

No	Biomass	Heating rate [K/min]	Cellulose [wt.%]	Hemicellulose [wt.%]	Lignin [wt.%]	A [s ⁻¹]	Ea [kJ/mol]	n	Source
1	Pine sawdust	5	55.92	15.35	10.55	1.34E+10	116.12	3.28	(Mishra and Mohanty, 2018)
2		10	55.92	15.35	10.55	2.83E+05	67.97	2.04	
3		15	55.92	15.35	10.55	8.21E+04	62.11	2.48	
4		20	55.92	15.35	10.55	1.01E+05	62.45	2.01	
5		25	55.92	15.35	10.55	9.41E+03	51.83	1.41	
6	Sal sawdust	5	52.36	14.59	11.18	1.08E+05	64.28	2.8	(Mishra and Mohanty, 2018)
7		10	52.36	14.59	11.18	1.84E+06	74.58	2.6	
8		15	52.36	14.59	11.18	8.09E+05	70.85	2.31	
9		20	52.36	14.59	11.18	6.15E+06	78.51	2.95	
10		25	52.36	14.59	11.18	2.21E+05	64.41	2.26	
11	Areca nut husk	5	48.98	16.81	13.27	1.04E+04	53.42	2.39	(Mishra and Mohanty, 2018)
12		10	48.98	16.81	13.27	9.25E+04	61.95	2.03	
13		15	48.98	16.81	13.27	7.18E+05	67	2.37	
14		20	48.98	16.81	13.27	2.52E+05	63.8	2.23	
15		25	48.98	16.81	13.27	2.28E+05	63.15	2.22	
16	Walnut shell	5	23.95	22.18	48.11	6.40E+04	67.4	1.79	(Uzun and Yaman, 2017)
17	Oil palm empty fruit bunch	10	26.6	26.9	25.4	8.23E+08	121.48	4.4	(Yiin et al., 2018)
18	Coffee ground residues	5	10.6	36.6	40.6	5.13E+04	64.6	1.67	(Fermoso and Mašek, 2018)
19		10	10.6	36.6	40.6	1.67E+07	89.46	2.24	
20		15	10.6	36.6	40.6	5.87E+05	72.42	1.84	
21		25	10.6	36.6	40.6	8.56E+05	72.77	1.69	
22		50	10.6	36.6	40.6	3.79E+06	77.94	1.72	
23		100	10.6	36.6	40.6	2.91E+07	85.22	1.84	
24	Castor (Ricinus communis) residue	5	38.42	22.4	20.2	3.30E+01	28.04	1.73	(Kaur et al., 2018)
25		10	38.42	22.4	20.2	8.09E+01	29.09	2.26	
26		15	38.42	22.4	20.2	8.06E+01	28.15	1.84	
27		20	38.42	22.4	20.2	1.06E+02	28.39	1.84	
28		30	38.42	22.4	20.2	1.67E+02	28.66	2.1	
29		40	38.42	22.4	20.2	1.27E+02	27.11	1.62	
30	Prosopis juliflora	2	49.4	18	28.3	2.73E+08	97.02	3.04	(Chandrasekaran et al., 2017)
31		5	49.4	18	28.3	9.38E+08	100.75	3.05	
32		10	49.4	18	28.3	1.25E+07	82.01	2.26	
33		15	49.4	18	28.3	1.19E+07	80.51	2.33	
34		20	49.4	18	28.3	1.02E+07	79.76	2.07	
35		25	49.4	18	28.3	2.55E+07	83.08	2.28	
36	Guarana seed residue	10	7.82	59.37	13.49	2.36E+10	120.81	3.8	(Lopes et al., 2018)
37		15	7.82	59.37	13.49	2.22E+09	109.48	3.51	
38	African Jatropha	25	10.08	48.83	13.96	2.02E+06	84.5	1.46	(Titiloye et al., 2013)
39	African rice husk	25	37.34	10.07	41.08	4.59E+07	108.7	1.61	(Titiloye et al., 2013)
40	Bamboo	10	45.7	25.9	24.95	4.04E+07	103.7	1.69	(Yao et al., 2008)
41	C = H = L = 0.33	20	33	33	33	1.84E+07	90.37	1.215	(Sunphorka et al., 2017)
42		40	33	33	33	1.75E+07	91.01	1.28	
43	Date seed	10	20	55	23	7.71E+07	90.85	1.2	(Sait et al., 2012)
44	Empty fruit Bunches	10	38.3	35.3	22.1	9.89E+06	89.07	1.47	(Font et al., 2009)
45		50	38.3	35.3	22.1	9.93E+07	100.4	1.47	
46	Giant Leuciana	5	41.88	29.93	25.46	3.03E+07	88.66	1.33	(Sunphorka et al., 2017)
47	Hornbeam wood	2	48.9	23.3	20.1	2.28E+07	108.3	2.02	(Müller-Hagedorn et al., 2003)
48	Olive stones	10	57	18	25	1.36E+07	99.02	1.7	(Šimkovic and Csomorová, 2006)

49	Oriental oak	white	20	50.4	14.3	22.8	1.82E+07	107.8	1.88	(Park et al., 2009)
50	Palm fiber		15	36.69	30.51	32.8	3.11E+06	90.59	1.61	(Ly et al., 2013)
51			20	36.69	30.51	32.8	1.30E+06	86.02	1.64	
52	Palm shell		10	20.8	22.7	50.7	9.93E+07	104.4	1.39	(Pasangulapati et al., 2012)
53			50	20.8	22.7	50.7	9.80E+07	103.4	1.46	
54	Pinewood		10	39	34	12	4.73E+06	91.71	1.46	(Naik et al., 2010)
55	Poplar wood sawdust		20	44.74	16.73	30.72	4.77E+07	101.4	1.62	(XiaoLi et al., 2013)
56			60	44.74	16.73	30.72	9.96E+07	103.2	2.03	
57	Raw wood		30	40.49	15.74	43.77	1.01E+08	105.5	1.41	(Chen et al., 2011)
58	Rice bran		10	16.19	17.08	7.85	4.54E+10	139.8	2.13	(Xu and Chen, 2013)
59	Rice husk		10	28.6	28.6	24.4	1.01E+08	112.2	1.71	(Chen et al., 2012; Worasuwannarak et al., 2007)
60			20	36.06	21.34	21.16	7.62E+07	98.26	1.33	
61	Sisal β		10	73.8	11	9.7	1.76E+09	140.2	2.25	(Martin et al., 2010)
62	Willow		20	40.9	19.4	32.7	1.52E+07	107.2	1.87	(Mayer et al., 2012)

References

- Chandrasekaran, A., Ramachandran, S., Subbiah, S., 2017. Determination of kinetic parameters in the pyrolysis operation and thermal behavior of *Prosopis juliflora* using thermogravimetric analysis. *Bioresource Technology* 233, 413–422. doi:10.1016/j.biortech.2017.02.119.
- Chen, W.H., Hsu, H.C., Lu, K.M., Lee, W.J., Lin, T.C., 2011. Thermal pretreatment of wood (Lauan) block by torrefaction and its influence on the properties of the biomass. *Energy* 36, 3012–3021. URL: <https://ideas.repec.org/a/eee/energy/v36y2011i5p3012-3021.html>.
- Chen, W.H., Lu, K.M., Tsai, C.M., 2012. An experimental analysis on property and structure variations of agricultural wastes undergoing torrefaction. *Applied Energy* 100, 318–325. doi:10.1016/j.apenergy.2012.05.056.
- Fermoso, J., Mašek, O., 2018. Thermochemical decomposition of coffee ground residues by TG-MS: A kinetic study. *Journal of Analytical and Applied Pyrolysis* 130, 358–367. doi:10.1016/j.jaap.2017.12.007.
- Font, R., Moltó, J., Gálvez, A., Rey, M.D., 2009. Kinetic study of the pyrolysis and combustion of tomato plant. *Journal of Analytical and Applied Pyrolysis* 85, 268–275. doi:10.1016/j.jaap.2008.11.026.
- Kaur, R., Gera, P., Jha, M.K., Bhaskar, T., 2018. Pyrolysis kinetics and thermodynamic parameters of castor (*Ricinus communis*) residue using thermogravimetric analysis. *Bioresource Technology* 250, 422–428. doi:10.1016/j.biortech.2017.11.077.
- Lopes, F.C.R., Pereira, J.C., Tannous, K., 2018. Thermal decomposition kinetics of guarana seed residue through thermogravimetric analysis under inert and oxidizing atmospheres. *Bioresource Technology* 270, 294–302. doi:10.1016/j.biortech.2018.09.021.
- Ly, H.V., Kim, J., Kim, S.S., 2013. Pyrolysis characteristics and kinetics of palm fiber in a closed reactor. *Renewable Energy* 54, 91–95. doi:10.1016/j.renene.2012.08.053.
- Martin, A.R., Martins, M.A., da Silva, O.R.R.F., Mattoso, L.H.C., 2010. Studies on the thermal properties of sisal fiber and its constituents. *Thermochimica Acta* 506, 14–19. doi:10.1016/j.tca.2010.04.008.
- Mayer, Z.A., Apfelbacher, A., Hornung, A., 2012. A comparative study on the pyrolysis of metal- and ash-enriched wood and the combustion properties of the gained char. *Journal of Analytical and Applied Pyrolysis* 96, 196–202. doi:10.1016/j.jaap.2012.04.007.
- Mishra, R.K., Mohanty, K., 2018. Pyrolysis kinetics and thermal behavior of waste sawdust biomass using thermogravimetric analysis. *Bioresource Technology* 251, 63–74. doi:10.1016/j.biortech.2017.12.029.
- Müller-Hagedorn, M., Bockhorn, H., Krebs, L., Müller, U., 2003. A comparative kinetic study on the pyrolysis of three different wood species doi:10.1016/S0165-2370(03)00065-2.
- Naik, S., Goud, V.V., Rout, P.K., Jacobson, K., Dalai, A.K., 2010. Characterization of Canadian biomass for alternative renewable biofuel. *Renewable Energy* 35, 1624–1631. URL: <https://ideas.repec.org/a/eee/rene/v35y2010i8p1624-1631.html>.

- Park, H.J., Park, Y.K., Dong, J.I., Kim, J.S., Jeon, J.K., Kim, S.S., Kim, J., Song, B., Park, J., Lee, K.J., 2009. Pyrolysis characteristics of Oriental white oak: Kinetic study and fast pyrolysis in a fluidized bed with an improved reaction system. *Fuel Processing Technology* 90, 186–195. doi:10.1016/j.fuproc.2008.08.017.
- Pasangulapati, V., Ramachandriya, K.D., Kumar, A., Wilkins, M.R., Jones, C.L., Huhnke, R.L., 2012. Effects of cellulose, hemicellulose and lignin on thermochemical conversion characteristics of the selected biomass. *Bioresource Technology* 114, 663–669. doi:10.1016/j.biortech.2012.03.036.
- Sait, H.H., Hussain, A., Salema, A.A., Ani, F.N., 2012. Pyrolysis and combustion kinetics of date palm biomass using thermogravimetric analysis. *Bioresource Technology* 118, 382–389. doi:10.1016/j.biortech.2012.04.081.
- Šimkovic, I., Csomorová, K., 2006. Thermogravimetric analysis of agricultural residues: Oxygen effect and environmental impact. *Journal of Applied Polymer Science* 100, 1318–1322. doi:10.1002/app.23818.
- Sunphorka, S., Chalermainsuwan, B., Piumsomboon, P., 2017. Artificial neural network model for the prediction of kinetic parameters of biomass pyrolysis from its constituents. *Fuel* 193, 142–158. doi:10.1016/j.fuel.2016.12.046.
- Titiloye, J.O., Abu Bakar, M.S., Odetoeye, T.E., 2013. Thermochemical characterisation of agricultural wastes from West Africa. *Industrial Crops and Products* 47, 199–203. doi:10.1016/j.indcrop.2013.03.011.
- Uzun, B.B., Yaman, E., 2017. Pyrolysis kinetics of walnut shell and waste polyolefins using thermogravimetric analysis doi:10.1016/J.JOEI.2016.09.001.
- Worasuwannarak, N., Sonobe, T., Tanthapanichakoon, W., 2007. Pyrolysis behaviors of rice straw, rice husk, and corncob by TG-MS technique. *Journal of Analytical and Applied Pyrolysis* 78, 265–271. doi:10.1016/j.jaap.2006.08.002.
- XiaoLi, G., Xu, M., LiXian, L., Cheng, L., KangHua, C., ZhongZheng, L., 2013. Pyrolysis of poplar wood sawdust by TG-FTIR and Py-GC/MS. *Journal of Analytical and Applied Pyrolysis* 102, 16–23. URL: <https://www.cabdirect.org/cabdirect/abstract/20133282426>.
- Xu, Y., Chen, B., 2013. Investigation of thermodynamic parameters in the pyrolysis conversion of biomass and manure to biochars using thermogravimetric analysis. *Bioresource Technology* 146, 485–493. doi:10.1016/j.biortech.2013.07.086.
- Yao, F., Wu, Q., Lei, Y., Guo, W., Xu, Y., 2008. Thermal decomposition kinetics of natural fibers: Activation energy with dynamic thermogravimetric analysis. *Polymer Degradation and Stability* 93, 90–98. doi:10.1016/j.polymdegradstab.2007.10.012.
- Yiin, C.L., Yusup, S., Quitain, A.T., Uemura, Y., Sasaki, M., Kida, T., 2018. Thermogravimetric analysis and kinetic modeling of low-transition-temperature mixtures pretreated oil palm empty fruit bunch for possible maximum yield of pyrolysis oil. *Bioresource Technology* 255, 189–197. doi:10.1016/j.biortech.2018.01.132.