

Raw Experimental Data on the Adsorption Study

1. Effect of Carbonization Temperature on Preparation

VA stem bark-derived AC							
Temp (°C)	400	450	500	550	600	650	700
Removal (%)	82	89	92	94	91	88	80

2. Effect of Impregnation Chemicals, Chemical Agents

VA stem bark-derived AC			
Chemicals	NaOH	H ₃ PO ₄	NaCl
Removal (%)	88	98	97

3. Determination of pH Point of Zero Charge (pH_{pzc})

Initial pH	2	3	4	5	6	7	8	9	10
Final pH	2.7	3.4	4.2	5.1	6	6.8	7.3	8.1	8.9
ΔpH	0.7	0.4	0.2	0.1	0	-0.2	-0.7	-0.9	-1.1

4. Effect of Biosorbent Dose

Adsorption conditions: Volume of the MB aqueous solution 50 ml, initial concentration of MB: 10 mg/l, pH: 8, temperature: 45°C, and contact time: 60 min.

Biosorbent Dose (g)	Absorbance after biosorption	C _e (mg/l)	q _e (mg/g)	% Removal
0.1	0.185	3.388	1.322	66.1
0.15	0.121	2.404	1.519	75.9
0.2	0.04	1.159	1.768	88.4
0.25	0.015	0.776	1.845	92.2
0.3	0.016	0.791	1.842	92.1
0.35	0.016	0.791	1.842	92.1

5. Effect of Initial Concentration

Adsorption conditions: Volume of the MB aqueous solution 50 ml, pH: 8, biosorbent dose: 0.25 g, temperature: 45°C, and contact time: 60 min.

Initial Conc. of MB (mg/l)	Absorbance after biosorption	C _e (mg/l)	q _e (mg/g)	% Removal
10	0.0003	0.55	1.89	93.8
15	0.0625	1.506	2.78	91.2
20	0.165	3.073	3.59	87.64
25	0.427	7.099	4.39	74.6
30	0.698	11.263	5.12	62.46
35	0.989	15.749	5.83	54.6

6. Effect of pH

Adsorption conditions: Volume of the MB aqueous solution 50 ml, initial concentration of MB: 10 mg/l, biosorbent dose: 0.25 g, temperature: 45°C, and contact time: 60 min.

pH	Absorbance	C _e (mg/l)	q _e (mg/g)	% Removal
2	0.14	2.696	1.461	71.04
3	0.082	1.805	1.639	81.95
4	0.063	1.513	1.697	86.87
5	0.042	1.19	1.762	89.9
6	0.021	0.868	1.826	91.32
7	0.015	0.776	1.845	92.24
8	0.011	0.707	1.859	93.01
9	0.012	0.729	1.854	92.71
10	0.012	0.729	1.854	92.71

7. Effect of Contact Time

Adsorption conditions: Volume of the MB aqueous solution 50 ml, initial concentration of MB: 10 mg/l, biosorbent dose: 0.25 g, pH: 8, and temperature: 45°C.

Time (min)	Absorbance	C _e (mg/l)	q _e (mg/g)	% Removal
15	0.227	4.033	1.193	59.67
30	0.108	2.205	1.559	77.95
45	0.06	1.467	1.707	85.33
60	0.023	0.9	1.82	91
75	0.014	0.76	1.848	92.4
90	0.015	0.776	1.845	92.24

8. Effect of Temperature

Adsorption conditions: Volume of the MB aqueous solution 50 ml, initial concentration of MB: 10 mg/l, biosorbent dose: 0.25 g, contact time: 60 min and pH: 8.

Temperature (°C)	Absorbance	C _e (mg/l)	q _e (mg/g)	% Removal
25	0.033	1.052	1.789	89.48
35	0.021	0.868	1.826	91.72
45	0.012	0.729	1.854	93.11
55	0.0001	0.547	1.891	94.23

9. Data on Thermodynamic Study

Adsorption conditions: 0.25 g of biosorbent in 50 ml of 10 mg/l, pH of solution: 8, Contact time: 60 min and contact time: 60 min.

Temp (K)	C _e (mg/l)	q _e (mg/g)	$\frac{q_e}{C_e}$	lnKc	$\frac{1}{T}(\text{K}^{-1})$	$\Delta G(\frac{\text{kJ}}{\text{mol}})$	$\Delta H(\frac{\text{kJ}}{\text{mol}})$	$\Delta S(\frac{\text{J}}{\text{molK}})$
298	1.052	1.789	1.701	0.53	0.0033	-1.215	14.16	52.09
308	0.868	1.826	2.104	0.74	0.0032	-1.895		
318	0.729	1.854	2.543	0.93	0.0031	-2.389		
328	0.547	1.891	3.457	1.24	0.003	-3.423		

10. Data on Kinetic Study

Adsorption conditions: volume of the solution 50 ml, initial concentration: 10 mg/l, temperature: 45°C, pH: 8, biosorbent dose: 0.25 g and contact time (30-90) min.

Time (min)	C _t (mg/l)	q _t (mg/g)	q _e (mg/g)	q _e - q _t	log(q _e - q _t)	t/q _t
30	2.205	1.559	1.89	0.331	-0.480	19.244
45	1.467	1.707	1.89	0.183	-0.738	26.362
60	0.9	1.82	1.89	0.07	-1.154	32.967
75	0.76	1.848	1.89	0.042	-1.377	40.58
90	0.776	1.845	1.89	0.045	-1.347	48.780