

In-Depth Study on Synergic Interactions and Thermo-Kinetic Analysis of (Wheat Straw and Woody Sawdust) Biomass Co-Pyrolysis over Mussel Shell-Derived CaO Catalyst Using Coats–Redfern Method

Table. S1 Represents the Thermo-Kinetic Properties of (WS-WB) blends

Sample Code	Symbols	Overall Temperature Range (180-430 °C)						
		E _a (kJ/mol)	A (s ⁻¹)	R ²	T _p (°C)	ΔH (kJ/mol)	ΔG (kJ/mol)	ΔS (kJ/mol K)
100WS	F1	63.94	7.61E+02	0.98	328.27	58.95	161.11	-0.17
80WS-20WB		60.05	2.98E+02	0.98	330.32	55.03	162.26	-0.18
60WS-40WB		59.05	2.22E+02	0.99	327.93	54.05	162.31	-0.18
40WS-60WB		60.86	2.73E+02	0.99	334.27	55.81	164.22	-0.18
20WS-80WB		60.60	2.61E+02	0.99	334.34	55.55	164.20	-0.18
100WB		58.75	1.75E+02	0.99	368.72	53.41	170.63	-0.18
100WS	F2	79.02	3.44E+04	0.98	328.27	74.02	157.12	-0.14
80WS-20WB		73.90	9.95E+03	0.98	330.32	68.88	158.50	-0.15
60WS-40WB		72.42	6.67E+03	0.98	327.93	67.43	158.67	-0.15
40WS-60WB		73.09	6.03E+03	0.98	334.27	68.04	160.81	-0.15
20WS-80WB		74	7.72E+03	0.98	334.34	68.95	160.48	-0.15
100WB		72.18	5.22E+03	0.98	368.72	66.85	165.94	-0.15
100WS	F3	97.29	3.30E+06	0.97	328.27	92.29	152.58	-0.10
80WS-20WB		90.59	6.47E+05	0.96	330.32	85.58	154.25	-0.11

60WS-40WB		88.59	3.87E+05	0.96	327.93	83.60	154.55	-0.11
40WS-60WB		87.79	2.39E+05	0.96	334.27	82.74	156.94	-0.12
20WS-80WB		90.27	4.48E+05	0.95	334.34	85.22	156.24	-0.12
100WB		88.52	3.07E+05	0.94	368.72	83.18	160.54	-0.12
100WS	F4	117.83	5.32E+08	0.94	328.27	112.83	147.70	-0.06
80WS-20WB		109.35	6.74E+07	0.94	330.32	104.34	149.70	-0.07
60WS-40WB		106.74	3.53E+07	0.93	327.93	101.74	150.14	-0.08
40WS-60WB		104.26	1.42E+07	0.92	334.27	99.21	152.78	-0.09
20WS-80WB		108.52	4.08E+07	0.92	334.34	103.46	151.71	-0.08
100WB		48.70	2.81E+07	0.90	368.72	101.47	154.73	-0.08
100WS	R1	52.55	4.05E+01	0.96	328.27	47.55	164.47	-0.19
80WS-20WB		49.43	1.93E+01	0.96	330.32	44.42	165.38	-0.20
60WS-40WB		48.88	1.59E+01	0.97	327.93	43.88	165.30	-0.20
40WS-60WB		51.46	2.43E+01	0.98	334.27	46.41	167.03	-0.20
20WS-80WB		50.54	1.96E+01	0.98	334.34	45.49	167.21	-0.20
100WB		48.70	1.32E+01	0.98	368.72	43.36	174.38	-0.20
100WS	R2	57.80	7.87E+01	0.97	328.27	52.80	166.30	-0.19
80WS-20WB		54.34	3.44E+01	0.98	330.32	49.33	167.38	-0.20
60WS-40WB		53.57	2.70E+01	0.98	327.93	48.57	167.35	-0.20
40WS-60WB		55.81	3.74E+01	0.99	334.27	50.76	169.20	-0.20
20WS-80WB		55.16	3.24E+01	0.99	334.34	50.11	169.30	-0.20

100WB		53.31	2.17E+01	0.99	368.72	47.97	176.33	-0.20
100WS	P3	11.34	4.35E-03	0.90	328.27	6.32	168.84	-0.27
80WS-20WB		10.27	3.14E-03	0.91	330.32	5.26	169.98	-0.27
60WS-40WB		10.10	2.91E-03	0.92	327.93	5.10	169.54	-0.27
40WS-60WB		10.95	3.56E-03	0.95	334.27	5.90	171.10	-0.27
20WS-80WB		10.61	3.21E-03	0.99	334.34	5.56	171.31	-0.27
100WB		10.01	2.69E-03	0.95	368.72	4.67	181.04	-0.28
100WS	P4	6.16	9.15E-04	0.81	328.27	1.16	171.48	-0.28
80WS-20WB		5.38	6.72E-04	0.83	330.32	0.36	172.82	-0.28
60WS-40WB		5.25	6.27E-04	0.84	327.93	0.25	172.35	-0.28
40WS-60WB		5.88	7.70E-04	0.90	334.27	0.84	173.77	-0.28
20WS-80WB		5.62	6.96E-04	0.87	334.34	0.57	174.04	-0.28
100WB		5.17	5.85E-04	0.90	368.72	-0.17	184.34	-0.28
100WS	D1	114.40	7.95E+06	0.97	328.27	109.40	165.28	-0.09
80WS-20WB		108.18	1.92E+06	0.97	330.32	103.16	166.37	-0.10
60WS-40WB		107.06	1.33E+06	0.98	327.93	102.06	166.85	-0.11
40WS-60WB		112.23	2.93E+06	0.98	334.27	107.18	168.72	-0.10
20WS-80WB		110.44	1.97E+06	0.98	334.34	105.39	168.93	-0.10
100WB		106.75	9.26E+05	0.98	368.72	101.42	172.88	-0.11
100WS	D2	120.88	2.00E+07	0.97	328.27	115.88	167.15	-0.08
80WS-20WB		114.27	4.39E+06	0.98	330.32	109.25	168.32	-0.10

60WS-40WB		112.87	2.85E+06	0.98	327.93	107.87	168.85	-0.10
40WS-60WB		117.64	5.63E+06	0.99	334.27	112.58	170.82	-0.10
20WS-80WB		116.14	4.07E+06	0.99	334.34	111.08	170.96	-0.10
100WB		112.43	1.90E+06	0.99	368.72	107.09	174.72	-0.11
100WS	D3	128.78	3.16E+07	0.98	328.27	123.78	172.78	-0.08
80WS-20WB		121.62	6.03E+06	0.98	330.32	116.60	174.08	-0.10
60WS-40WB		119.91	3.65E+06	0.99	327.93	114.91	174.65	-0.10
40WS-60WB		124.14	6.25E+06	0.99	334.27	119.09	176.79	-0.10
20WS-80WB		123.11	5.08E+06	0.99	334.34	118.06	176.83	-0.10
100WB		119.4	2.36E+06	0.99	368.72	114.06	180.53	-0.10
100WS	D4	123.49	8.50E+06	0.98	328.27	118.49	174.04	-0.09
80WS-20WB		116.70	1.78E+06	0.98	330.32	111.68	175.27	-0.11
60WS-40WB		115.19	1.13E+06	0.99	327.93	110.19	175.80	-0.11
40WS-60WB		119.78	2.13E+06	0.99	334.27	114.73	177.88	-0.10
20WS-80WB		118.44	1.60E+06	0.99	334.34	113.38	177.99	-0.11
100WB		114.73	7.46E+05	0.99	368.72	109.39	182.01	-0.11
100WS	A2	27.33	2.76E-01	0.97	328.27	22.33	164.10	-0.24
80WS-20WB		25.37	1.65E-01	0.98	330.32	20.36	165.20	-0.24
60WS-40WB		24.88	1.41E-01	0.99	327.93	19.88	164.92	-0.24
40WS-60WB		25.78	1.59E-01	0.99	334.27	20.73	166.73	-0.24
20WS-80WB		25.63	1.54E-01	0.99	334.34	20.57	166.76	-0.24

100WB		24.70	1.24E-01	0.99	368.72	19.36	175.28	-0.24
100WS	A3	15.12	1.44E-02	0.96	328.27	10.12	166.64	-0.26
80WS-20WB		13.81	9.85E-03	0.97	330.32	8.80	167.79	-0.26
60WS-40WB		13.48	8.77E-03	0.98	327.93	8.49	167.41	-0.26
40WS-60WB		14.08	9.69E-03	0.99	334.27	9.03	169.18	-0.26
20WS-80WB		13.97	9.42E-03	0.99	334.34	8.92	169.22	-0.26
100WB		13.35	7.98E-03	0.98	368.72	8.02	178.58	-0.26

Table. S2 Represents the Thermo-Kinetic properties of the Optimum Blend with three mass loadings

Overall Temperature Range (150–500 °C)								
Sample Code	Symbols	E _a (kJ/mol)	A (s ⁻¹)	R ²	T _p (°C)	ΔH (kJ/mol)	ΔG (kJ/mol)	ΔS (kJ/mol K)
5%-CaO	F1	57.17	1.76E+02	0.98	322.33	52.22	160.57	-0.18
7%-CaO		51.33	4.08E+01	0.98	322.91	46.37	162.07	-0.19
10%-CaO		59.40	2.94E+02	0.98	321.75	54.46	160.15	-0.18
5%-CaO	F2	66.24	2.02E+03	0.97	322.33	61.29	157.57	-0.16
7%-CaO		59.08	3.32E+02	0.96	322.91	54.12	159.43	-0.18
10%-CaO		67.62	2.69E+03	0.97	321.75	62.68	157.42	-0.16
5%-CaO	F3	76.95	3.48E+04	0.95	322.33	72	154.17	-0.14
7%-CaO		68.11	3.73E+03	0.94	322.91	63.16	156.48	-0.16
10%-CaO		77.22	3.49E+04	0.95	321.75	72.28	154.35	-0.14
5%-CaO	F4	88.94	8.24E+05	0.93	322.33	83.99	150.50	-0.11
7%-CaO		78.20	5.42E+04	0.92	322.91	73.24	153.31	-0.13
10%-CaO		87.94	5.98E+05	0.93	321.75	83	151.02	-0.11
5%-CaO	R1	49.90	2.44E+01	0.98	322.33	44.95	163.08	-0.20
7%-CaO		44.97	7.16E+00	0.98	322.91	40.02	164.34	-0.21
10%-CaO		52.67	4.72E+01	0.98	321.75	47.73	162.48	-0.19
5%-CaO	R2	53.31	3.09E+01	0.98	322.33	48.36	165.32	-0.20
7%-CaO		47.98	8.18E+00	0.98	322.91	43.02	166.69	-0.21
10%-CaO		55.85	5.62E+01	0.98	321.75	50.91	164.79	-0.19

5%-CaO	P3	10.74	3.78E-03	0.95	322.33	5.79	167.35	-0.27
7%-CaO		9.09	2.20E-03	0.95	322.91	4.14	168.55	-0.28
10%-CaO		11.72	5.11E-03	0.96	321.75	6.77	166.68	-0.27
5%-CaO	P4	5.85	8.33E-04	0.91	322.33	0.90	169.95	-0.28
7%-CaO		4.61	4.94E-04	0.90	322.91	-0.34	171.46	-0.29
10%-CaO		6.60	1.11E-03	0.93	321.75	1.65	169.12	-0.28
5%-CaO	D1	108.64	2.74E+06	0.98	322.33	103.69	164.24	-0.10
7%-CaO		98.80	2.66E+05	0.98	322.91	93.85	166.02	-0.12
10%-CaO		114.11	9.52E+06	0.99	321.75	109.16	163.50	-0.09
5%-CaO	D2	112.92	4.23E+06	0.99	322.33	107.97	166.38	-0.10
7%-CaO		102.60	3.63E+05	0.98	322.91	97.64	168.28	-0.12
10%-CaO		118.13	1.37E+07	0.99	321.75	113.18	165.71	-0.09
5%-CaO	D3	117.93	3.49E+06	0.99	322.33	112.98	172.34	-0.10
7%-CaO		106.96	2.53E+05	0.98	322.91	102	174.42	-0.12
10%-CaO		122.75	1.03E+07	0.99	321.75	117.81	171.77	-0.10
5%-CaO	D4	114.58	1.45E+06	0.99	322.33	109.63	173.33	-0.11
7%-CaO		104.04	1.18E+05	0.98	322.91	99.09	175.30	-0.13
10%-CaO		119.66	4.56E+06	0.99	321.75	114.72	172.69	-0.10
5%-CaO	A2	24.17	1.30E-01	0.98	322.33	19.22	163.25	-0.24
7%-CaO		21.24	5.81E-02	0.97	322.91	16.28	164.46	-0.25
10%-CaO		25.32	1.75E-01	0.98	321.75	20.38	162.81	-0.24
5%-CaO	A3	13.17	8.56E-03	0.97	322.33	8.22	165.73	-0.26
7%-CaO		11.21	4.63E-03	0.96	322.91	6.25	166.98	-0.27
10%-CaO		13.96	1.08E-02	0.97	321.75	9.01	165.24	-0.26