

Calorific Value Prediction Model Using Structure Composition of Heat-Treated Lignocellulosic Biomass

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Table s1. Data from previous studies, 111 structural analyses and calorific value data

No.	Type	Biomass	Cell	Hemie	Lig	Ref
1	Woody	Loblolly pine wood	47.89	20.28	28.5	[1]
2	Woody	Torrefied loblolly pine wood (250°C 0.25h)	46.27	16.43	32.2	
3	Woody	Torrefied loblolly pine wood (250°C 0.5h)	48.42	10.9	37.25	
4	Woody	Torrefied loblolly pine wood (250°C 1h)	49.37	7.65	41.62	
5	Woody	Torrefied loblolly pine wood (250°C 2h)	47.71	4.47	44.53	
6	Woody	Torrefied loblolly pine wood (250°C 4h)	44.24	1.75	52.33	
7	Woody	Torrefied loblolly pine wood (250°C 6h)	43.88	1.46	55.4	
8	Woody	Torrefied loblolly pine wood (250°C 8h)	38.31	0.71	57.8	
9	Woody	Torrefied loblolly pine wood (300°C 0.5h)	22.34	1.85	73.39	
10	Woody	Wood wastes	53.5	16	20.6	[2]
11	Woody	Torrefied wood wastes (225°C 30min)	49.4	15.43	20.7	
12	Woody	Torrefied wood wastes (275°C 30min)	46.5	3.4	35.5	
13	Woody	Torrefied wood wastes (300°C 30min)	34.71	4.58	48.7	
14	Woody	Torrefied wood wastes (225°C 60min)	43.3	14.12	25.3	
15	Woody	Torrefied wood wastes (275°C 60min)	46.63	5.2	38.3	
16	Woody	Torrefied wood wastes (300°C 60min)	30.5	5.1	55.9	
17	Woody	Poplar	50.11	22.54	24.71	[3]
18	Woody	Beech	44.87	33.53	16.763	
19	Woody	Loblolly pine	54	11.8	25	[4]
20	Woody	Torrefied loblolly pine (250°C)	51	9.2	34.1	
21	Woody	Torrefied loblolly pine (275°C)	52.7	6.5	36.7	
22	Woody	Torrefied loblolly pine (300°C)	32.7	2.3	62.7	
23	Woody	Jack Pine	45	17.88	34.06	[5]
24	Woody	Torrefied jack Pine (400°C)	13.82	0.42	83.65	
25	Woody	Torrefied jack Pine (454°C)	2.72	0.02	96.76	
26	Woody	Balsam Fir	40.72	31.99	24.29	
27	Woody	Black spruce	44.66	23.2	28.83	
28	Woody	Torrefied black spruce (400°C)	9.55	0.28	89.59	
29	Woody	Acacia spp	43.16	28.53	23.69	[6]
30	Woody	Torrefied Acacia spp (200°C 15min)	44.45	23.67	26.36	

31	Woody	Torrefied Acacia spp (200°C 30min)	45.02	21.17	27.7	
32	Woody	Torrefied Acacia spp (200°C 45min)	46.09	19.3	28.12	
33	Woody	Macaranga spp.	45.64	23.1	27.03	
34	Woody	Torrefied Macaranga spp (200°C 15min)	48	19.06	28.07	
35	Woody	Torrefied Macaranga spp (200°C 30min)	49.02	15.72	29.34	
36	Woody	Torrefied Macaranga spp (200°C 45min)	48.91	16.63	29.74	
37	Woody	Torrefied Macaranga spp (250°C 15min)	50.45	12.45	31.05	
38	Woody	Torrefied Macaranga spp (200°C 30min)	49.58	10.84	32.61	
39	Woody	Empty fruit branch	44.24	30.61	12.69	
40	Woody	Torrefied Empty fruit branch (200°C 15min)	48.71	21.08	16.21	
41	Woody	Torrefied Empty fruit branch (300°C 15min)	47.1	16.12	23.28	
42	Woody	Oil Palm Trunk	33.44	40.21	10.84	
43	Woody	Torrefied Oil Palm Trunk (200°C 15min)	38.06	35.44	11.12	
44	Woody	Torrefied Oil Palm Trunk (200°C 30min)	46.98	28.99	11.89	
45	Woody	Torrefied Oil Palm Trunk (200°C 45min)	45.34	29.35	12.82	
46	Woody	Torrefied Oil Palm Trunk (250°C 15min)	46.14	28.01	12.07	
47	Woody	Torrefied Oil Palm Trunk (250°C 30min)	44.11	27.42	14.41	
48	Woody	Torrefied Oil Palm Trunk (250°C 45min)	42.76	27.37	16.82	
49	Woody	Torrefied Oil Palm Trunk (300°C 15min)	42.01	27.18	19.55	
50	Woody	Torrefied Oil Palm Trunk (300°C 30min)	39.96	26.27	23.87	
51	Woody	Torrefied Oil Palm Trunk (300°C 45min)	36.76	23.19	27.95	
52	Woody	Torrefied mixed waste wood (200°C)	39.4	24.6	28.1	[7]
53	Woody	Torrefied mixed waste wood (250°C)	42.8	16.7	32.9	
54	Woody	Torrefied mixed waste wood (300°C)	38.3	13.3	39.3	
55	Woody	Oak waste wood	38.3	25.5	22	
56	Woody	Torrefied oak waste wood (200°C)	41.1	26.3	26.5	
57	Woody	Torrefied oak waste wood (250°C)	43.7	7.7	31.4	
58	Woody	Torrefied oak waste wood (300°C)	36.2	5.3	43.7	[8]
59	Woody	Lauan	40.49	15.74	43.77	
60	Herbal	Torrefied oat hull (225°C)	34.4	27.34	15.4	[9]
61	Herbal	Torrefied oat hull (255°C)	38.92	0.81	35.18	
62	Herbal	Torrefied sugar bagasse (230°C)	31.09	13.13	46.2	[10]
63	Herbal	Barley straw	41.5	36.3	8.8	[2]
64	Herbal	Torrefied barley straw (225°C 30min)	39.8	32.4	10.25	
65	Herbal	Torrefied barley straw (275°C 60min)	48	2.6	33	
66	Herbal	Torrefied barley straw (300°C 60min)	5.5	5	48.2	
67	Herbal	Cumin stalk	44	11.3	10.86	
68	Herbal	Torrefied cumin stalk (225°C 30min)	38.8	11.3	17.3	
69	Herbal	Torrefied cumin stalk (275°C 30min)	24	5	34.1	
70	Herbal	Torrefied cumin stalk (225°C 60min)	39.76	6.86	18.2	

71	Herbal	Torrefied cumin stalk (300°C 60min)	9.26	4.31	35.3	[11]
72	Herbal	Bamboo	50	23	28	
73	Herbal	Torrefied bamboo (210°C)	56	14	30	
74	Herbal	Torrefied bamboo (240°C)	58	7	34	
75	Herbal	Torrefied bamboo (270°C)	53	2	45	
76	Herbal	Torrefied sugarcane bagasse (200°C 15min)	37.1	24.9	21.5	[12]
77	Herbal	Torrefied sugarcane bagasse (200°C 30min)	36.9	24.2	22.8	
78	Herbal	Torrefied sugarcane bagasse (200°C 45min)	35.7	23.5	24.9	
79	Herbal	Torrefied sugarcane bagasse (200°C 60min)	35.1	22.9	26.6	
80	Herbal	Torrefied sugarcane bagasse (225°C 15min)	36.9	23.8	22.8	
81	Herbal	Torrefied sugarcane bagasse (225°C 30min)	34.8	22.2	26.6	
82	Herbal	Torrefied sugarcane bagasse (225°C 45min)	33.2	21.9	28.8	
83	Herbal	Torrefied sugarcane bagasse (250°C 15min)	33.6	21.5	28.6	
84	Herbal	Torrefied sugarcane bagasse (250°C 30min)	31.3	20.1	32.4	
85	Herbal	Torrefied sugarcane bagasse (250°C 45min)	30.4	19.8	33.7	
86	Herbal	Torrefied sugarcane bagasse (275°C 15min)	29.9	19.7	33.8	
87	Herbal	Torrefied sugarcane bagasse (275°C 30min)	25.9	17.6	40.3	
88	Herbal	Torrefied sugarcane bagasse (300°C 15min)	20.3	10.6	52.4	
89	Herbal	Conservation Reserve Program biomass	30.18	23.12	13.01	[13]
90	Herbal	Torrefied conservation Reserve Program biomass (200°C)	27.62	20.05	14.08	
91	Herbal	Torrefied conservation Reserve Program biomass (250°C)	26.95	19.38	15.84	
92	Herbal	Torrefied conservation Reserve Program biomass (300°C)	22.49	8.87	19.25	
93	Herbal	Torrefied verge grass (230°C 15min)	26.22	12.84	39.64	[14]
94	Herbal	Torrefied verge grass (250°C 15min)	25.35	10.96	41.09	
95	Herbal	Torrefied verge grass (270°C 15min)	19.46	5.44	54.52	
96	Herbal	Torrefied verge grass (290°C 15min)	1.99	0.59	75.82	
97	Herbal	Torrefied verge grass (250°C 30min)	24.1	7.69	47.6	
98	Herbal	Torrefied verge grass (270°C 30min)	16.06	4.99	57.34	
99	Herbal	Bagasse	40.19	19.74	28.75	
100	Herbal	Torrefied bagasse (250°C 15min)	41.74	16.9	30.91	
101	Herbal	Torrefied bagasse (290°C 15min)	48.74	5.56	44.73	
102	Herbal	Torrefied bagasse (310°C 15min)	37.6	3.32	50.23	
103	Herbal	Torrefied bagasse (250°C 30min)	48.04	13.58	34.65	
104	Herbal	Torrefied bagasse (270°C 30min)	41.63	7.24	42.59	
105	Herbal	Torrefied bagasse (290°C 30min)	43.12	5.32	44.82	
106	Herbal	Torrefied bagasse (310°C 30min)	25.87	2.03	57.34	
107	Herbal	Torrefied rice husk (200°C)	41.69	17.62	20.96	[15]
108	Herbal	Torrefied rice husk (250°C)	39.38	11.12	27.3	
109	Herbal	Torrefied rice husk (300°C)	23.15	0.2	54.02	
110	Herbal	Torrefied rice straw (250°C)	39.76	20.08	17.27	

111	Herbal	Torrefied rice straw (300°C)	10.89	5.89	64.9	
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