Supplementary Material S1. 2^3 design matrix with experimental results of mass yield for $ZnCl_2$-doped biomass (1:2 w w^{-1}) after pyrolysis and washing process.

Run	Factors			Yield (%)		
	A	B	C	y_1	y_2	$\bar{y}$
1	-	-	-	47.1	44.6	45.6
2	+	-	-	47.1	47.6	47.4
3	-	+	-	42.9	44.8	43.9
4	+	+	-	41.2	46.3	43.8
5	-	-	+	49.4	47.6	48.5
6	+	-	+	49.9	46.4	48.2
7	-	+	+	40.3	42.3	41.3
8	+	+	+	41.0	40.1	40.6

Note: A: impregnation time; B: final carbonization temperature; C: heating rate.

Supplementary Material S2. 2^3 factorial design analysis of variance (ANOVA) for mass yield of $ZnCl_2$-doped black wattle biochar (1:2 w w^{-1}) after pyrolysis and washing process. SS: sum of squares; df: degrees of freedom; MS: mean square ($R^2 = 0.81881$; adj. $R^2 = 0.69801$).

Source	SS	df	MS	F-value	p-value
A	0.0225	1	0.0225	0.00638	0.938295
B	104.0400	1	104.0400	29.50443	0.000622
C	1.3225	1	1.3225	0.37504	0.557269
A × B	1.0000	1	1.0000	0.28359	0.608828
A × C	1.5625	1	1.5625	0.44311	0.524352
B × C	21.1600	1	21.1600	6.00071	0.039960
Lack of Fit	0.3600	1	0.3600	0.10209	0.757518
Pure Error	28.2100	8	3.5263		
Total SS	157.6775	15			

Note: A: impregnation time; B: final carbonization temperature; C: heating rate.

Supplementary Material S3. 2^3 design matrix with experimental results of specific surface area (A_{BET}), total pore volume (V_p), and average pore diameter (D_p) for $ZnCl_2$-doped biomass (1:2 w w^{-1}) after pyrolysis and washing process.

	Factors			A_{BET} (m² g^{-1})			V_p (cm³ g^{-1})			D_p (nm)
Run	A	B	C	$A_{BET,1}$	$A_{BET,2}$	$\overline{A_{BET}}$	$V_{p,1}$	$V_{p,2}$	$\overline{V_p}$	$\overline{D_p}$
1	-	-	-	805.7	743	774	0.52	0.36	0.44	1.29
2	+	-	-	1301.4	765.3	1033.4	1.02	0.38	0.70	1.57
3	-	+	-	1524.8	1549	1537	1.01	0.76	0.89	1.32
4	+	+	-	1146.8	1499.5	1323.2	0.73	0.73	0.73	1.27
5	-	-	+	700.6	841.7	771.2	0.45	0.42	0.44	1.29
6	+	-	+	528.6	585.9	557.3	0.48	0.28	0.38	1.81
7	-	+	+	1477.2	1538	1508	1.04	0.74	0.89	1.41
8	+	+	+	1346.2	1481.5	1413.9	1	0.72	0.9	1.5

Note: A: impregnation time; B: final carbonization temperature; C: heating rate.

Supplementary Material S4. 2^3 design matrix with experimental results of BET analysis for commercial activated carbon (CAC) and biochar samples doped with $ZnCl_2$ in 1:1 ratio (w w^{-1}) after pyrolysis and washing process.

	Factors					
Run	A	B	C	A_{BET} (m² g^{-1})	V_p (cm³ g^{-1})	D_p (nm)
3	-	+	-	1119.2	0.55	n.d.
4	+	+	-	1254.0	0.62	1.9
7	-	+	+	950.4	0.52	2.2
8	+	+	+	1189.8	0.59	n.d.
CAC	n.a.	n.a.	n.a.	595.2	0.24	1.6

Note: n.d.: not determined; n.a.: not applicable; A: impregnation time; B: final carbonization temperature; C: heating rate.

Supplementary Material S5. 2^3 design matrix with experimental results of EPR analysis for the biochar samples doped with $ZnCl_2$ in 1:2 ratio (w w^{-1}) after pyrolysis and washing process.

| | Factors | | | | | |
Run	A	B	C	g-factor	ΔH_{pp} (G)	N (spin g^{-1})
1	-	-	-	20.030	21	7.71×10^{18}
2	+	-	-	20.030	31	4.30×10^{18}
3	-	+	-	20.030	152	5.29×10^{16}
4	+	+	-	20.030	162	2.20×10^{17}
5	-	-	+	20.031	14	2.28×10^{19}
6	+	-	+	20.031	21	3.15×10^{19}
7	-	+	+	20.034	136	2.89×10^{17}
8	+	+	+	20.034	138	2.79×10^{17}