SUPPORTING INFORMATION

Valorization of Pinecone as a pyrolysis Feedstock: Identification of Bio-oil and Synthesis of Activated Biochar for Cr(VI) Elimination from Wastewater

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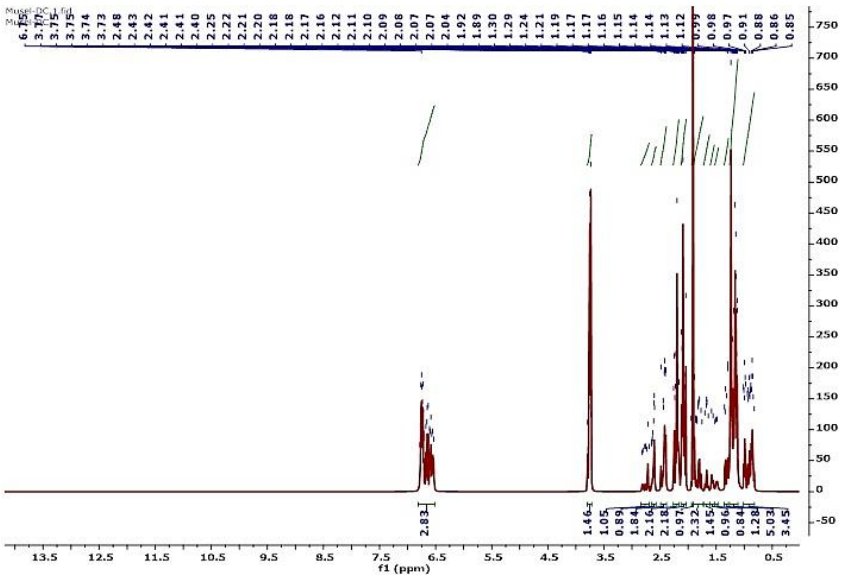

Figure 1S. ^{1}H NMR spectrum of the PC-derived BO.

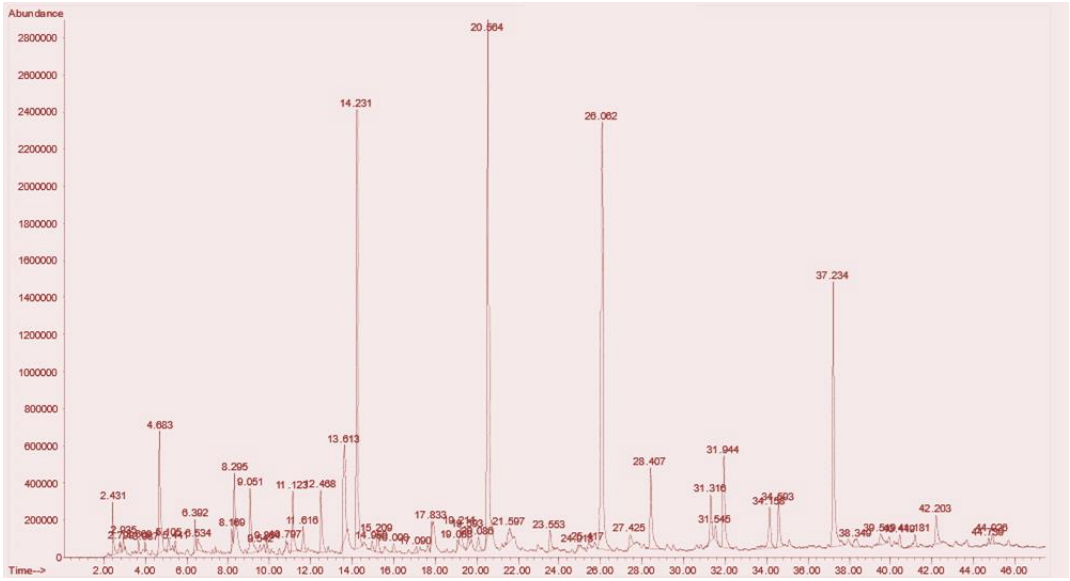

Figure 2S. The GC-MS spectrum of PC-derived BO.

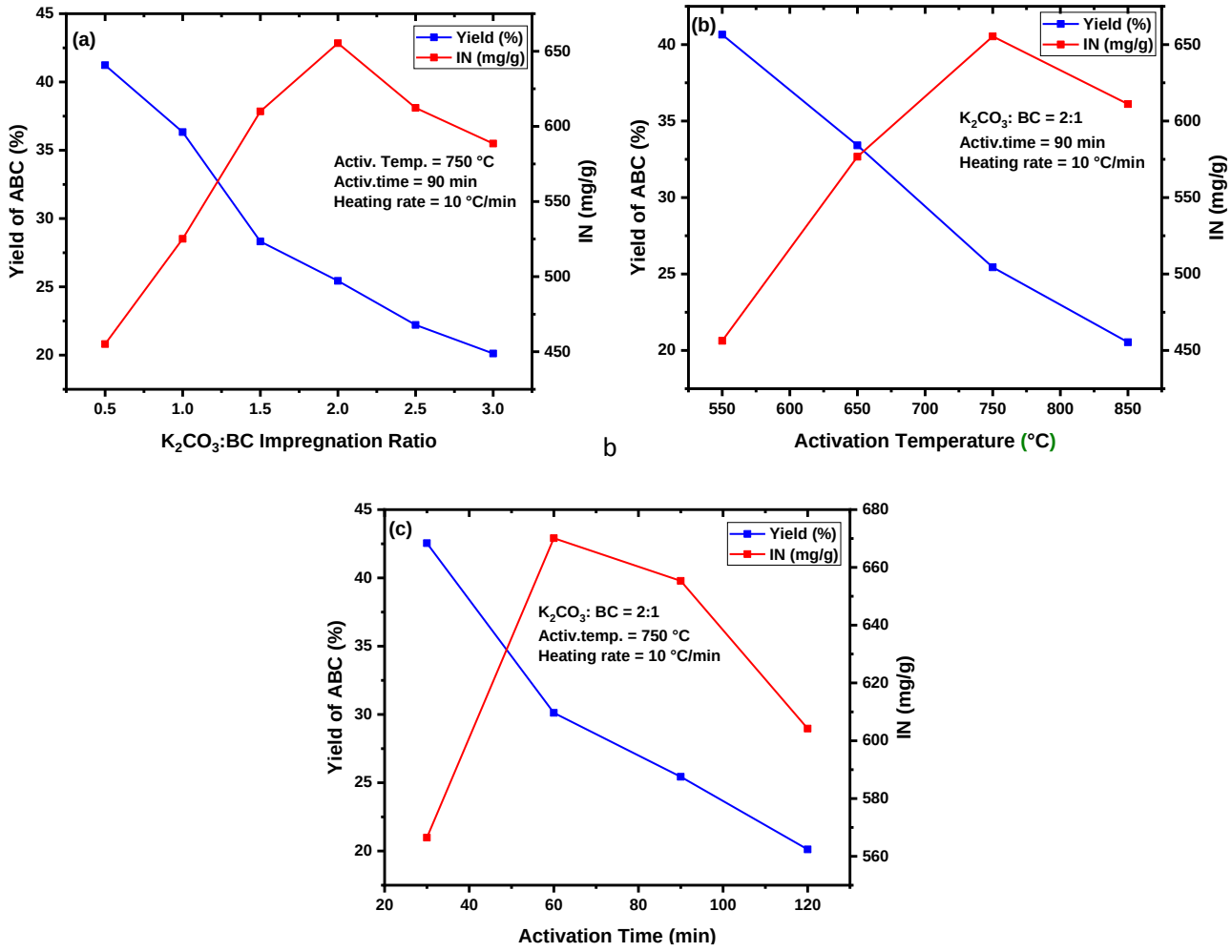

Figure 3S. Effect of the activation variables on the ABC yield and IN.

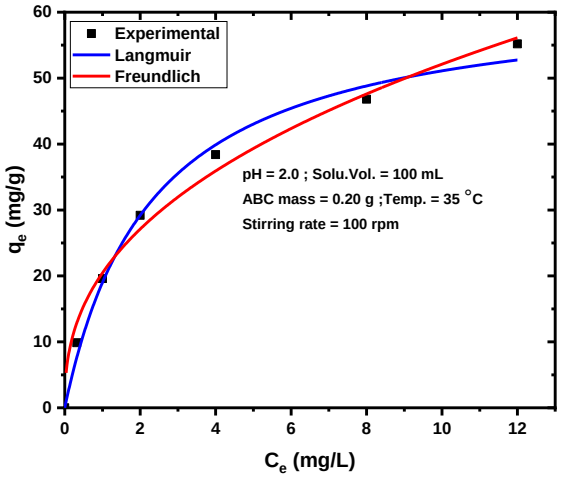

Figure 4S. The adsorption isotherms of Cr(VI) adsorption by the ABC.

Table 1S. Compounds identified by GC-MS for PC-derived BO.

Compound	Chemical Formula	M. Wt.(g/mol)	Area (%)
Acetic acid	$C_2H_4O_2$	78	0.92
Tetramethyl succinimide	$C_8H_{13}NO_2$	88	0.33
Propanoic acid	$C_3H_6O_2$	92	0.24
Toluene	C_7H_6O	112	0.23
2H-Pyran	C_5H_6O	102	0.14
2-Furancarboxaldehyde	$C_6H_6O_2$	89	3.96
2-Furanmethanol	$C_5H_6O_2$	98.10	0.32
2,4-Xylene	C8H10	80	0.26
2-Cyclopenten-1-one, 2-methyl	C_6H_8O	96.13	0.69
Ethanone	C_2H_4O	44.05	2.35
3-Hexanone	$C_6H_{12}O$	100.16	0.37
3,5-Dimethyl-2(5H)-furanone	$C_6H_6O_2$	112.13	0.36
2-Furancarboxaldehyde	$C_6H_6O_2$	118	1.17
Phenol	C_6H_6O	94.11	2.65
5-dimethyl hexa-2,4-diene	C_8H_{14}	110.20	0.18
2-Furanone, 2,5-dihydro-3,5-dimethyl	$C_6H_8O_2$	112.12	0.36
1,3,5-Trimethylbenzene	C_9H_{12}	120.19	0.10
2-Methyl-Cyclopenten-1-one	C_5H_6O	82.10	2.63
Phenol, 2-methyl	$C_{10}H_{12}O_2$	164.20	2.15
p-Cresol	C_7H_8O	108.14	20.51
Phenol, 2-methoxy	$C_{10}H_{12}O_2$	164.20	12.99
2,5-dihydroxytoluene	$C_7H_{10}O$	110.15	0.33
Phenol, 2,6-dimethyl	$C_8H_{10}O$	122.16	0.78
2-Cyclopenten-1-one, 3-ethyl-2-hydroxy	$C_7H_{10}O$	126.15	0.34
Bicyclo[3.3.1]nonan-3-ol, 7-methylene	$C_{10}H_{16}O$	152.23	0.27
Phenol, 2,4-dimethyl	$C_8H_{10}O$	122.16	0.20
p-Ethylphenol	$C_8H_{10}O$	122.16	0.17
2-Methoxy-5-methylphenol	$C_8H_{10}O_2$	138.16	0.44
2-Ethoxyphenol	$C_8H_{10}O_2$	138.16	0.77
3,4-Dimethoxytoluene	$C_9H_{12}O_2$	152.19	0.81
Phenylcyclopentene	$C_{11}H_{12}$	144.21	0.09
Phenol, 2,4,6-trimethyl	$C_9H_{12}O$	136.19	0.17
Phenethyl alcohol	$C_8H_{10}O$	122.16	16.30
1,2-Benzenediol	$C_7H_8O_2$	124.14	0.53
2-Methoxy-4-vinylphenol	$C_9H_{10}O_2$	150.17	3.52
Phenol, 4-allyl-2-methoxy-	$C_{10}H_{12}O_2$	164.20	1.48
Isoeugenol	$C_{10}H_{14}O_2$	166.22	5.25
Longifolene	$C_{15}H_{24}$	204.35	2.09
trans-Isoeugenol	$C_{10}H_{12}O_2$	164.2	9.98
3-Hydroxycarbofuranphenol	$C_{10}H_{12}O_3$	150.13	0.57
1H-indene	C_9H_8	116.16	0.64
2-Propanone	C_3H_6O	58.08	1.16
Naphthalene, 7-isopropyl-1-methyl	$C_{14}H_{16}$	184.28	0.11
Naphthalene, 1,6,7-trimethyl	$C_{13}H_{14}$	170.25	0.36

Table 2S: Models of isotherms and kinetics implemented in describing the adsorption of DBT from both models of fuel by the ABC.

Model of isotherm	Linear form	Description of Parameters
Langmuir	$\frac{C_e}{q_e} = \frac{1}{Q_m K_L} + \frac{C_e}{Q_m}$	C_e (mg/L): Cr(VI) concentration at equilibrium. q_e (mg/g): amount of Cr(VI) eliminated at equilibrium. q_m (mg/g): maximum Cr(VI) adsorption capacity. K_L (L/mg): the Langmuir constant.
Freundlich	$\ln q_e = \ln K_F + \frac{1}{n} \ln C_e$	C_e (mg/L): Cr(VI) concentration at equilibrium. q_e (mg/g): amount of Cr(VI) eliminated at equilibrium. K_F (mg/g): Cr(VI) adsorption capacity. n: heterogeneity factor.