**Supplementary data for**

**Graphene oxide coated wad as a new sorbent in fixed bed column for the removal of crystal violet from contaminated water**

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Table S1. Thomas kinetic model parameters for crystal violet adsorption in different conditions.

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| PH | Q  (mL/min) | C0  (mg/L) | h  cm. | VB  (L) | VE  (L) | r2 | QB  (mg/g) | QE  (mg/g) | Kth ×10-4  (L min-1 mg-1) | q0  (mg/g) | EBCT  (min) |
| 3.0 | 6.0 | 50.0 | 1.0 | 0.24 | 1.08 | 0.9531 | 120.20 | 19.57 | 5.16 | 31.38 | 0.82 |
| 5.0 | 6.0 | 50.0 | 1.0 | 0.48 | 1.80 | 0.9727 | 240.50 | 91.31 | 3.86 | 58.98 | 0.82 |
| 7.0 | 6.0 | 50.0 | 1.0 | 0.24 | 1.32 | 0.9784 | 118.75 | 44.00 | 5.74 | 25.47 | 0.82 |
| 5.0 | 4.0 | 50.0 | 1.0 | 0.6 | 1.50 | 0.9717 | 300.68 | 72.66 | 3.82 | 44.22 | 1.22 |
| 5.0 | 6.0 | 50.0 | 1.0 | 0.48 | 1.80 | 0.9451 | 249.54 | 35.81 | 3.84 | 58.41 | 0.82 |
| 5.0 | 8.0 | 50.0 | 1.0 | 0.32 | 1.84 | 0.9902 | 162.70 | 81.07 | 5.74 | 45.83 | 0.61 |
| 5.0 | 6.0 | 30.0 | 1.0 | 1.02 | 2.58 | 0.9893 | 310.88 | 94.60 | 3.67 | 52.14 | 0.82 |
| 5.0 | 6.0 | 50.0 | 1.0 | 0.48 | 1.80 | 0.9717 | 249.54 | 35.81 | 3.92 | 57.40 | 0.82 |
| 5.0 | 6.0 | 80.0 | 1.0 | 0.24 | 0.84 | 0.9263 | 199.90 | 36.48 | 5.44 | 58.62 | 0.82 |
| 5.0 | 6.0 | 50.0 | 0.6 | 0.18 | 0.84 | 0.9303 | 156.06 | 36.46 | 8.6 | 35.73 | 0.49 |
| 5.0 | 6.0 | 50.0 | 1.0 | 0.48 | 1.80 | 0.9451 | 249.54 | 35.81 | 3.84 | 58.41 | 0.82 |
| 5.0 | 6.0 | 50.0 | 1.4 | 0.90 | 2.46 | 0.9877 | 229.74 | 38.84 | 3.56 | 66.53 | 1.63 |

Table S2. Parameters of Adams Bohart and Yoon-Nelson model for crystal violet adsorption in different conditions.

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| PH | Q  (mL/min) | C0  (mg/L) | h  (cm) | Adams Bohart parameters | | | Yoon-Nelson parameters | | | |
| NAB  (mg/ L) | KAB × 10-4  (L/mg min) | r2 | KNY(min-1) | (min) | r2 | q0  (mg/g) |
| 3.0 | 6.0 | 50.0 | 1.0 | 0.71 | 9.50 | 0.9595 | 0.031 | 125.5 | 0.9205 | 39.22 |
| 5.0 | 6.0 | 50.0 | 1.0 | 1.07 | 6.40 | 0.9385 | 0.025 | 190.0 | 0.9518 | 59.37 |
| 7.0 | 6.0 | 50.0 | 1.0 | 0.69 | 8.40 | 0.9247 | 0.030 | 108.9 | 0.9637 | 33.85 |
| 5.0 | 4.0 | 50.0 | 1.0 | 1.08 | 5.44 | 0.9242 | 0.026 | 228.4 | 0.9813 | 47.59 |
| 5.0 | 6.0 | 50.0 | 1.0 | 0.99 | 7.24 | 0.9564 | 0.025 | 190.4 | 0.9525 | 59.50 |
| 5.0 | 8.0 | 50.0 | 1.0 | 0.84 | 9.56 | 0.9129 | 0.032 | 116.2 | 0.9437 | 48.44 |
| 5.0 | 6.0 | 30.0 | 1.0 | 1.19 | 5.20 | 0.9471 | 0.02 | 303.5 | 0.9532 | 56.91 |
| 5.0 | 6.0 | 50.0 | 1.0 | 1.07 | 6.40 | 0.934 | 0.025 | 190.0 | 0.9525 | 59.37 |
| 5.0 | 6.0 | 80.0 | 1.0 | 0.63 | 20.75 | 0.9807 | 0.051 | 119.2 | 0.9077 | 59.67 |
| 5.0 | 6.0 | 50.0 | 0.6 | 0.65 | 25.20 | 0.9202 | 0.059 | 72.5 | 0.935 | 37.79 |
| 5.0 | 6.0 | 50.0 | 1.0 | 0.94 | 8.06 | 0.9642 | 0.025 | 190.0 | 0.9525 | 59.37 |
| 5.0 | 6.0 | 50.0 | 1.4 | 1.43 | 3.04 | 0.9856 | 0.024 | 281.7 | 0.9752 | 63.06 |

Table S3. The column performance indicators at different conditions

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| pH | Q (ml/min) | C0 (mg/L) | h (cm) | Number of BV | AER |
| 3.0 | 6.0 | 50.0 | 1.0 | 0.049 | 0.089 |
| 5.0 | 6.0 | 50.0 | 1.0 | 0.098 | 0.053 |
| 7.0 | 6.0 | 50.0 | 1.0 | 0.049 | 0.073 |
| 5.0 | 4.0 | 50.0 | 1.0 | 0.13 | 0.052 |
| 5.0 | 6.0 | 50.0 | 1.0 | 0.098 | 0.053 |
| 5.0 | 8.0 | 50.0 | 1.0 | 0.066 | 0.064 |
| 5.0 | 6.0 | 30.0 | 1.0 | 0.21 | 0.037 |
| 5.0 | 6.0 | 50.0 | 1.0 | 0.098 | 0.053 |
| 5.0 | 6.0 | 80.0 | 1.0 | 0.049 | 0.11 |
| 5.0 | 6.0 | 50.0 | 0.6 | 0.061 | 0.068 |
| 5.0 | 6.0 | 50.0 | 1.0 | 0.098 | 0.055 |
| 5.0 | 6.0 | 50.0 | 1.4 | 0.13 | 0.053 |