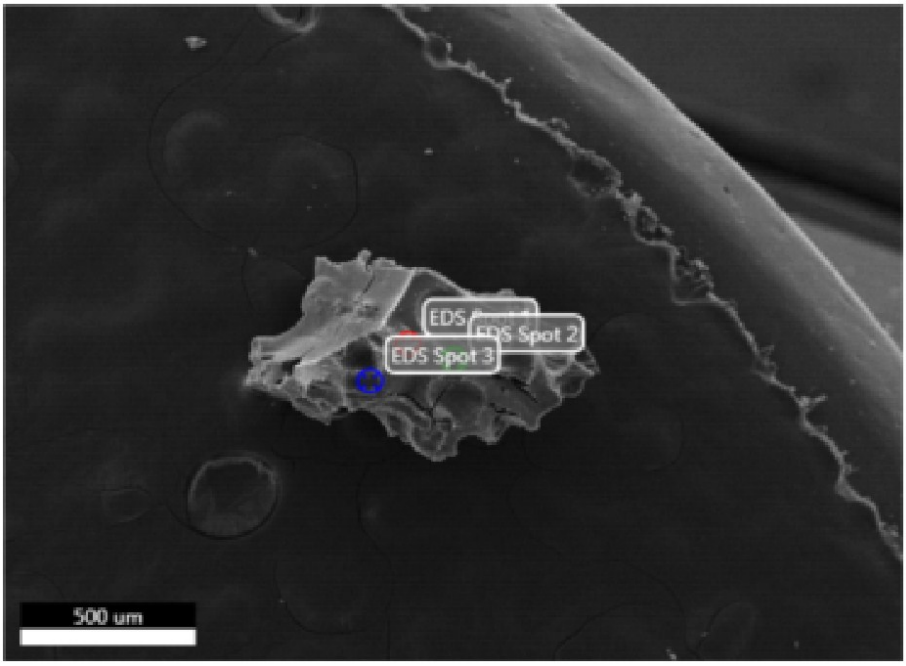
Supplementary information

Table S1. Product yield from in-situ catalytic pyrolysis.

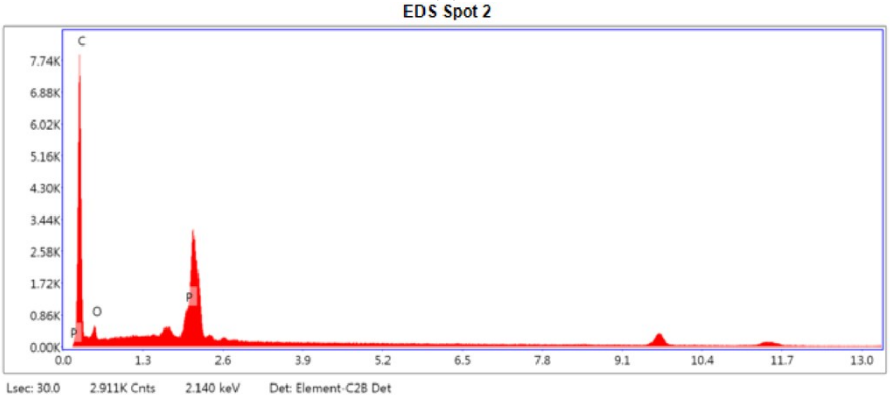
Run Order	Temp	C/B	Bio-oil yield (wt. %)	Biochar yield (wt. %)	Syngas yield (wt. %)
1	400	0.625	16	23.65	60.35
2	350	1	13.75	23	63.25
3	350	0.25	15.7	18.8	65.5
4	400	1.15	12.25	18.65	69.1
5	400	0.625	18.15	20.2	61.65
6	400	0.625	18.75	25.85	55.4
7	400	0.094	25.5	14.5	60
8	400	0.625	18.65	24.7	56.65
9	329.28	0.625	10.25	17.5	72.25
10	450	0.25	19.35	20	60.65
11	450	1	14.6	18.5	66.9
12	400	0.625	20.55	17	62.45
13	470.71	0.625	17.1	20.5	62.4

Table S2. Product yield from ex-situ catalytic pyrolysis.

Run Order	Temp	C/B	Bio-oil yield (wt. %)
1	300	0.1	25.26
2	400	0.215	23.1
3	400	0.052365	32
4	400	0.215	23.63
5	500	0.1	26.6
6	300	0.33	20.03
7	400	0.215	27.5
8	500	0.33	20.76
9	400	0.215	28.7
10	258.579	0.215	23.23
11	400	0.215	25.53
12	541.421	0.215	24.73
13	400	0.377635	23.03



(a)



(b)

Figure S1. Surface elemental distribution of corn stover derived AC given by EDX.

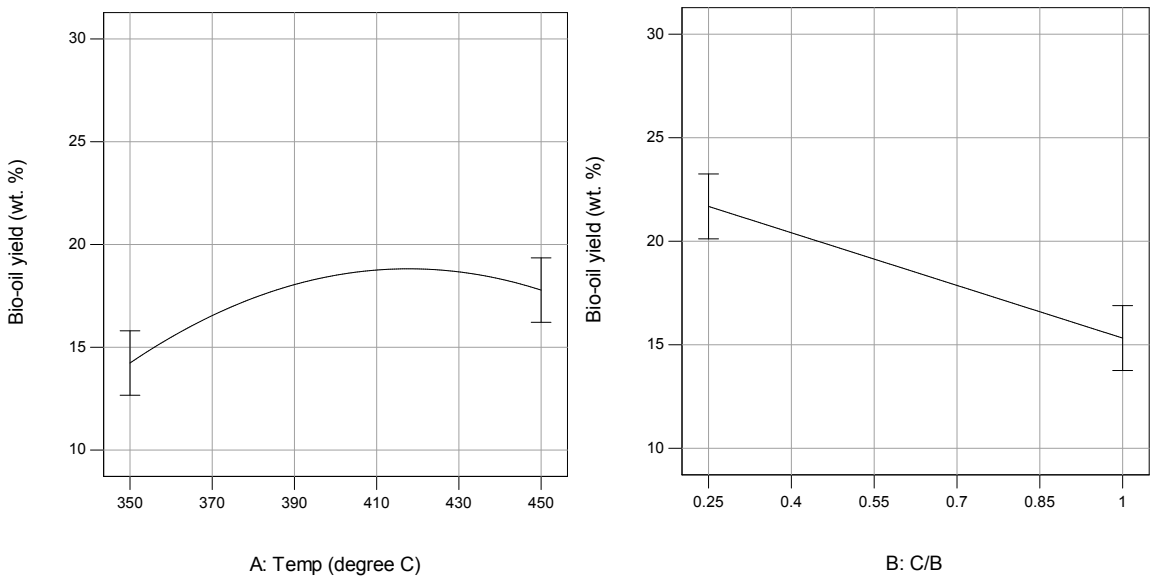


Figure S2. Plot of main effects on bio-oil yield from in-situ catalytic pyrolysis

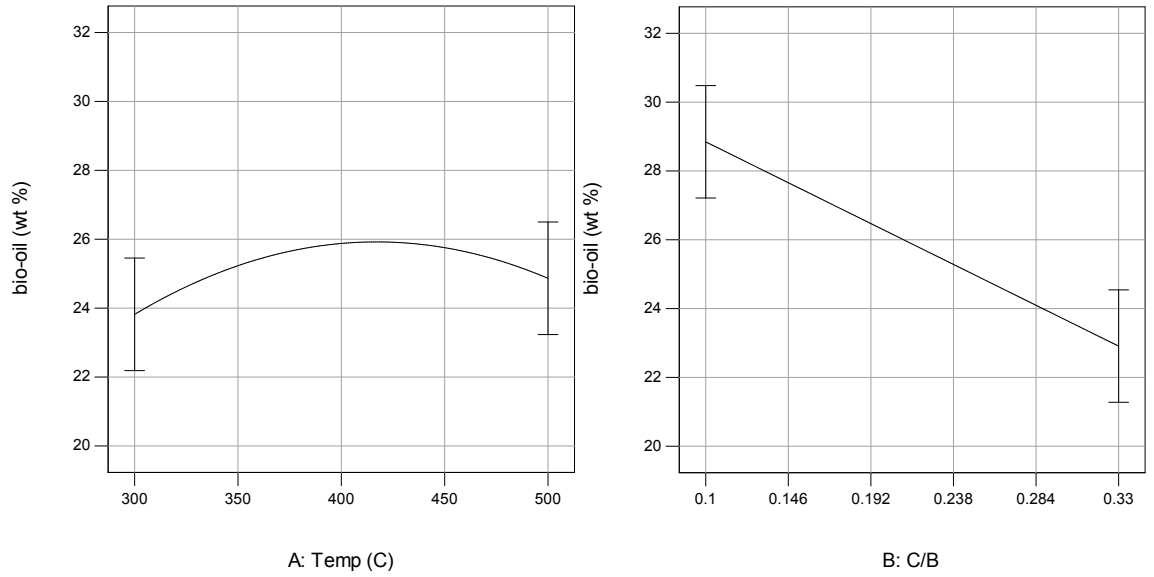


Figure S3. Plot of main effects on bio-oil yield from ex-situ catalytic pyrolysis

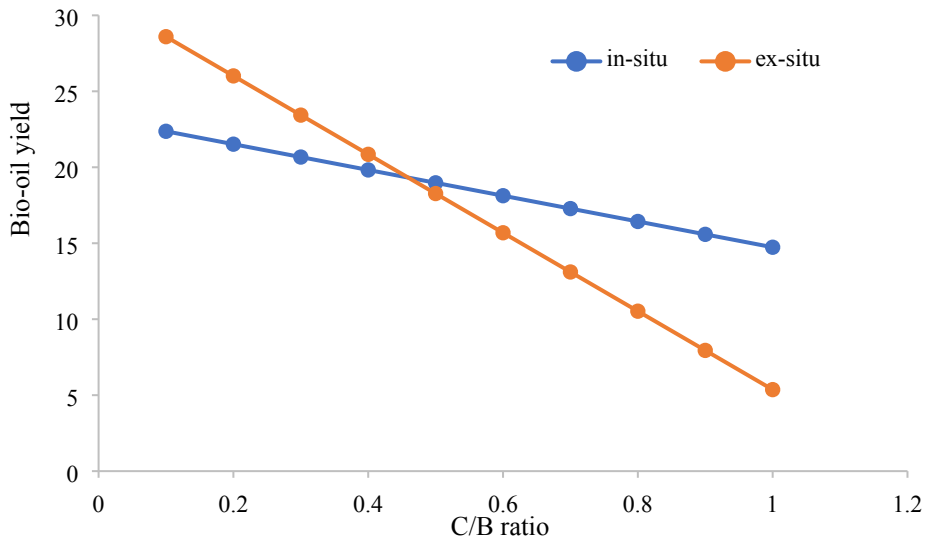


Figure S4. Comparison of bio-oil yield from in-situ and ex-situ catalytic pyrolysis (operated temperature: 450 °C)

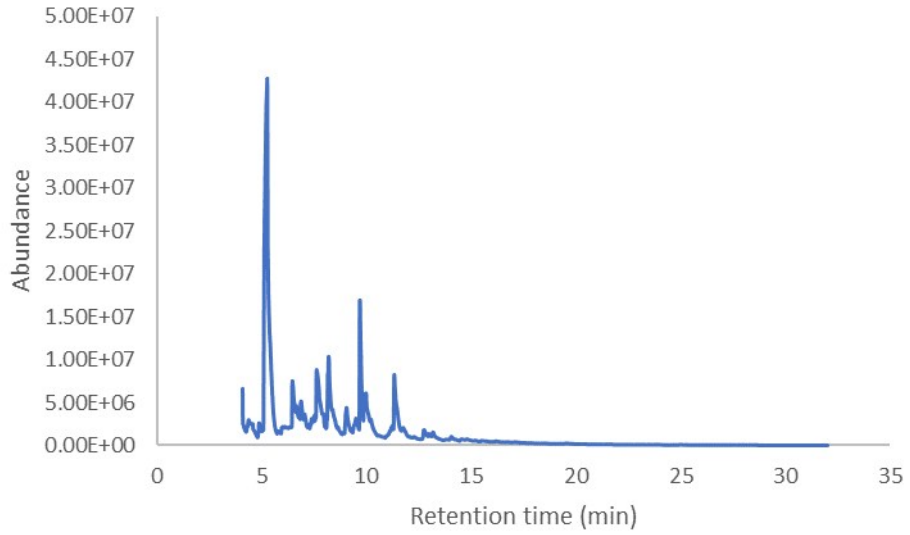
Table S3. Yields of major compounds in bio-oil from in-situ catalytic pyrolysis.

Run Order	Temp	C/B	Phenol concentration (mg/ml bio-oil)	Furfural concentration (mg/ml bio-oil)	Guaiacol concentration (mg/ml bio-oil)
1	400	0.625	9.72	9.52	0
2	400	0.625	5.26	15.16	0.9
3	470.71	0.625	4.54	16.54	2.46
4	350	0.25	4.78	20.9	2.86
5	400	1.155	7.16	2.38	0
6	329.28	0.625	5.12	7.42	0.6
7	450	0.25	4.14	20.2	3.5
8	350	1	9.9	6.76	0
9	400	0.625	5.76	18.02	2.14
10	400	0.625	4.82	11.98	1.64
11	400	0.625	4.24	12.6	1.44
12	450	1	6.84	3.52	0
13	400	0.094	4.32	14.4	2.48

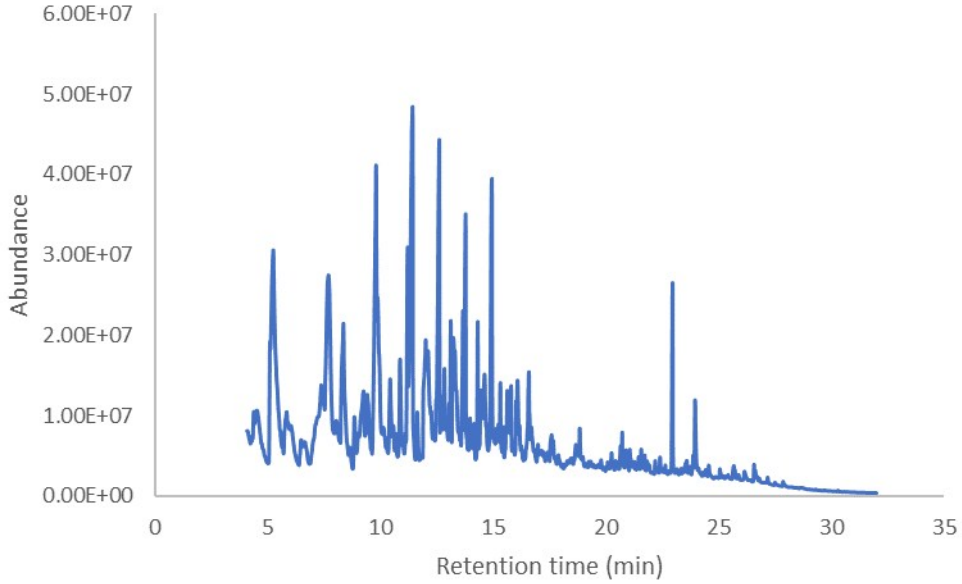
Table S4. Yields of major compounds in bio-oil from ex-situ catalytic pyrolysis.

Run	Temp	C/B	Phenol concentration (mg/ml bio-oil)	Furfural concentration (mg/ml bio-oil)	Guaiacol concentration (mg/ml bio-oil)
1	300	0.1	6.82	32.98	8.78
2	300	0.33	19.76	28.28	2.76
3	258.5	0.215	7.9	39.66	11.42

4	400	0.215	6.36	18.15	2.78
5	400	0.215	4.14	21.62	3.72
6	400	0.215	6.3	30.18	7.66
7	541.4	0.215	17.74	27.7	3.58
8	400	0.215	7.76	25.58	7.82
9	400	0.377	4.2	12.98	1.1
10	500	0.33	12.66	14.42	2.06
11	500	0.1	10.26	38.38	9.08
12	400	0.215	6.98	25.64	7.32
13	400	0.052	5.72	33.46	14.12



(a)



(b)

Figure S5. Comparison of GC/MS chromatograms of bio-oils from fresh (a) and 7th used (b) AC catalysts.