Supplementary Material

Replacing potassium hydroxide with carbide lime waste in preparing sludge-based activated carbon for methylene blue removal from aqueous solutions

Ahmad A. Al Madhoon [1], Munjed A. Maraqa [2,3,*], Amr El Dieb [2] and Ahmad M. Alhalabi [2]

[1] Sharjah City Municipality, Sharjah P.O. Box 22, United Arab Emirates

[2] Department of Civil and Environmental Engineering, United Arab Emirates University, Al Ain P.O. Box 15551, United Arab Emirates

[3] National Water and Energy Center, United Arab Emirates University, Al Ain P.O. Box 15551, United Arab Emirates

[*] Correspondence: m.maraqa@uaeu.ac.ae

Table S1. Studies on preparation of SBAC using KOH as an activating agent [1].

Study	SCC (%)	T (°C)	R	t (min)	S_{BET} (m^2/g)	Main findings
Almahbashi et al. [1]	30	500	1	180	372.7[b]	S_{BET} is significantly affected by activation temperature and impregnation ratio
Hunsom and Autthanit [2]	68.7	800	-	30	920	S_{BET} and pore volume increase with increasing activation temperature from 500 to 800 °C
Monsalvo et al. [3]	48.7	750	3	30	1832	Activation with KOH allows a higher development of porosity as compared to the use of CO_2 or air
Lillo-Rodenas et al. [4]	31.4	700	1	60	1058	Different sewage sludges result in different S_{BET} values
	27.9	700	1	60	1310	
	25.7	700	1	60	1882	
Li et al. [5]	21	900	0.22	30	546.9	Using KOH significantly increases S_{BET} and pore volume
Ros et al. [6]	31.4	700	1	60	853	A highly porous SBAC was obtained with NaOH or KOH. Increasing the impregnation ratio enhanced the sorption capacity
	31.4	700	2	60	1061	
	31.4	700	3	60	1686	
Wang et al. [7]	-	600	0.1	60	381.6	SBAC with KOH activation removed 99.7% of acid brilliant scarlet GR dye

[1] SCC is the sludge carbon content, T is the activation temperature, R is the impregnation ratio, t is the activation time, and S_{BET} is the Brunauer–Emmett–Teller specific surface area. [b] Optimum value obtained by the authors.

Table S2. Characteristics of sewage sludge used.

Parameter	Value
pH	7.65
Solids content (%)	18.43
Volatile solids (%)	17.52
Total carbon content (%)	31.65
Yield of CS and SBAC from sewage sludge (%) [1]	43.21-59.34

[1] Yield (%) = (W_{after}/W_{before}) × 100%, where W_{before} is the weight of dry sewage sludge and W_{after} is the weight of sewage sludge converted to CS or SBAC.

Table S3. Studies on the removal of organic contaminants from water using SBAC [1].

Study	Activating agent	T (°C)	R	t (min)	S_{BET} (m^2/g)	Contaminant	Uptake (mg/g)
Calvo et al. [8]	H_2SO_4	625	1.0	30	390	Methylene blue	20
Rozada et al. [9]	$ZnCl_2$	650	1.0	5	472	Methylene blue	137
Rozada et al. [9]	H_2SO_4	650	1.0	30	216	Methylene blue	24.5
Wang et al. [7]	KOH	600	0.42	60	381.6	Brilliant scarlet GR	15
Al-Qodah and Shawabkah [10]	H_2SO_4	200	1.0	60	580	Pesticides	110
Monsalvo et al. [3]	KOH	750	3.0	30	1832	4-chlorophenol	330
Ziyang et al. [11]	NaClO	600	0.5	120	423	Methylene blue	68
dos Reis et al. [12] [2]	$ZnCl_2$	500	0.5	15	679.3	Diclofenac	156.7
dos Reis et al. [12] [2]	$ZnCl_2$	500	0.5	15	679.3	Nimesulide	66.5
Bjorklund and Li [13] [3]	$ZnCl_2$	500	0.68	120	721	HOCs [a]	85
Li et al. [14]	$ZnCl_2$	800	3.27	60	766	Methylene blue	95
Li et al. [5] [2]	KOH	900	0.22	30	546.9	Dimethyl sulfide	53.5
Li et al. [5] [2]	KOH	900	0.22	30	546.9	Dimethyl disulfide	151.3
Hu et al. [15]	1:1 CO_2/N_2	800	None	30	113.5	Methylene blue	317
Mohamed et al. [16] [2,3]	$ZnCl_2$	500	0.68	120	721.2	Perfluoroalkyl	>91% [4]

[1] T is the activation temperature, R is the impregnation ratio, t is the activation time, S_{BET} is the Brunauer–Emmett–Teller specific surface area, and HOCs are hydrophobic organic compounds, including four PAHs, two phthalates, and two alkylphenols. [2] Washed SBAC before use with concentrated HCl. [3] SBAC was superior to granular activated carbon and similar to powder activated carbon. [4] Removal efficiency.

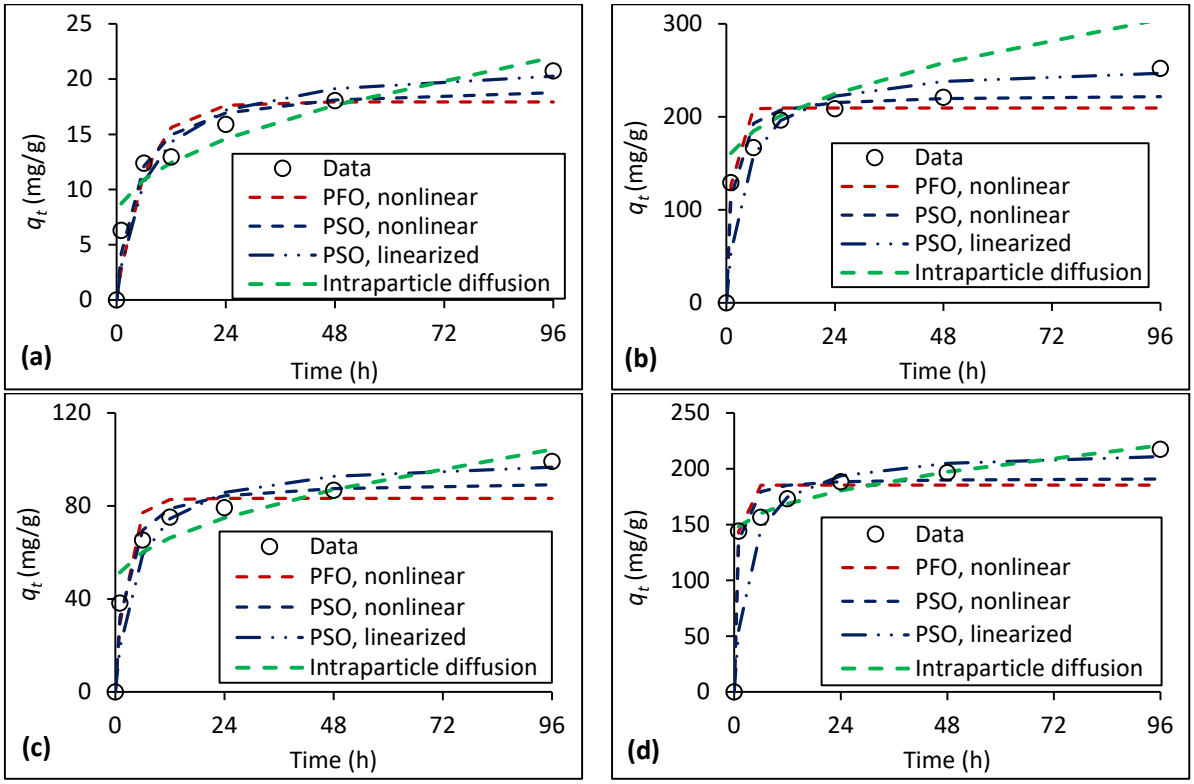


Figure S1. Examples of fitting methylene blue rate data to PFO, PSO, and intraparticle diffusion models for (**a**) CS, (**b**) SBAC-CL3, (**c**) SBAC-CL1, and (**d**) SBAC-KOH1.

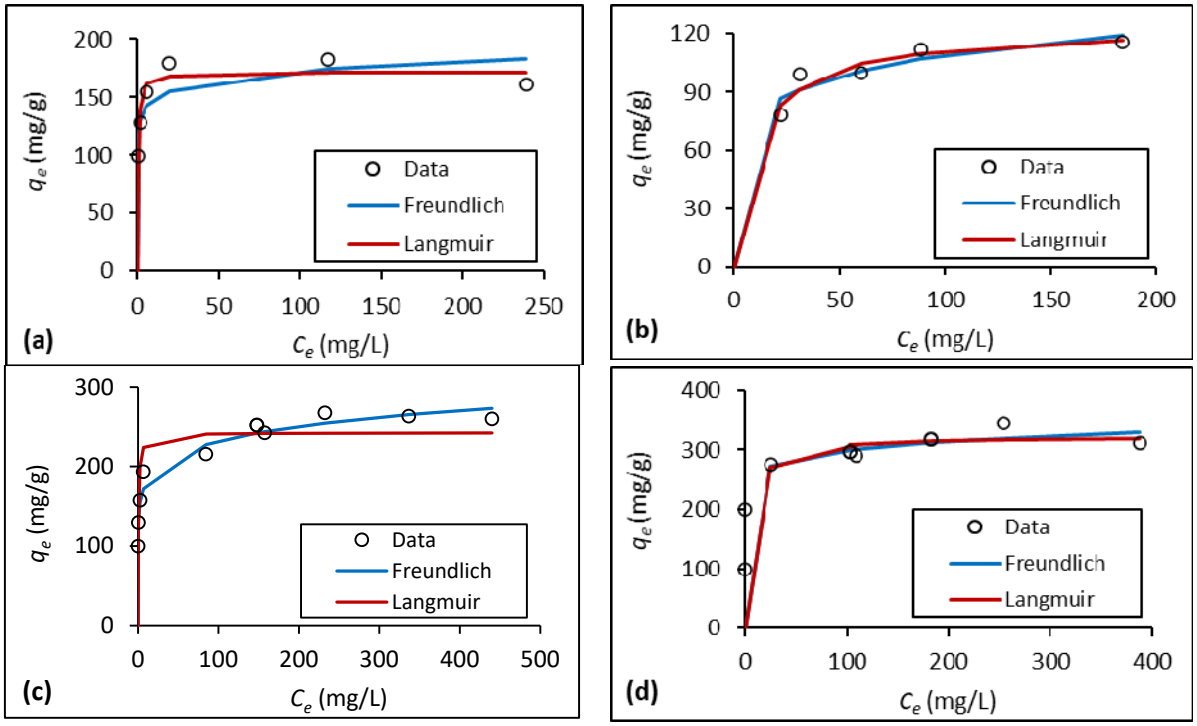


Figure S2. Modeling adsorption equilibrium of methylene blue onto (**a**) SBAC-CL2, (**b**) SBAC-KOH2, (**c**) SBAC-CL3, and (**d**) SBAC-KOH3.

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