

Appendix 1. Controlling factors and their levels

factors	level 1	level 2	level 3	level 4
pH	3	5	7	9
RB5 concentration (mg/L)	25	50	75	100
contact time (min)	15	30	45	60
adsorbent dose (mg/L)	100	250	500	1000

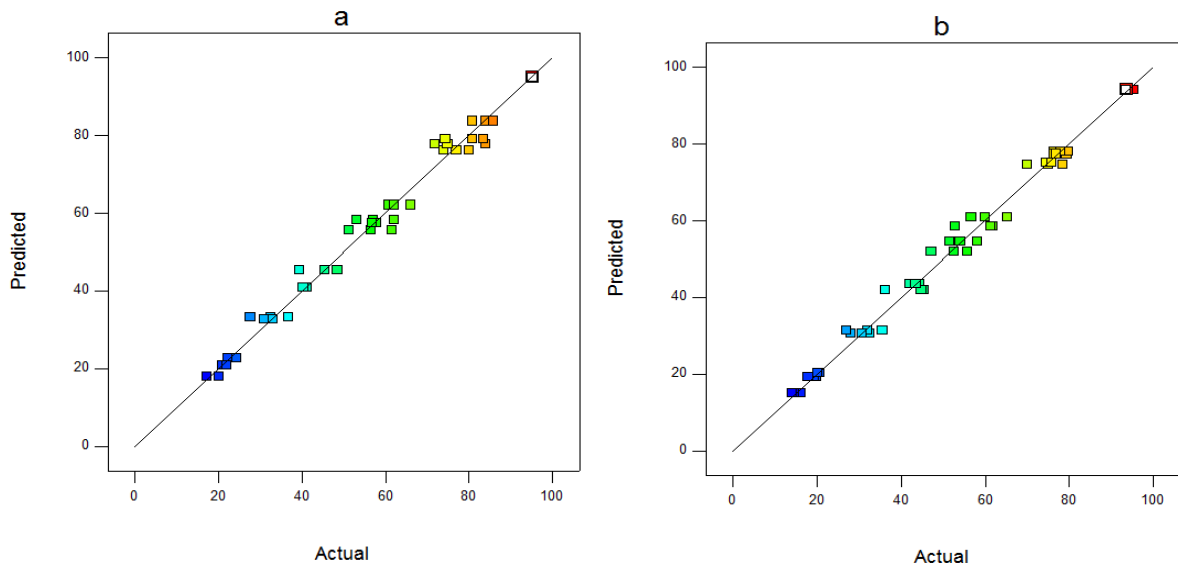
Appendix 2. Design matrix and results of RB5 removal by MWCNT and SWCNT at different condition

Run	factors				MWCNTs		SWCNTs	
	A	B	C	D	% removal	q <sub>e</sub>	% removal	q <sub>e</sub>
	pH	Initial Concentration mg/L	Time min	Dose adsorbent mg/L				
1	3	25	15	100	54.56	136.41	57.40	143.49
2	9	25	60	250	51.80	51.80	56.41	56.41
3	7	100	30	100	19.12	191.19	21.62	216.19
4	7	25	45	1000	75.33	18.83	83.46	20.86
5	5	25	30	500	77.47	38.73	79.49	39.75
6	9	100	15	500	31.61	63.21	32.44	64.88
7	9	75	30	1000	43.36	32.52	44.53	33.39
8	5	50	15	1000	60.62	30.31	62.90	31.45
9	7	75	15	250	20.43	61.30	22.93	68.78
10	5	75	60	100	42.17	316.28	40.67	305.03
11	3	75	45	500	74.50	111.74	77.00	115.49
12	9	50	45	100	15.04	75.18	18.24	91.19
13	3	100	60	1000	94.25	94.25	95.30	95.30
14	5	100	45	250	30.52	122.09	32.36	129.42
15	7	50	60	500	78.03	78.03	76.87	76.87
16	3	50	30	250	58.69	117.37	57.19	114.37

Appendix 3. ANOVA for response

Appendix 3. Effect of the factors obtained by fractional factorial design on RB5 adsorption

factor	degree of freedom	sum of squares		mean squares		F value		prob>F	% contribution	
		MWCNT	SWCNT	MWCNT	SWCNT	MWCNT	SWCNT		MWCNT	SWCNT
Model	12	26603.1	26334.5	2216.92	2194.54	205.91	252.40	< 0.0001	100	100
pH	3	6965.36	7566.38	2321.79	2522.13	215.65	290.08	< 0.0001	26.18	28.73
Initial dye Concentration	3	4360.94	3334.75	1453.65	1111.58	135.01	127.85	< 0.0001	16.39	12.66
Time	3	3490.28	3972.96	1163.43	1324.32	108.06	152.31	< 0.0001	13.12	15.09
Dose adsorbent	3	11786.5	11460.4	3928.84	3820.14	364.91	439.36	< 0.0001	44.31	43.52
Lack of Fit	3	19.16	1.35	6.39	0.45	0.57	0.048	0.63, 0.98		
Pure Error	32	357.68	302.96	11.18	9.47					
Residuals	35	376.83	304.31	10.77	8.69					
R <sup>2</sup>		0.9860	0.9886							
R <sup>2</sup> <sub>adj</sub>		0.9812	0.9847							



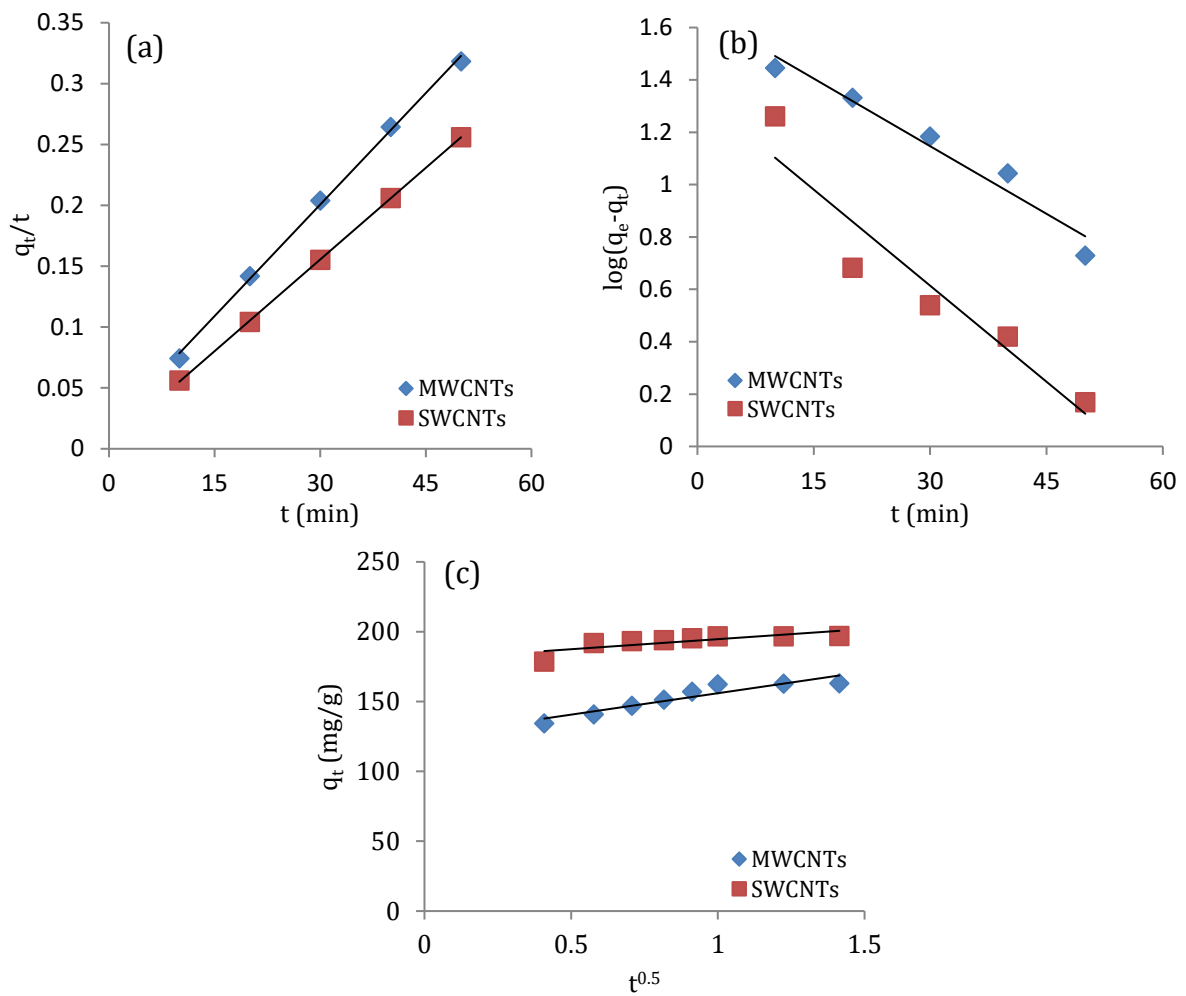
Appendix 4. The actual and predicted values of RB5 adsorption by MWCNTs (a) and SWCNTs (b)

Appendix 5. Summary of selected diagnostics for reactive black 5 adsorbed by SWCNTs

isotherms	AICc	$R_y^2$	$R_N^2$	M <sup>2</sup>	linearity assessment
BET	27.97	0.992	0.899	$3.24 \times 10^{-2}$	Uncertain
Freundlich	27.96	0.992	0.926	5.97	Non-Linear
F-P	48.11	0.992	0.936	$7.6 \times 10^2$	Non-Linear
Langmuir	22.860	0.997	0.882	$3.9 \times 10^{-3}$	Linear
L-F	33.46	1.00	0.936	$1.68 \times 10^1$	Non-Linear
L-P	32.869	0.997	0.883	$3.91 \times 10^{-3}$	Linear
Linear	28.98	0.982	0.737	$8.92 \times 10^{-9}$	Linear
p-p	51.67	0.982	0.887	$8.83 \times 10^1$	Non-Linear
toth	53.11	1.00	0.960	$8.25 \times 10^{-1}$	Non-Linear

Appendix 6. Summary of selected diagnostics for reactive black 5 adsorbed by MWCNTs

isotherms	AICc	$R_y^2$	$R_N^2$	M <sup>2</sup>	linearity assessment
BET	32.79	0.922	0.898	1.078	Non-Linear
Freundlich	33.31	0.914	0.935	1.35	Non-Linear
F-P	53.40	0.916	0.959	8.108	Non-Linear
Langmuir	31.16	0.945	0.948	1.459	Non-Linear
L-F	50.20	0.953	0.935	$5.76 \times 10^{-1}$	Non-Linear
L-P	42.07	0.855	0.931	$7.77 \times 10^3$	Non-Linear
Linear	35.41	0.855	0.932	$7.73 \times 10^{-8}$	Linear
p-p	49.10	0.855	0.961	$8.7 \times 10^{18}$	Non-Linear
toth	54.72	0.929	0.990	$2.078 \times 10^{-1}$	Non-Linear



Appendix 7. Pseudo-first order (a), pseudo-second order (b) and intraparticle diffusion kinetic models for adsorption of RB5 on MWCNTs and SWCNTs