Supplementary Materials

Application of random forest integrated with feature reduction for biomass torrefaction

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Table.S1. Dataset.

Biomass	Torrefaction condition	Ref.
olive residue, almond shell	N_2, 275 ℃, 60 min	[1]
olive tree	He, 220~280 ℃, 60~360 min	[2]
rice husk	Ar, 220~270 ℃, 30~60 min	[3]
coffee grounds	N_2, 200~300 ℃, 30 min	[4]
banana leaf waste	N_2, 220~280 ℃, 1 min	[5]
rice straw, rice husk	N_2, 200~300 ℃, 30 min	[6]
pearl millet, walnut shell	N_2, 230~300 ℃, 30~90 min	[7]
ash tree, hazelnut shell, refuse-derived fuel	N_2, 230~290 ℃, 30 min	[8]
garden waste	Ar, 200~300 ℃, 30~60 min	[9]
mixture of municipal organic wastes and biomass	N_2, 200~275 ℃, 30 min	[10]
empty fruit bunches	N_2, 225~300 ℃, 40 min	[11]
oil palm empty fruit bunch	N_2, 250~300 ℃, 30 min	[12]
caragana	N_2, 225~275 ℃, 10~20 min	[13]
pellet consists of 80% larch and 20% oak	anoxic, 200~270 ℃, 20~40 min	[14]
rice straw, bamboo dust	N_2, 250 ℃, 15 min	[15]
pine sawdust	N_2, 260~300, 11 min	[16]
ananas comosus peel, annona squamosa peel	N_2, 210~300 ℃, 30~60 min	[17]
eucalyptus grandis	N_2, 230~290 ℃, 60 min	[18]
leucaena leucocephala	N_2, 260~300 ℃, 0~30 min	[19]
moso bamboo	N_2, 200~300 ℃, 60~120 min	[20]
rice husk, rice straw	N_2, 200~300 ℃	[21]
pongamia seed pods	N_2, 200~300 ℃, 60 min	[22]
rubberwood	N_2, 200~300 ℃, 20~60 min	[23]
cellulose	N_2, 200~290 ℃, 30 min	[24]

Biomass	Torrefaction condition	Ref.
fruit waste	N_2, 210~300 ℃, 30~60 min	[25]
empty fruit bunches	N_2, 225~300 ℃, 20~60 min	[26]
mustard crop residue	N_2, 200~300 ℃, 30~60 min	[27]
pine, kenaf	N_2, 250 ℃, 30 min	[28]
prosopis juliflora	N_2, 230~270 ℃, 30 min	[29]
sugarcane bagasse	N_2, 230~280 ℃, 30~45 min	[30]
orange peel	N_2, 220~280 ℃, 30 min	[31]
rice husk, rice straw	N_2, 200~300 ℃, 60 min	[32]
poplar wood	N_2, 200~300 ℃, 60 min	[33]
olive kernel	N_2, 300 ℃, 60 min	[34]
rice husk	oxygen-deficient, 240~280 ℃, 0~90 min	[35]
miscanthus, hops waste	oxygen-deficient, 250 ℃, 60 min	[36]
waste vine shoots	N_2, 220~280 ℃, 10~60 min	[37]
almond shells, olive stones	N_2, 250~300 ℃, 45 min	[38]
sugarcane leaves	N_2, 225~300 ℃, 30 min	[39]
corncob	N_2, 210~300 ℃, 30 min	[40]
bamboo forest residues	N_2, 200~300 ℃, 60 min	[41]
leftover rice, leftover cabbage, leftover pork, watermelon peel	Ar, 200~300 ℃, 30 min	[42]
wooden block	N_2, 220~280 ℃, 40 min	[43]
sugarcane bagasse	N_2, 200~275 ℃, 60 min	[44]
sorghum straw	N_2, 230~300 ℃, 30~108 min	[45]
pigeon pea stalk, eucalyptus	N_2, 200~300 ℃, 30 min	[46]
sorghum straw	N_2, 230~300 ℃, 10 min	[47]
rice straw	N_2, 200~250 ℃, 45 min	[48]
pine wood, rice husk	N_2, 210~300 ℃, 30 min	[49]
rice husk	N_2, 220~300 ℃, 30 min	[50]
mixture of waste wood, oak waste wood and sewage sludge	oxygen-deficient, 220~300 ℃, 120 min	[51]
corncob, rice husk	N_2, 200~300 ℃, 30~60 min	[52]
ponkan peel waste	N_2, 200~300 ℃, 15~60 min	[53]
black alder	N_2, 250~300 ℃, 30~60 min	[54]
Norway spruce	N_2, 225~275 ℃, 30~60 min	[55]
sugarcane bagasse	N_2, 200~300 ℃, 15~60 min	[56]
pigeon pea stalk	N_2, 225~275 ℃, 15~45 min	[57]
rice husk	N_2, 210~300 ℃, 30 min	[58]
wood biomass	Ar, 230~290 ℃, 60 min	[59]
pine wood	N_2, 250~290 ℃, 30~60 min	[60]
vine pruning, olive tree pruning, corn stalk, poultry litters	N_2, 300 ℃, 30 min	[61]
rice straw, cotton stalk	N_2, 210~290 ℃, 20~60 min	[62]
cotton stalk, corn stalk	N_2, 200~290 ℃, 30 min	[63]
oil palm fiber, Eucalyptus	N_2, 250~300 ℃, 60 min	[64]

Biomass	Torrefaction condition	Ref.
willow, reed canary grass, wheat straw	N_2, 230~290 ℃, 30 min	[65]
rice straw	N_2, 200~300 ℃, 60 min	[66]

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Figure S1. The statistical distribution of each variable in terms of the inherent properties of the raw biomass, the torrefaction conditions, and the fuel properties of torrefied biomass with violin-plots.

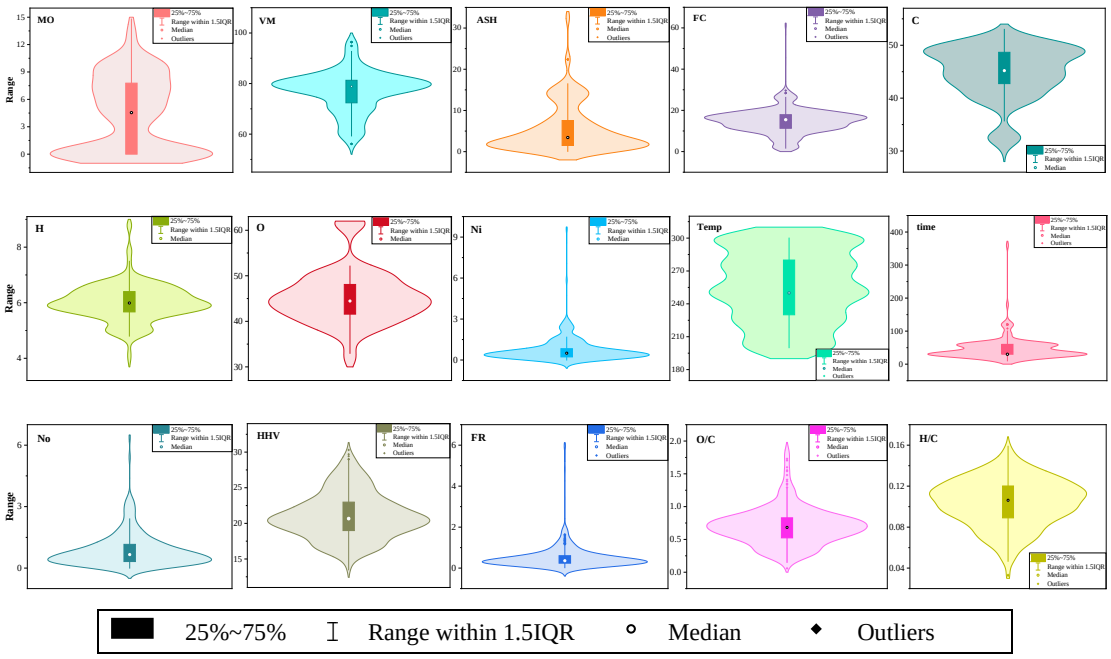


Table S2 detailed information of the PCCs

	MO	VM	ASH	FC	C	H	O	Ni	Temp	time	FR	H/C	O/C	No	HHV
MO	1	-0.0528	-0.0695	-0.1631	0.2258	0.0350	-0.2314	-0.0646	-0.0308	0.1578	0.2167	-0.1705	-0.2344	0.0406	0.1081
VM	-0.0528	1	-0.7296	-0.6075	0.2505	0.2738	0.1266	-0.2502	0.0011	0.0209	-0.4055	0.1728	0.1496	-0.2544	0.2461
ASH	-0.0695	-0.7296	1	0.1833	-0.3715	-0.3149	-0.1538	0.2068	-0.0523	-0.0645	0.2637	-0.0283	-0.0277	0.2119	-0.4458
FC	-0.1631	-0.6075	0.1833	1	-0.0176	-0.1895	0.0672	0.1744	0.0764	-0.0292	0.2257	-0.1851	-0.1808	0.1748	0.0702
C	0.2258	0.2505	-0.3715	-0.0176	1	0.3661	-0.6048	-0.0712	0.0486	0.1571	0.1400	-0.2351	-0.5219	-0.0159	0.3134
H	0.0351	0.2738	-0.3149	-0.1895	0.3661	1	-0.3201	-0.0789	-0.0245	-0.1314	-0.2102	0.2346	-0.2026	-0.0459	0.1300
O	-0.2314	0.1266	-0.1538	0.0672	-0.6048	-0.3201	1	-0.2577	-0.0174	-0.0884	-0.0288	0.1027	0.4626	-0.2458	-0.0030
Ni	-0.0646	-0.2502	0.2068	0.1744	-0.0714	-0.0789	-0.2577	1	0.0366	-0.0855	-0.0087	-0.1139	-0.1908	0.8646	0.0095
Temp	-0.0308	0.0011	-0.0523	0.0764	0.0486	-0.0245	-0.0174	0.0366	1	-0.0226	0.2495	-0.6242	-0.491	0.0714	0.5376
time	0.1578	0.0209	-0.0645	-0.0292	0.1571	-0.1314	-0.0884	-0.0855	-0.0226	1	0.2249	-0.3306	-0.1898	0.0208	0.3427
FR	0.2167	-0.4055	0.2637	0.2257	0.1400	-0.2103	-0.0288	-0.0088	0.2495	0.2249	1	-0.5497	-0.4223	0.0562	0.1748
H/C	-0.1705	0.1729	-0.0283	-0.1851	-0.2351	0.2346	0.1027	-0.1139	-0.6242	-0.3306	-0.5497	1	0.7451	-0.2240	-0.6076
O/C	-0.2344	0.1496	-0.0276	-0.1809	-0.5212	-0.2026	0.4626	-0.1908	-0.491	-0.1898	-0.4223	0.7451	1	-0.3192	-0.5284
No	0.0406	-0.2544	0.2119	0.1748	-0.0159	-0.0459	-0.2459	0.8646	0.0714	0.0208	0.0563	-0.2240	-0.3192	1	0.1132
HHV	0.1081	0.2461	-0.4458	0.0702	0.3134	0.13004	-0.0030	0.0095	0.5376	0.3427	0.1748	-0.6076	-0.5284	0.1132	1