Supplementary material

Table S1: Summary of the main features of each technique/device

Technique	Average efficiency*	Main characteristics	Main disadvantages
Stacks, soil pits, earth mounds	8–12%	– -Cheap and readily available – Cultural significance	– High emissions – Slow production (days) – Low efficiency
Beehive kilns	30–60%	– Large production* – Cultural significance	– Slow production (days) – Need for thick logs
Stoves and TLUDs	10–20%	– Rapid production (hours) – Syngas production – Small feedstock	Low efficiency: small batch production
Retort kilns	25–35%	Gas recovery: low emissions	– External feedstock to start-up – High investment cost – Slow production (days)
Kon-Tiki kilns	20–30%	– Low emissions – Rapid production (hours) – No external fuel to start-up	Incomplete pyrolysis of thick logs
Microwave-assisted pyrolysis	50%	– Easily controllable process – High yields	– Requires inert gas – Difficulty in scaling – Availability of microwave technologies
Solar-assisted pyrolysis	30–40%	Sun starts pyrolysis (no external energy supply needed)	– High investment cost – Solar intermittence and optical efficiency – Heterogeneity of the material produced

*Depends on size.

Table S2: Summary of physicochemical properties reported for biochars produced using non-conventional devices. References: SC: soil conditioning, WT: water treatment, ES: energy storage, N/A: non-applicable

Feedstock	Device	Peak temp (°C)	Yield (%)	C (%)	H (%)	N (%)	A_{BET} ($m^2 g^{-1}$)	Application	Reference
Robinia pseudoacacia wood	Open-air stack	238–523	—	67.5–41.3	2.43	1.19	43–156	WT: Cadmium (12 mg/g) and oxytetracycline (14 mg/g) removal	[1]
Eupatorium adenophorum wood	Earth-mound kiln	400–500	21	—	—	—	—	SC	[2]
Wood mixture	Soil pit	—	—	88.2	1.9	0.36	404	WT: 2,4-Dichlorophenoxyacetic acid (2,4-D) removal	[3]
Shorea robusta wood	Soil pit	—	—	86.1	2.3	0.43	197	WT: 2,4-Dichlorophenoxyacetic acid (2,4-D) removal	[3]
Elephant grass	Soil pit	650	18 ± 1	68.5 ± 2.6	2.1 ± 0.2	—	64 ± 4	SC	[4]
Corn residues	Soil pit	650	14 ± 1	53.9 ± 1.5	3.4 ± 0.2	1.4 ± 0.7	52 ± 4	SC	[4]
Wood and rice husks	Soil pit	600–700	18–27	85.3–71.5	1.4–2.1	0.59–0.66	75–111	N/A	[5]
Wood and rice husks	Steel shielded soil pit	600–700	25–32	88.8–71.2	2.7	0.54	35	N/A	[5]
Coconut shells	Mud beehive kilns	—	—	87.4	3.2	0.58	91	WT: 2,4-Dichlorophenoxyacetic acid (2,4-D) removal	[3]
Dimocarpus longan wood	Mud beehive kilns	—	—	76.1	3.7	0.84	4	WT: 2,4-Dichlorophenoxyacetic acid (2,4-D) removal	[3]
Eucalyptus wood	Beehive kilns	300–700	23–25	82–93	0.1–0.6	1.0–2.5	190–370	WT: 2,4-Dichlorophenoxyacetic acid (2,4-D) removal	[6]
Eupatorium adenophorum wood	Brick kiln	400–500	19	—	—	—	—	SC	[2]
Corn cobs	Brick kilns	200	34.5	73.2	—	—	—	N/A	[7]
Eupatorium adenophorum wood	TLUD	400–500	18	—	—	—	—	SC	[2]
Elephant grass	TLUD	300	14	—	—	—	475	N/A	[8]
Pine wood and sawdust pellets	TLUD	1,000	—	—	—	—	429–470	ES	[9]
Dimocarpus longan wood	TLUD	—	—	86.2	1.4	0.35	333	WT: 2,4-Dichlorophenoxyacetic acid (2,4-D) removal	[3]
Woods	TLUD	720–755	18.9–25.3	69.9–76.5	1.2–3.1	0.6–1.3	190–473	SC	[10]
Eucalyptus branches.	Clay stove	350	—	71.8	—	3.3	—	SC	[11]
Pine wood	Retort kiln (ICPS)	200–300	30.4	—	—	—	—	N/A	[12]
Pine wood	Retort kiln (ICPS)	200–300	30	74.8	—	—	—	N/A	[7]
Wood	Retort kiln (drum)	200	25.3	71.4	—	—	—	N/A	[7]

(*Continued*)

Table S2: *Continued*

Feedstock	Device	Peak temp (°C)	Yield (%)	C (%)	H (%)	N (%)	A_{BET} ($m^2 g^{-1}$)	Application	Reference
Rice husks	Drum kiln	300–450	28.9	54.9	—	—	—	N/A	[7]
Corncobs	Retort kiln	250–300	33	68.8	3.83	0.9	—	N/A	[13]
Eucalyptus bark	Retort kiln	250–300	68	56.2	3.26	0.5	—	N/A	[13]
Wood and rice husks	All-steel kilns 45°-55°	600–700	13–27	54.7–81.7	1.3–2.2	0.54–1.04	11–215	N/A	[5]
Eupatorium adenophorum wood	Kon-Tiki kiln	680–700	—	72	1.33	0.54	215	SC	[14]
Wood	Kon-Tiki kiln	650–800	15–20	80.8	1.07	0.39	289	N/A	[15]
Eucalyptus wood	Kon-Tiki kiln	700–800	26 ± 9	78 ± 3	2.2 ± 0.5	0.7 ± 0.2	239 ± 80	WT: Paracetamol (98 mg/g) removal	[16]
Eucalyptus wood	Kon-Tiki kiln	700–800	26 ± 9	78 ± 3	2.2 ± 0.5	0.7 ± 0.2	239 ± 80	SC WT: Arsenic (7%) removal	[17]
Guava (*Psidium guajava*) wood chips	Solar-assisted reactor	489.3	41.35 ± 3.23	58.6	3.2	0.4	24.6	WT: Nitrate (35.5 mg/g) removal	[18]

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