000.2 g	1.00%	0.10 M	Sulfuric acid	185 °C	26 h		4278 g	Water	18.9 g	40 °C 1.7%
Comment															
MB3022	AV5	81.8 g	Canadian Rockies Hemp		999.9 g	1.00%	0.10 M	Sulfuric acid	180 °C	24 h		4262 g	Water	19.0 g	40 °C 2.9%
Comment															
MB3024	AV5	80.7 g	Canadian Rockies Hemp		999.6 g	1.00%	0.10 M	Sulfuric acid	180 °C	24 h		4256 g	Water	18.4 g	40 °C 2.0%
Comment															
MRa349	AV5	80.8 g	Canadian Rockies Hemp		999.4 g	1.00%	0.10 M	Sulfuric acid	185 °C	26 h		4254 g	Water	19.1 g	40 °C 2.2%
Comment															
MRa354	AV5	80.2 g	Canadian Rockies Hemp		999.7 g	1.00%	0.10 M	Sulfuric acid	185 °C	26 h		4414 g	Water	18.4 g	40 °C 1.7%
Comment															
MRa355	AV5	80.2 g	Canadian Rockies Hemp		999.5 g	1.00%	0.10 M	Sulfuric acid	180 °C	24 h		4262 g	Water	18.2 g	40 °C 1.8%
Comment															
MRa358	AV5	80.8 g	Canadian Rockies Hemp		999.9 g	1.00%	0.10 M	Sulfuric acid	180 °C	24 h		3317 g	Water	18.8 g	40 °C 2.1%
Comment															
MB3025	AV5	81.4 g	Canadian Rockies Hemp		1000.5 g	1.00%	0.10 M	Sulfuric acid	165 °C	21.5 h		4229 g	Water	18.4 g	40 °C 1.1%
Comment															
MB3029	AV5	81.6 g	Canadian Rockies Hemp		999.7 g	1.00%	0.10 M	Sulfuric acid	185 °C	26 h		4178 g	Water	18.8 g	40 °C 1.7%
Comment															
MB3031	AV5	82.5 g	Canadian Rockies Hemp		999.7 g	1.00%	0.10 M	Sulfuric acid	190 °C	25 h		4178 g	Water	19.8 g	40 °C 1.5%
Comment															
MB3032	AV5	81.9 g	Canadian Rockies Hemp		1000.5 g	1.00%	0.10 M	Sulfuric acid	180 °C	23.5 h		4341 g	Water	19.0 g	rt 4.8%
Comment															
MRa367	AV5	81.9 g	Canadian Rockies Hemp		1000.0 g	1.00%	0.10 M	Sulfuric acid	190 °C	24.5 h		4256 g	Water	19.8 g	rt 4.7%
Comment															
MRa368	AV5	81.4 g	Canadian Rockies Hemp		999.8 g	1.00%	0.10 M	Sulfuric acid	185 °C	27.5 h		4290 g	Water	20.3 g	rt 5.5%
Comment															
MB3034	AV5	84.7 g	Canadian Rockies Hemp		1000.2 g	1.00%	0.10 M	Sulfuric acid	180 °C	24.5 h		4254 g	Water	20.0 g	40 °C 2.0%
Comment															
MB3037	AV5	80.7 g	Canadian Rockies Hemp		999.8 g	1.00%	0.10 M	Sulfuric acid	185 °C	21.5 h		4325 g	Water	18.6 g	40 °C 1.7%
Comment															

Experiment	Reactor	Raw material			Acid			T	t	pressure	Wash		Output	Drying	KFT		
MB3039	AV5	81.2 g	Canadian Rockies Hemp		1000.0 g	1.00%	0.10 M	Sulfuric acid	180 °C	25 h			4253 g	Water	19.1 g	40 °C	1.8%
Comment																	
MB3040	AV5	80.0 g	Canadian Rockies Hemp		1002.2 g	1.00%	0.10 M	Sulfuric acid	185 °C	26 h			4301 g	Water	18.8 g	40 °C	
Comment															rt	4.3%	
MRa3042	AV5	80.0 g	Canadian Rockies Hemp		999.9 g	1.00%	0.10 M	Sulfuric acid	185 °C	26 h			4026 g	Water	19.3 g	40 °C	
Comment															rt	4.3%	
MB3044	AV5	82.4 g	Canadian Rockies Hemp		1000.0 g	1.00%	0.10 M	Sulfuric acid	180 °C	25 h			4316 g	Water	20.2 g	40 °C	
Comment															rt	4.5%	
MB3045	AV5	82.8 g	Canadian Rockies Hemp		1000.1 g	1.00%	0.10 M	Sulfuric acid	160 °C	23 h			3964 g	Water	22.8 g	rt	5.1%
Comment																	
MB3047	AV5	81.1 g	Canadian Rockies Hemp		1000.1 g	1.00%	0.10 M	Sulfuric acid	160 °C	24 h			3836 g	Water	22.7 g	rt	5.3%
Comment																	
MB3048	AV5	80.2 g	Canadian Rockies Hemp		1000.2 g	1.00%	0.10 M	Sulfuric acid	160 °C	23 h			4275 g	Water	23.9 g	rt	3.6%
Comment																	
MB3049	AV5	80.7 g	Canadian Rockies Hemp		999.7 g	1.00%	0.10 M	Sulfuric acid	155 °C	25 h			4248 g	Water	23.3 g	rt	3.6%
Comment																	

Comments

- Red text for T and t shows experiments where the temperature tracks have not yet been evaluated (or are not available)

Experiment overview – Step 2

Experiment	Oven	Qty	Lot	Base	grinding	Gas	T (rate)	T (max)	t	Wash	Drying	Output
TB1131	A	1.2 g	MB2933	1.2 g KOH (90%)	manual	Ar	20-27 °C/min	790 °C	1 h	20 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.16 g
Comment				ground biochar: brown powder, strong electrostatic charge								
TB1132	A	1.3 g	MB2935	1.3 g KOH (90%)	mill (2 min)	Ar	20-29 °C/min	792 °C	1 h	20 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.3 g
Comment				ground biochar: brown powder								
TB1133	A	1.0 g	MRa231	1.0 g KOH (90%)	mill (1 min)	Ar	3 °C/min	785 °C	1 h	20 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.3 g
Comment				ground biochar: brown powder; see temperature trend								
TB1134	A	1.0 g	MRa231	1.0 g KOH (90%)	mill (2 min)	Ar	3 °C/min	771 °C	1 h	20 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.3 g
Comment				ground biochar: brown powder; see temperature trend								
MB2946	A	1.0 g	MB2946X	1.0 g KOH (90%)	mill (1 min)	Ar	5 °C/min	770 °C	1 h	22 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.3 g
Comment				ground biochar: brown powder; see temperature trend								
MB2947A	A	0.25 g	MB2946X	0.25 g KOH (90%)	mill (1 min)	Ar	3 °C/min	803 °C	1 h	10 g 10% HCl (+ water)	40 °C N2 stream 210 mbar	< 0.01 g
Comment				ground biochar: brown powder; see temperature trend								
MB2947B	A	0.25 g	MB2946X	0.25 g KOH (90%)	mill (1 min)	Ar	3 °C/min	804 °C	2 h	10 g 10% HCl (+ water)	40 °C N2 stream 210 mbar	< 0.01 g
Comment				ground biochar: brown powder; see temperature trend								
MB2947C	A	0.25 g	MB2946X	0.25 g KOH (90%)	mill (1 min)	Ar	3 °C/min	806 °C	3 h	Batch discarded		
Comment				ground biochar: brown powder; see temperature trend								
MB2947D	A	0.25 g	MB2946X	0.25 g KOH (90%)	mill (1 min)	Ar	3 °C/min	810 °C	3 h	10 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	38 mg
Comment				ground biochar: brown powder; see temperature trend								
TB1135-1	A	0.25 g	MB2946X	0.25 g KOH (90%)	mill (1 min)	N2	3 °C/min	800 °C	1 h	14 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.06 g
Comment				ground biochar: brown powder; see temperature trend								
TB1135-2	A	0.25 g	MB2946X	0.25 g KOH (90%)	mill (1 min)	N2	3 °C/min	800 °C	1 h	14 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.07 g
Comment				ground biochar: brown powder; see temperature trend								
MB2952B	A	0.25 g	MB2946X	0.25 g KOH (90%)	mill (1 min)	N2	3 °C/min	800 °C	2 h	10 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.07 g
Comment				ground biochar: brown powder; see temperature trend								
MB2952C	A	0.25 g	MB2946X	0.25 g KOH (90%)	mill (1 min)	N2	3 °C/min	800 °C	3 h	10 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.05 g
Comment				ground biochar: brown powder; see temperature trend								

Experiment	Oven	Qty	Lot	Base	grinding	Gas	T (rate)	T (max)	t	Wash	Drying	Output
MB2952C2	A	0.25 g	MB2946X	0.25 g KOH (90%)	mill (1 min)	N2	3 °C/min	800 °C	2 h	10 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.06 g
Comment				ground biochar: brown powder; see temperature trend								
MB2955A	A	0.25 g	MB2946X	0.38 g KOH (90%)	mill (1 min)	N2	3 °C/min	800 °C	1 h	10 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	7 mg
Comment				Quartz tube shattered during experiment								
MB2955A2	A	0.25 g	MB2946X	0.38 g KOH (90%)	mill (1 min)	N2	3 °C/min	800 °C	1 h	10 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.09 g
Comment				ground biochar: brown powder; see temperature trend								
TB1136	A	0.26 g	MB2946X	0.39 g KOH (90%)	mill (1 min)	N2	3 °C/min	800 °C	2 h	14 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.08 g
Comment				ground biochar: brown powder; see temperature trend								
MB2962A	A	0.25 g	MB2946X	0.50 g KOH (90%)	mill (1 min)	N2	3 °C/min	800 °C	1 h	10 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.08 g
Comment				ground biochar: brown powder; see temperature trend								
MB2962B	A	0.25 g	MB2946X	0.50 g KOH (90%)	mill (1 min)	N2	3 °C/min	800 °C	2 h	10 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.09 g
Comment				ground biochar: brown powder; see temperature trend								
MB2963A	A	0.22 g	MB2960	0.22 g KOH (90%)	mill (1 min)	N2	3 °C/min	800 °C	1 h	10 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.07 g
Comment				ground biochar: brown powder; see temperature trend								
MB2963B	A	0.29 g	MB2960	0.29 g KOH (90%)	mill (1 min)	N2	3 °C/min	800 °C	2 h	10 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.12 g
Comment				ground biochar: brown powder; see temperature trend								
TB1137-1	A	0.26 g	MB2946X	1.06 g KOH (90%)	mill (1 min)	N2	3 °C/min	800 °C	1 h	23 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.06 g
Comment				ground biochar: brown powder; see temperature trend								
TB1137-2	A	0.28 g	MB2946X	1.13 g KOH (90%)	mill (1 min)	N2	3 °C/min	800 °C	2 h	23 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.06 g
Comment				ground biochar: brown powder; see temperature trend								
TB1137-3	A	0.26 g	MB2946X	1.06 g KOH (90%)	mill (1 min)	N2	3 °C/min	800 °C	1 h	23 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.07 g
Comment				ground biochar: brown powder; see temperature trend								
MB2965A	A	0.22 g	MB2959	1.08 g KOH (90%)	mill (2.5 min)	N2	3 °C/min	800 °C	1 h	20 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.02 g
Comment				ground biochar/KOH mixture likely absorbed some moisture; see temperature trend								
MB2965B	A	0.22 g	MB2959	1.08 g KOH (90%)	mill (2.5 min)	N2	3 °C/min	800 °C	2 h	20 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.01 g
Comment				ground biochar/KOH mixture likely absorbed some moisture; see temperature trend								
MB2965B2	B	0.22 g	MB2959	1.08 g KOH (90%)	mill (2.5 min)	N2	3 °C/min	800 °C	2 h	20 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.01 g
Comment				ground biochar/KOH mixture likely absorbed some moisture; see temperature trend								

Experiment	Oven	Qty	Lot	Base	grinding	Gas	T (rate)	T (max)	t	Wash	Drying	Output
MB2966A	B	0.26 g	MB2959	1.04 g KOH (90%)	mill (2.5 min)	N2	3 °C/min	800 °C	1 h	20 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.05 g
Comment				ground biochar: brown powder; see temperature trend								
MB2966B	A	0.26 g	MB2959	1.04 g KOH (90%)	mill (2.5 min)	N2	3 °C/min	800 °C	2 h	20 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.05 g
Comment				ground biochar: brown powder; see temperature trend								
MB2967A	B	0.26 g	MB2964	1.04 g KOH (90%)	mill (2.5 min)	N2	3 °C/min	800 °C	1 h	20 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.06 g
Comment				ground biochar: brown powder; see temperature trend								
MB2967B	A	0.26 g	MB2964	1.04 g KOH (90%)	mill (2.5 min)	N2	3 °C/min	800 °C	2 h	20 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.04 g
Comment				ground biochar: brown powder; see temperature trend								
MB2970A	B	0.24 g	MB2957	0.36 g KOH (90%)	mill (2.5 min)	N2	3 °C/min	800 °C	1 h	10 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.06 g
Comment				ground biochar: brown powder; see temperature trend								
MB2970B	A	0.24 g	MB2957	0.36 g KOH (90%)	mill (2.5 min)	N2	3 °C/min	800 °C	2 h	10 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.02 g
Comment				ground biochar: brown powder; see temperature trend								
MB2971A	B	0.24 g	MB2958	0.36 g KOH (90%)	mill (2.5 min)	N2	3 °C/min	800 °C	1 h	10 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.05 g
Comment				ground biochar: brown powder; see temperature trend								
MB2971B	A	0.24 g	MB2958	0.36 g KOH (90%)	mill (2.5 min)	N2	3 °C/min	800 °C	2 h	10 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.07 g
Comment				ground biochar: brown powder; see temperature trend								
MB2972A	B	0.24 g	MB2961	0.36 g KOH (90%)	mill (2.5 min)	N2	3 °C/min	800 °C	1 h	10 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.09 g
Comment				ground biochar: brown powder; see temperature trend								
MB2972B	A	0.24 g	MB2961	0.36 g KOH (90%)	mill (2.5 min)	N2	3 °C/min	800 °C	2 h	10 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.06 g
Comment				ground biochar: brown powder; see temperature trend								
MB2973A	B	0.24 g	MB2959	0.36 g KOH (90%)	mill (2.5 min)	N2	3 °C/min	800 °C	1 h	10 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.04 g
Comment				ground biochar: brown powder; see temperature trend								
MB2973B	A	0.24 g	MB2959	0.36 g KOH (90%)	mill (2.5 min)	N2	3 °C/min	800 °C	1 h	10 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.09 g
Comment				ground biochar: brown powder; see temperature trend								
MB2974A	B	0.24 g	MB2959	0.36 g KOH (90%)	mill (5 min)	N2	3 °C/min	800 °C	1 h	10 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.08 g
Comment				ground biochar: brown powder; see temperature trend								
MB2974B	A	0.24 g	MB2959	0.36 g KOH (90%)	mill (1 min)	N2	3 °C/min	800 °C	1 h	10 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.08 g
Comment				ground biochar: brown powder; see temperature trend								

Experiment	Oven	Qty	Lot	Base	grinding	Gas	T (rate)	T (max)	t	Wash	Drying	Output
MB2975A	B	0.24 g	MB2959	0.36 g KOH (90%)	mill (5 min)	N2	3 °C/min	800 °C	2 h	10 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.06 g
Comment				ground biochar: brown powder; see temperature trend								
MB2975B	A	0.24 g	MB2959	0.36 g KOH (90%)	mill (1 min)	N2	3 °C/min	800 °C	2 h	10 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.08 g
Comment				ground biochar: brown powder; see temperature trend								
MB2976A	B	0.24 g	MB2959	0.36 g KOH (90%)	mill (2.5 min)	N2	3 °C/min	800 °C	1 h	10 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.08 g
Comment				ground biochar (brown powder) compacted to pellet; see temperature trend								
MB2976B	A	0.24 g	MB2959	0.36 g KOH (90%)	mill (2.5 min)	N2	3 °C/min	800 °C	2 h	10 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.11 g
Comment				ground biochar (brown powder) compacted to pellet; see temperature trend								
MB2979A	B	0.24 g	MB2959	0.36 g KOH (90%)	mill (2.5 min)	N2	3 °C/min	800 °C	1 h	10 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.08 g
Comment				ground biochar: brown powder; see temperature trend								
MB2979B	A	0.24 g	MB2959	0.36 g KOH (90%)	mill (2.5 min)	N2	3 °C/min	800 °C	1 h	10 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.10 g
Comment				ground biochar: brown powder; see temperature trend								
MB2980A	B	0.24 g	MB2959/2956	0.36 g KOH (90%)	mill (20 min)	N2	3 °C/min	800 °C	1 h	10 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.08 g
				ground biochar (brown powder) compacted to pellet								
MB2980B	A	0.24 g	MB2959/2956	0.36 g KOH (90%)	mill (10 min)	N2	3 °C/min	800 °C	1 h	10 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.10 g
				ground biochar (brown powder) compacted to pellet								
MB2980C	B	0.52 g	MB2959/2956	0.78 g KOH (90%)	mill (20 min)	N2	3 °C/min	800 °C	1 h	21 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.16 g
				ground biochar (brown powder) compacted to pellet								
MB2980D	A	0.52 g	MB2959/2956	0.78 g KOH (90%)	mill (10 min)	N2	3 °C/min	800 °C	1 h	21 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.23 g
				ground biochar (brown powder) compacted to pellet								
KJo-0165A	A	0.24 g	MB2978	0.36 g KOH (90%)	mill (10 min)	N2	3 °C/min	800 °C	1 h	10 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.09 g
				ground biochar: brown powder								
KJo-0165B	B	0.24 g	MB2978	0.36 g KOH (90%)	mill (20 min)	N2	3 °C/min	800 °C	1 h	11 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.15 g
				ground biochar: brown powder								
KJo-0166A	A	0.24 g	MB2978	0.36 g KOH (90%)	mill (10 min)	N2	10 °C/min	800 °C	1 h	11 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.13 g
				ground biochar: brown powder								
KJo-0166B	B	0.24 g	MB2978	0.36 g KOH (90%)	mill (20 min)	N2	10 °C/min	800 °C	1 h	11 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.11 g
				ground biochar: brown powder								

Experiment	Oven	Qty	Lot	Base	grinding	Gas	T (rate)	T (max)	t	Wash	Drying	Output
KJo-0167A	A	0.24 g	MB2978	0.36 g KOH (90%)	mill (10 min)	N2	3 °C/min	800 °C	4 h	10 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.10 g
ground biochar (brown powder) compacted to pellet												
KJo-0167B	B	0.24 g	MB2978	0.36 g KOH (90%)	mill (20 min)	N2	3 °C/min	800 °C	4 h	11 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.06 g
ground biochar (brown powder) compacted to pellet												
KJo-0168A	A	0.24 g	MB2978	0.36 g KOH (90%)	mill (10 min)	N2	3 °C/min	900 °C	2 h	10 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.02 g
ground biochar (brown powder) compacted to pellet												
KJo-0168B	B	0.24 g	MB2978	0.36 g KOH (90%)	mill (20 min)	N2	3 °C/min	900 °C	1 h	10 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.09 g
ground biochar (brown powder) compacted to pellet												
KJo-0169	B	0.80 g	MB2978	1.20 g KOH (90%)	mill (10 min)	N2	3 °C/min	800 °C	1 h	30 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.23 g
ground biochar (brown powder) compacted to pellet												
KJo-0170	B	1.07 g	MB2978	1.61 g KOH (90%)	mill (20 min)	N2	3 °C/min	800 °C	1 h	38 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.62 g
ground biochar (brown powder) compacted to pellet												
KJo-0171A	B	1.60 g	MB2978	2.40 g KOH (90%)	mill (5 min)	N2	3 °C/min	800 °C	1 h	60 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.64 g
ground biochar (brown powder) compacted to two pellets of equal size												
KJo-0171B	A	0.24 g	MB2978	0.36 g KOH (90%)	mill (5 min)	N2	3 °C/min	800 °C	1 h	10 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.13 g
ground biochar (brown powder) compacted to pellet												
KJo-0172A	B	0.50 g	MB2978	0.50 g KOH (90%)	mill (2.5 min)	N2	3 °C/min	800 °C	1 h	11 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.24 g
ground biochar (brown powder) compacted to pellet												
KJo-0172B	A	0.50 g	MB2978	0.50 g KOH (90%)	mill (2.5 min)	N2	3 °C/min	800 °C	2 h	10 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.17 g
ground biochar (brown powder) compacted to pellet												
KJo-0175	A	1.60 g	MB2978	2.40 g KOH (90%)	mill (5 min)	N2	3 °C/min	800 °C	1 h	61 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.71 g
ground biochar (brown powder) compacted to two pellets of equal size, quartz tube shattered												
KJo-0176	B	0.24 g	MB2978	0.36 g KOH (90%)	mill (5 min)	N2	1.5 °C/min	800 °C	1 h	10 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.10 g
ground biochar (brown powder) compacted to pellet												
KJo-0177	A	1.60 g	MB2978	2.40 g KOH (90%)	mill (5 min)	N2	3 °C/min	800 °C	1 h	61 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.91 g
ground biochar (brown powder) compacted to two pellets of equal size												
KJo-0178	A	1.60 g	MB2955/74/75/76	2.40 g KOH (90%)	mill (1-5 min)	N2	3 °C/min	800 °C	1 h	60 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.55 g
ground biochar (brown powder) compacted to two pellets of equal size												
MB2981	B	1.44 g	MB2955/74/75/76	2.16 g KOH (90%)	mill (1-5 min)	N2	3 °C/min	800 °C	1 h	60 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.44 g
ground biochar (brown powder) compacted to six pellets of equal size												

Experiment	Oven	Qty	Lot	Base	grinding	homogeneous?	Gas	T (rate)	T (max)	t	Wash	Drying	Output	Volume	Species	Appearance
TB1138	A	1.54 g	various	2.31 g KOH (90%)	mill (5 min)		N2	3 °C/min	800 °C	1 h	59 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.59 g		1	black/grey brittle
				ground biochar (brown powder) compacted to two pellets of equal size									38%			
MRa320	B	1.43 g	various	2.14 g KOH (90%)	mill (5 min)		N2	3 °C/min	800 °C	1 h	53 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.55 g		1	black/grey brittle
				ground biochar (brown powder) compacted to two pellets of equal size									38%			
MB2984	B	1.40 g	various	2.10 g KOH (90%)	mill (5 min)		N2	3 °C/min	800 °C	1 h	53 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.48 g		1	black/grey brittle
				ground biochar (brown powder) compacted to two pellets of equal size									34%			
TB1139	A	1.39 g	KJ0-0173	2.08 g KOH (90%)	mill (5 min)		N2	3 °C/min	800 °C	1 h	50 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.54 g		1	black/grey brittle
				ground biochar (brown powder) compacted to two pellets of equal size									39%			
TB1140A	A	1.28 g	KJ0-0173	1.92 g KOH (90%)	mill (5 min)		N2	3 °C/min	800 °C	1 h	49 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.46 g		1	black/grey brittle
				ground biochar (brown powder) compacted to two pellets of equal size									36%			
TB1140B	B	1.28 g	KJ0-0173	1.92 g KOH (90%)	mill (5 min)		N2	3 °C/min	800 °C	1 h	50 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.48 g		1	black/grey brittle
				ground biochar (brown powder) compacted to two pellets of equal size									38%			
MRa323	A	1.06 g	KJ0-0173	1.60 g KOH (90%)	mill (3 min)		N2	3 °C/min	800 °C	1 h	39 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.44 g		1	black/grey brittle
				ground biochar (sonicated, brown powder) compacted to two pellets of equal size									41%			
TB1141	A	1.08 g	various	1.62 g KOH (90%)	mill (5 min)		N2	3 °C/min	800 °C	1 h	30 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.40 g		1	black/grey brittle
				ground biochar (brown powder) compacted to two pellets of equal size									37%			
MRa326	A	1.28 g	KJ0-0173	1.92 g KOH (90%)	mill (3 min)		N2	3 °C/min	800 °C	1 h	48 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.51 g		1	black/grey brittle
				ground biochar (sonicated, brown powder) compacted to two pellets of equal size									39%			
MRa327	B	1.04 g	KJ0-0173	1.56 g KOH (90%)	mill (3 min)		N2	3 °C/min	800 °C	1 h	39 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.46 g		1	black/grey brittle
				ground biochar (sonicated, brown powder) compacted to two pellets of equal size									44%			
MB2988	B	1.04 g	KJ0-0173	1.56 g KOH (90%)	mill (5 min)		N2	3 °C/min	800 °C	1 h	45 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.42 g		1	black/grey brittle
				ground biochar (brown powder) compacted to two pellets of equal size									40%			
MRa328	B	1.20 g	KJ0-0173	1.80 g KOH (90%)	mill (3 min)		N2	3 °C/min	800 °C	1 h	45 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.53 g		1	black/grey brittle
				ground biochar (sonicated, brown powder) compacted to two pellets of equal size									44%			
MRa329	A	1.04 g	KJ0-0173 (extra dried)	1.56 g KOH (90%)	mill (1 min)		N2	3 °C/min	800 °C	1 h	39 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.43 g		2	shiny grey voluminous
				ground biochar (brown powder) compacted to two pellets of equal size									42%			
MB2990A	A	1.28 g	MB2982	1.92 g KOH (90%)	mill (5 min)	no	N2	3 °C/min	800 °C	1 h	48 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.50 g		1	black/grey brittle
				ground biochar (brown powder) compacted to two pellets of equal size									39%			
MB2990B	B	1.04 g	MB2982	1.56 g KOH (90%)	mill (5 min)	no	N2	3 °C/min	800 °C	1 h	39 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.42 g		1	black/grey brittle
				ground biochar (brown powder) compacted to two pellets of equal size									40%			

Experiment	Oven	Qty	Lot	Base	grinding	homogeneous?	Gas	T (rate)	T (max)	t	Wash	Drying	Output	Vol/Dens	Species	Appearance	
MRa331A	B	1.28 g	MB2985 (extra dried)	1.92 g KOH (90%)		mill (5 min)	no	N2	3 °C/min	800 °C	1 h	48 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.64 g		Mostly 1	shiny grey voluminous
				ground biochar (brown powder) compacted to two pellets of equal size										50%			
MRa331B	A	1.04 g	MB2985 (extra dried)	1.56 g KOH (90%)		mill (5 min)	no	N2	3 °C/min	800 °C	1 h	39 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.46 g		Mostly 1	shiny grey voluminous
				ground biochar (brown powder) compacted to two pellets of equal size										44%			
MRa333A	A	1.28 g	MB2985 (extra dried)	1.15 g KOH (90%)	0.77 g NaOH (98%)	mill (5 min)		N2	3 °C/min	800 °C	1 h	48 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.21 g		2	shiny grey voluminous
				ground biochar (brown powder) compacted to two pellets of equal size										17%			
MRa333B	B	1.04 g	MB2985 (extra dried)	0.94 g KOH (90%)	0.62 g NaOH (98%)	mill (5 min)		N2	3 °C/min	800 °C	1 h	39 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.26 g		2	shiny grey voluminous
				ground biochar (brown powder) compacted to two pellets of equal size										25%			
MRa334A	A	1.04 g	MB2985 (extra dried)	1.25 g KOH (90%)	0.31 g NaOH (98%)	mill (5 min)	no	N2	3 °C/min	800 °C	1 h	39 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.48 g		Mostly 2	shiny grey voluminous
				ground biochar (brown powder) compacted to two pellets of equal size										46%			
MRa334B	B	0.88 g	MB2985 (extra dried)	1.06 g KOH (90%)	0.26 g NaOH (98%)	mill (5 min)	no	N2	3 °C/min	800 °C	1 h	33 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.39 g		Mostly 2	shiny grey voluminous
				ground biochar (brown powder) compacted to two pellets of equal size										45%			
MB2993A	A	1.28 g	MB2982	1.15 g KOH (90%)	0.77 g NaOH (98%)	mill (5 min)		N2	3 °C/min	800 °C	1 h	48 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.22 g		Mostly 2	shiny grey voluminous
				ground biochar (brown powder) compacted to two pellets of equal size										18%			
MB2993B	B	1.04 g	MB2982	0.94 g KOH (90%)	0.62 g NaOH (98%)	mill (5 min)		N2	3 °C/min	800 °C	1 h	39 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.19 g		Mostly 2	shiny grey voluminous
				ground biochar (brown powder) compacted to two pellets of equal size										18%			
MB2995A	A	1.28 g	MB2983 (extra dried)	1.92 g KOH (90%)		mill (4 min)		N2	3 °C/min	800 °C	1 h	48 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.54 g	3.9 ml	Mostly 1	shiny grey voluminous
				ground biochar (brown powder) compacted to two pellets of equal size										42%	7.3 ml/g		
MB2995B	B	1.04 g	MB2983 (extra dried)	1.56 g KOH (90%)		mill (4 min)		N2	3 °C/min	800 °C	1 h	39 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.46 g	5.6 ml	1/2 mix	shiny grey voluminous
				ground biochar (brown powder) compacted to two pellets of equal size										44%	12.3 ml/g		
TB1144A	A	1.04 g	KJo-0174	1.56 g KOH (90%)		ball mill (15 Hz, 80 sec)	no	N2	3 °C/min	800 °C	1 h	38 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.61 g	5.0 ml	1 + fibres	black/grey somewhat shiny
				ground biochar (brown powder) NOT compacted										59%	8.2 ml/g		
TB1144B	B	1.28 g	KJo-0174	1.92 g KOH (90%)		ball mill (15 Hz, 80 sec)	no	N2	3 °C/min	800 °C	1 h	54 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.36 g	6.0 ml	2 (?)	black/grey shiny
				ground biochar (brown powder) compacted to two pellets of equal size										28%	16.9 ml/g		
MB2997A	A	1.28 g	MB2985 (extra dried)	1.92 g KOH (90%)		mill (5 min)	no	N2	3 °C/min	800 °C	1 h	48 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.55 g	3.6 ml	1	black/grey somewhat shiny
				ground biochar (brown powder) compacted to two pellets of equal size										43%	6.6 ml/g		
MB2997B	B	1.04 g	MB2985 (extra dried)	1.56 g KOH (90%)		mill (5 min)	no	N2	3 °C/min	800 °C	1 h	40 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.45 g	2.9 ml	1	black/grey somewhat shiny
				ground biochar (brown powder) compacted to two pellets of equal size										43%	6.4 ml/g		
MB2999A	A	1.28 g	KJo-0174	1.92 g KOH (90%)		ball mill (25 Hz, 80 sec)	no	N2	3 °C/min	800 °C	1 h	48 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.68 g	4.6 ml	Mostly 1/2 mix	shiny black/grey voluminous
				ground biochar (brown powder) compacted to two pellets of equal size										53%	6.8 ml/g		

Experiment	Oven	Qty	Lot	Base	grinding	homogeneous?	Gas	T (rate)	T (max)	t	Wash	Drying	Output	Vol/Dens	Species	Appearance
MB2999B	B	1.04 g	KJ0-0174	1.56 g KOH (90%)	ball mill (25 Hz, 80 sec)	no	N2	3 °C/min	800 °C	1 h	39 g (+ water)	10% HCl (atm. Pressure)	0.40 g 38%	4.6 ml 11.5 ml/g	1 + fibres	shiny black/grey voluminous
				ground biochar (brown powder) NOT compacted												
TB1146	A	1.28 g	MB2982	1.92 g KOH (90%)	mill (5 min)		N2	3 °C/min	800 °C	1 h	51 g (+ water)	10% HCl (atm. Pressure)	0.52 g 41%	4.0 ml 7.6 ml/g	1	black/grey somewhat shiny
				ground biochar/KOH mix (brown powder, MB2990) dried at 100 °C, then compacted to two pellets of equal size												
TB1147	B	1.08 g	MB2983 (extra dried)	1.62 g KOH (90%)	mill (4 min)		N2	3 °C/min	800 °C	1 h	37 g (+ water)	10% HCl (atm. Pressure)	0.36 g 33%	5.0 ml 14.1 ml/g	Mostly 1	black/grey somewhat shiny
				ground biochar/KOH mix (brown powder, MB2995) dried at 100 °C, then compacted to two pellets of equal size												
MB3001A	A	1.28 g	KJ0-0174	1.92 g KOH (90%)	ball mill (35 Hz, 80 sec)	no	N2	3 °C/min	800 °C	1 h	48 g (+ water)	10% HCl (atm. Pressure)	0.49 g 38%	10.6 ml 21.5 ml/g	Mostly 2	shiny black/grey very voluminous
				ground biochar (brown powder) compacted to two pellets of equal size												
MB3001B	B	1.04 g	KJ0-0174	1.56 g KOH (90%)	ball mill (35 Hz, 80 sec)	no	N2	3 °C/min	800 °C	1 h	39 g (+ water)	10% HCl (atm. Pressure)	0.48 g 46%	8.2 ml 17.2 ml/g	Mostly 2	shiny black/grey very voluminous
				ground biochar (brown powder) NOT compacted												
MB3003A	A	1.28 g	MB2986 (2% water)	1.92 g KOH (90%)	ball mill (35 Hz, 80 sec)		N2	3 °C/min	800 °C	1 h	48 g (+ water)	10% HCl (atm. Pressure)	0.57 g 45%	5.7 ml 9.9 ml/g	Mostly 1	black/grey somewhat shiny
				freshly ground biochar (brown powder) compacted to two pellets of equal size												
MB3003B	B	1.04 g	MB2986 (2% water)	1.56 g KOH (90%)	ball mill (35 Hz, 80 sec)		N2	3 °C/min	800 °C	1 h	39 g (+ water)	10% HCl (atm. Pressure)	0.44 g 42%	9.0 ml 20.7 ml/g	Mostly 1/2 mix	shiny black/grey voluminous
				freshly ground biochar (brown powder) NOT compacted												
MB3004A	A	1.28 g	MB2986 (2% water)	1.92 g KOH (90%)	ball mill (35 Hz, 80 sec)		N2	3 °C/min	800 °C	1 h	48 g (+ water)	10% HCl (atm. Pressure)	0.59 g 46%	17.4 ml 29.4 ml/g	Mostly 2	shiny black/grey very voluminous
				ground biochar (brown powder) compacted to two pellets of equal size												
MB3004B	B	1.04 g	MB2986 (2% water)	1.56 g KOH (90%)	ball mill (35 Hz, 80 sec)		N2	3 °C/min	800 °C	1 h	39 g (+ water)	10% HCl (atm. Pressure)	0.41 g 39%	8.4 ml 20.7 ml/g	Mostly 1/2 mix	shiny black/grey voluminous
				ground biochar (brown powder) NOT compacted												
TB1151A	A	1.40 g	KJ0-0174	2.10 g KOH (90%)	ball mill (15 Hz, 10 min)	yes	N2	3 °C/min	800 °C	1 h	51 g (+ water)	10% HCl (atm. Pressure)	0.53 g 38%	2.5 ml 4.7 ml/g	1	black/grey brittle
				ground biochar (brown powder) compacted to two pellets of equal size												
TB1151B	B	1.08 g	KJ0-0174	1.62 g KOH (90%)	ball mill (15 Hz, 10 min)	yes	N2	3 °C/min	800 °C	1 h	39 g (+ water)	10% HCl (atm. Pressure)	0.45 g 42%	2.5 ml 5.6 ml/g	1	black/grey brittle
				ground biochar (brown powder) NOT compacted												
MB3007A	A	1.20 g	KJ0-0174	1.80 g KOH (90%)	ball mill (15 Hz, 30 min)	yes	N2	3 °C/min	800 °C	1 h	48 g (+ water)	10% HCl (atm. Pressure)	0.50 g 42%	3.0 ml 6.0 ml/g	1	black/grey barely shiny
				ground biochar (brown powder) compacted to two pellets of equal size												
MB3007B	B	1.04 g	KJ0-0174	1.56 g KOH (90%)	ball mill (15 Hz, 30 min)	yes	N2	3 °C/min	800 °C	1 h	39 g (+ water)	10% HCl (atm. Pressure)	0.43 g 42%	2.9 ml 6.7 ml/g	1	black/grey barely shiny
				ground biochar (brown powder) NOT compacted												
MB3009	A	1.28 g	MB2992	1.92 g KOH (90%)	mill (1 min)	yes	N2	3 °C/min	800 °C	1 h	48 g (+ water)	10% HCl (atm. Pressure)	0.41 g 32%	3.0 ml 7.4 ml/g	1	black/grey brittle
				ground biochar (brown powder) compacted to two pellets of equal size												
MB3012A	A	1.28 g	MB2983 (2% water)	1.92 g KOH (90%)	ball mill (35 Hz, 10+1 min)	no	N2	3 °C/min	800 °C	1 h	48 g (+ water)	10% HCl (atm. Pressure)	0.64 g 50%	10.2 ml 16.0 ml/g	1/2 mix	shiny black/grey voluminous
				ground biochar (brown powder) NOT compacted												

Experiment	Oven	Qty	Lot	Base	grinding	homogeneous?	Gas	T (rate)	T (max)	t	Wash	Drying	Output	Vol/Dens	Species	Appearance	
MB3012B	B	1.04 g	MB2983 (2% water)	1.56 g KOH (90%)	ball mill (15 Hz, 10+1 min)	no	N2	3 °C/min	800 °C	1 h	39 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.44 g	10.8 ml	Mostly 1/2 mix	shiny black/grey voluminous	
			ground biochar (brown powder) NOT compacted										42%	24.6 ml/g			
MB3013A	A	1.28 g	MB2983 (2% water)	1.92 g KOH (90%)	ball mill (35 Hz, 10+1 min)	no	N2	3 °C/min	800 °C	1 h	48 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.58 g	4.3 ml	Mostly 1/2 mix	shiny black/grey	
			ground biochar (brown powder) compacted to two pellets of equal size										45%	7.5 ml/g			
MB3013B	B	1.04 g	MB2983 (2% water)	1.56 g KOH (90%)	ball mill (15 Hz, 10+1 min)	no	N2	3 °C/min	800 °C	1 h	39 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.40 g	12.8 ml	Mostly 2	shiny black/grey very voluminous	
			ground biochar (brown powder) compacted to two pellets of equal size										38%	32.2 ml/g			
MB3015A	A	1.20 g	MB2986 (2% water)	1.80 g KOH (90%)	ball mill (15 Hz, 30+1 min)	no	N2	3 °C/min	800 °C	1 h	45 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.39 g	8.0 ml	Mostly 2	shiny black/grey voluminous	
			ground biochar (brown powder) compacted to two pellets of equal size										33%	20.5 ml/g			
MB3015B	B	1.00 g	MB2986 (2% water)	1.50 g KOH (90%)	ball mill (15 Hz, 30+1 min)	no	N2	3 °C/min	800 °C	1 h	39 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.36 g	8.0 ml	Mostly 2	shiny black/grey voluminous	
			ground biochar (brown powder) NOT compacted										36%	22.5 ml/g			
MRa340A	A	1.28 g	MB2996	1.92 g KOH (90%)	ball mill (15 Hz, 120 min)	yes	N2	3 °C/min	800 °C	1 h	48 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.49 g	4.0 ml	1	black/grey barely shiny	
			ground biochar (brown powder) compacted to two pellets of equal size										38%	8.2 ml/g			
MRa340B	B	1.04 g	MB2996	1.56 g KOH (90%)	ball mill (15 Hz, 120 min)	yes	N2	3 °C/min	800 °C	1 h	39 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.44 g	3.5 ml	1	black/grey barely shiny	
			ground biochar (brown powder) NOT compacted										42%	7.9 ml/g			
TB1155A	A	1.28 g	MB2986 (2% water)	1.54 g KOH (90%)	0.38 g NaOH (98%)	ball mill (15 Hz, 10 min)	no	N2	3 °C/min	800 °C	1 h	48 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.69 g	4.0 ml		black/grey somewhat shiny
			NaOH not fully ground!, ground biochar (brown powder) compacted to two pellets of equal size										54%	5.8 ml/g			
TB1155B	B	1.04 g	MB2986 (2% water)	1.25 g KOH (90%)	0.31 g NaOH (98%)	ball mill (15 Hz, 10 min)	no	N2	3 °C/min	800 °C	1 h	39 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.45 g	4.0 ml		black/grey somewhat shiny
			NaOH not fully ground!, ground biochar (brown powder) NOT compacted										43%	8.9 ml/g			
MB3017A	A	1.28 g	MB3002 (2% water)	1.54 g KOH (90%)	0.38 g NaOH (98%)	ball mill (35 Hz, 10 min)	yes	N2	3 °C/min	800 °C	1 h	48 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.53 g	19.1 ml	2	shiny black/grey very voluminous
			ground biochar (brown powder) compacted to two pellets of equal size										41%	36.3 ml/g			
MB3017B	B	1.04 g	MB3002 (2% water)	1.25 g KOH (90%)	0.31 g NaOH (98%)	ball mill (35 Hz, 10 min)	yes	N2	3 °C/min	800 °C	1 h	39 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.33 g	12.2 ml	2	shiny black/grey voluminous
			ground biochar (brown powder) NOT compacted										32%	36.7 ml/g			
MB3019A	A	1.28 g	MB3002 (2% water)	1.92 g KOH (90%)		ball mill (15 Hz, 10+1 min)	no	N2	3 °C/min	800 °C	1 h	48 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.47 g	15.9 ml	2	shiny black/grey very voluminous
			ground biochar (brown powder) compacted to two pellets of equal size										37%	33.9 ml/g			
MB3019B	B	1.04 g	MB3002 (2% water)	1.56 g KOH (90%)		ball mill (15 Hz, 10+1 min)	no	N2	3 °C/min	800 °C	1 h	39 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.39 g	9.3 ml	Mostly 2	shiny black/grey voluminous
			ground biochar (brown powder) NOT compacted										38%	23.7 ml/g			
MB3021A	A	1.28 g	MB3002 (2% water)	1.92 g KOH (90%)		mill (2 min)		N2	3 °C/min	800 °C	1 h	48 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.52 g	7.3 ml	Mostly 1	shiny black/grey
			ground biochar (brown powder) compacted to two pellets of equal size										41%	14.0 ml/g			
MB3021B	B	1.04 g	MB3002 (2% water)	1.56 g KOH (90%)		mill (2 min)		N2	3 °C/min	800 °C	1 h	39 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.43 g	5.3 ml	Mostly 1	shiny black/grey
			ground biochar (brown powder) NOT compacted										42%	12.2 ml/g			

Experiment	Oven	Qty	Lot	Base	grinding	homogeneous?	Gas	T (rate)	T (max)	t	Wash	Drying	Output	Vol/Dens	Species	Appearance
MB3023A	A	1.08 g	MB2989	1.30 g KOH (90%) 0.32 g NaOH (98%)	ball mill (35 Hz, 10 min)	yes	N2	3 °C/min	800 °C	1 h	48 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.28 g 26%	16.5 ml 59.1 ml/g	2	shiny black/grey very voluminous
MB3023B	B	0.80 g	MB2989	0.96 g KOH (90%) 0.24 g NaOH (98%)	ball mill (35 Hz, 10 min)	yes	N2	3 °C/min	800 °C	1 h	39 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.25 g 31%	13.5 ml 54.7 ml/g	Mostly 2	shiny black/grey very voluminous
MRa352A	A	1.28 g	MB3002 (2% water)	1.92 g KOH (90%)	ball mill (35 Hz, 10 min)	yes	N2	3 °C/min	800 °C	1 h	48 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.62 g 48%	2.9 ml 4.7 ml/g	1	black/grey barely shiny
MRa352B	B	1.04 g	MB3002 (2% water)	1.56 g KOH (90%)	ball mill (35 Hz, 10 min)	yes	N2	3 °C/min	800 °C	1 h	39 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.53 g 51%	2.8 ml 5.3 ml/g	1	black/grey barely shiny
MB353A	A	1.28 g	MB2991	1.92 g KOH (90%)	ball mill (35 Hz, 10 min)	yes	N2	3 °C/min	800 °C	1 h	48 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.53 g 41%	2.0 ml 3.8 ml/g	1	black/grey barely shiny
MRa353B	B	1.04 g	MB2991	1.39 g KOH (90%) 0.17 g NaOH (98%)	ball mill (35 Hz, 10 min)	yes	N2	3 °C/min	800 °C	1 h	39 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.44 g 43%	3.5 ml 7.9 ml/g	Mostly 1	black/grey barely shiny
TB1158A	A	1.04 g	MB2991	1.25 g KOH (90%) 0.31 g NaOH (98%)	ball mill (35 Hz, 10 min)	yes	N2	3 °C/min	800 °C	1 h	50 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.40 g 39%	17.0 ml 42.3 ml/g	2	shiny black/grey very voluminous
TB1158B	B	0.96 g	MB2991	1.37 g KOH (90%) 0.08 g NaOH (98%)	ball mill (35 Hz, 10 min)	yes	N2	3 °C/min	800 °C	1 h	45 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.39 g 40%	3.0 ml 7.8 ml/g	Mostly 1	black/grey barely shiny
TB1160A	A	1.04 g	MB2991	1.25 g KOH (90%) 0.31 g NaOH (98%)	ball mill (35 Hz, 10 min)	yes	N2	3 °C/min	800 °C	1 h	48 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.46 g 44%	17.0 ml 37.0 ml/g	2	shiny black/grey very voluminous
TB1160B	B	1.04 g	MB2991	1.56 g KOH (90%)	ball mill (35 Hz, 10 min)	yes	N2	3 °C/min	800 °C	1 h	41 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.43 g 41%	2.0 ml 4.6 ml/g	1	black/grey barely shiny
TB1162A	A	1.04 g	MB2989	1.56 g KOH (90%)	mill (3 min)	yes	N2	3 °C/min	800 °C	1 h	45 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.44 g 43%	4.0 ml 9.0 ml/g	Mostly 1	shiny black/grey
TB1162B	B	1.04 g	MB2989	1.25 g KOH (90%) 0.31 g NaOH (98%)	mill (3 min)	yes	N2	3 °C/min	800 °C	1 h	45 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.32 g 31%	8.0 ml 25.2 ml/g	Mostly 2	shiny black/grey
MB3026	B	1.04 g	MB3005 (2% water)	1.56 g KOH (90%)	mill (3 min)	yes	N2	3 °C/min	800 °C	1 h	39 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.40 g 39%	8.3 ml 20.6 ml/g	1/2 mix	shiny black/grey voluminous
MB3027	B	1.04 g	MB3005 (2% water)	1.25 g KOH (90%) 0.31 g NaOH (98%)	mill (3 min)	no	N2	3 °C/min	800 °C	1 h	39 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.28 g 27%	18.0 ml 64.7 ml/g	2	shiny black/grey very voluminous
MB3028	B	1.04 g	MB2989	1.56 g KOH (90%)	mill (10 min)	yes	N2	3 °C/min	800 °C	1 h	39 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.42 g 40%	5.1 ml 12.1 ml/g	Mostly 1	shiny black/grey

Experiment	Oven	Qty	Lot	Base	grinding	homogeneous?	Gas	T (rate)	T (max)	t	Wash	Drying	Output	Vol/Dens	Species	Appearance	
MB3030	A	1.04 g	MB2989	1.25 g KOH (90%)	0.31 g NaOH (98%)	mill (10 min)	no	N2	3 °C/min	800 °C	1 h	39 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.29 g	16.8 ml	2	shiny black/grey very voluminous
ground biochar (brown powder) compacted to two pellets of equal size																	
TB1165	C	12.4 g	MB2992	18.5 g KOH (90%)		5 millings (3 min each)	yes	N2	3 °C/min	800 °C	1 h	193 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	4.55 g	35.0 ml	1	dull black/grey
Rotating oven, powder not compacted																	
TB1166	C	7.8 g	MB3006 (2% water)	9.41 g KOH (90%)		4 millings (3 min each)	yes	N2	3 °C/min	800 °C	1 h	210 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	3.25 g	65.0 ml	1/2 mix	shiny black/grey
Rotating oven, powder not compacted																	
MB3036	B	1.04 g	MB2992 + H2O	1.56 g KOH (90%)		mill (1+3 min)	yes	N2	3 °C/min	800 °C	1 h	39 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.34 g	3.0 ml	1	black/grey barely shiny
water added to mill => 7-8% (calc), ground biochar (brown powder) compacted to two pellets of equal size																	
TB1167	C	14.8 g	MB2994	22.3 g KOH (90%)		blender, 90 sec	yes	N2	3 °C/min	800 °C	1 h	200 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	6.40 g	50.0 ml	Mostly 1	shiny black/grey
Rotating oven, powder not compacted																	
MB3038	B	1.04 g	MB2994	1.56 g KOH (90%)		blender, 90 sec	yes	N2	3 °C/min	800 °C	1 h	39 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.53 g	2.4 ml	Mostly 1	black/grey barely shiny
ground biochar (brown powder from TB1167) compacted to two pellets of equal size																	
MRa373	A	1.04 g	MB2989 + H2O	1.56 g KOH (90%)		mill (3 min)	yes	N2	3 °C/min	800 °C	1 h	39 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.43 g	3.5 ml	Mostly 1	shiny black/grey
water added to biochar => 8% (KFT), ground biochar (brown powder) compacted to two pellets of equal size																	
MRa375	A	1.04 g	MB2996 + H2O	1.56 g KOH (90%)		mill (1+3 min)	yes	N2	3 °C/min	800 °C	1 h	40 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.51 g	3.2 ml	Mostly 1	black/grey barely shiny
water added to mill => 9% (calc), ground biochar (brown powder) compacted to two pellets of equal size																	
MRa376	C	16.7 g	MB2998 + H2O	25.0 g KOH (90%)		blender, 10+80 sec	?	N2	3 °C/min	800 °C	1 h	189 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	7.6 g	60.0 ml	Mostly 1	shiny black/grey
water added to blender => 7-8% (calc), rotating oven, powder not compacted																	
MB3041	B	1.3 g	MB2996	1.3 g KOH (90%)		mill (3 min)	yes	N2	3 °C/min	800 °C	1 h	39 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.46 g	3.0 ml	1	black/grey barely shiny
ground biochar (brown powder) compacted to two pellets of equal size																	
MB3043	C	16.5 g	MB3000	24.72 g KOH (90%)		blender, 90 sec	yes	N2	3 °C/min	800 °C	1 h	285 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	7.11 g	70.0 ml	Mostly 1	black/grey barely shiny
Rotating oven, powder not compacted																	
MRa380	A	1.0 g	MB2996 + H2O	1.0 g KOH (90%)		mill (3 min)	yes	N2	3 °C/min	800 °C	1 h	39 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.48 g	5.0 ml	1/2 mix	shiny black/grey
water added to biochar => 11.5% (KFT), ground biochar (brown powder) compacted to two pellets of equal size																	
MB3046	C	15.6 g	MB3032	24.20 g KOH (90%)		blender, 90 sec	yes	N2	3 °C/min	800 °C	1 h	311 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	7.05 g	95.0 ml	*	shiny black/grey
KOH not milled, rotating oven, powder not compacted																	
MRa385	C	17.8 g	MRa367	26.6 g KOH (90%)		blender, 6x15 sec	no	N2	3 °C/min	800 °C	1 h	183 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	8.60 g	125.0 ml	Mostly 1/2 mix	shiny black/grey
Rotating oven, powder not compacted																	
MRa386	A	2.1 g	MRa368	2.1 g KOH (90%)		mill (3 min)	yes	N2	3 °C/min	800 °C	1 h	60 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.65 g	3.7 ml	1	black/grey barely shiny
ground biochar (brown powder) compacted to two pellets of equal size																	

Experiment	Oven	Qty	Lot	Base	grinding	homogeneous?	Gas	T (rate)	T (max)	t	Wash	Drying	Output	Vol/Dens	Species	Appearance
MRa389A	C	17.2 g	MB3005/3008/3010 + H2O	25.8 g KOH (90%)	blender, 2x45 sec	?	N2	3 °C/min	800 °C	1 h	178 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	8.2 g 48%	70.0 ml 8.5 ml/g	1	black/grey barely shiny
			water added to blender => 5% (calc), rotating oven, powder not compacted													
MRa389B	C	16.5 g	MB3005/3008/3010 + H2O	24.8 g KOH (90%)	blender, 2x45 sec	?	N2	3 °C/min	800 °C	1 h	114 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	5.2 g 31%	50.0 ml 9.6 ml/g	1	black/grey somewhat shiny
			water added to blender => 5% (calc), rotating oven, powder not compacted													
MRa389C	C	15.2 g	MB3005/3008/3010 + H2O	22.9 g KOH (90%)	blender, 2x45 sec	?	N2	3 °C/min	800 °C	1 h	154 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	7.3 g 48%	60.0 ml 8.2 ml/g	1	black/grey barely shiny
			water added to blender => 5% (calc), rotating oven, powder not compacted													
MB3050	C	17.8 g	MB3044	17.8 g KOH (90%)	blender, 90 sec	yes	N2	3 °C/min	800 °C	1 h	125 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	8.1 g 46%	40.0 ml 4.9 ml/g	Mostly 1*	dull black/grey
			Rotating oven, powder not compacted													
MB3051	C	16.3 g	MB3040	24.5 g KOH (90%)	blender, 4x45 sec	yes	N2	3 °C/min	800 °C	1 h	269 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	7.20 g 44%	90.0 ml 12.5 ml/g	Mostly 1	black/grey somewhat shiny
			Rotating oven, powder not compacted													
MRa394	C	21.4 g	MB3045	21.4 g KOH (90%)	blender, 90 sec	no	N2	3 °C/min	800 °C	1 h	148 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	7.2 g 34%	40.0 ml 5.5 ml/g	Mostly 1*	dull black/grey
			Rotating oven, powder not compacted													
MB3054	C	16.0 g	MB3034	16.0 g KOH (90%)	blender, 90 sec	no	N2	3 °C/min	800 °C	1 h	124 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	7.51 g 47%	70.0 ml 9.3 ml/g	*	dull black/grey
			Rotating oven, powder not compacted													
MRa395	A	1.3 g	MB3034	1.3 g KOH (90%)	blender, 90 sec	no	N2	3 °C/min	800 °C	1 h	39 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	0.6 g 46%	3.0 ml 5.0 ml/g	Mostly 1*	dull black/grey
			ground biochar (brown powder) compacted to two pellets of equal size													
MRa398A	C	25.6 g	MB3016/3018/3020	38.5 g KOH (90%)	blender, 2x45 sec	no	N2	3 °C/min	800 °C	1 h	256 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	12.6 g 49%	100.0 ml 7.9 ml/g	1	dull black/grey
			Rotating oven, powder not compacted, powder turned dark during milling													
MRa398B	C	30.4 g	MB3016/3018/3020	45.6 g KOH (90%)	blender, 2x45 sec	no	N2	3 °C/min	800 °C	1 h	303 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	14.2 g 47%	90.0 ml 6.3 ml/g	1	dull black/grey
			Rotating oven, powder not compacted, powder turned dark during milling													
MB3055	C	40.6 g	(various combined lots)	61.0 g KOH (90%)	blender, 2x45 sec	no	N2	3 °C/min	800 °C	1 h	573 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	19.4 g 48%	105.0 ml 5.4 ml/g	1	dull black/grey
			Rotating oven, powder not compacted, powder turned dark during milling													
MRa399	C	47.7 g	(various combined lots)	71.5 g KOH (90%)	blender, 3x30 sec	no	N2	3 °C/min	800 °C	1 h	488 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	21.7 g 46%	125.0 ml 5.8 ml/g	1	dull black/grey
			Rotating oven, powder not compacted													
MRa401	C	48.7 g	TB1168 (pilot plant #1)	73.1 g KOH (90%)	blender, 3x30 sec	no	N2	3 °C/min	800 °C	1 h	517 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	23.9 g 49%	125.0 ml 5.2 ml/g	1	dull black/grey
			Rotating oven, powder not compacted													
MRa402	C	48.8 g	TB1168 (pilot plant #1) + H2O	73.3 g KOH (90%)	blender, 10 + 3x30 sec	no	N2	3 °C/min	800 °C	1 h	500 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	23.6 g 48%	110.0 ml 4.7 ml/g	1	dull black/grey
			Rotating oven, powder not compacted													
MRa403	C	44.9 g	(various combined lots)	67.4 g KOH (90%)	blender, 2x45 sec	no	N2	3 °C/min	800 °C	1 h	504 g 10% HCl (+ water)	100 °C N2 stream (atm. Pressure)	21.4 g 48%	120.0 ml 5.6 ml/g	1	dull black/grey
			Rotating oven, powder not compacted, powder turned dark during milling													

Comments

- Yellow/red text for the lot of biochar show cases where the quality of the milled material was somewhat/significantly impaired by contact with air and/or moisture (leading to heating or colour change of the material, stickiness, clumping or similar changed in appearance)
- The information on homogeneity of the milled material is based on optical and acoustic evaluation