**Supplementary information**

**Removal of Lead and Cadmium with an optimized composite of expanded graphite/g-C3N4 /phenylenediamine**

**Mahboobeh Zarei 1, Majid Baghdadi 2 \*, Fatemeh Yazdian 3, Naser Mehrdadi 2**

*1Environmental Engineering, Water and Wastewater, Kish International Campus, University of Tehran, Iran.*

*2Department of Environmental Engineering, graduate Faculty of environment,*[*University of Tehran*](https://scholar.google.com/citations?view_op=view_org&hl=en&org=3127243484376623607)*, Tehran, Iran.*

*3*[*Life Science Engineering*](https://fnst.ut.ac.ir/en/~yazdian)*, Faculty of New Sciences and Technologies, University of Tehran, Tehran, Iran.*

**Figs. S1-5**

**Tables S1-3**

**Figs.**

|  |
| --- |
| **Fig. S1.** Comparison of Langmuir isotherms for Pb2+ - Cd2+. |
| **Fig. S2.** Comparison of Freundlich isotherms for Pb2+ - Cd2+ (pH=5 - absorbent dosage=2 g/l -T=23 ºC - time= 60 min). |
|  |  |
| **Fig. S3.** Comparison of PFO (a) model and PSO (b) for Pb2+ - Cd2+(pH=5, absorbent dosage=2 g/L,T=23º C, sample volume=100 mL). |
| **Fig. S4.** Comparisonof theIntra-particle diffusion (IP) model for Pb2+ - Cd2+(pH=5, absorbent dosage=2 g/L ,T=23 ºC, sample volume=100 mL). |
| **Fig. S5.** Estimation of liquid film diffusion models for Pb2+ - Cd2+(pH=5, absorbent dosage=2 g/L ,T=23 ºC, sample volume=100 mL). |

**Table S1.** ANOVA for Quadratic model.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Source** | **Sum of squares** | **df** | **Mean square** | **F-value** | **p-value** |  |
| **Model** | 1094.28 | 9 | 121.59 | 9.31 | 0.0038 | **Significant** |
| A-Expanded graphite | 361.94 | 1 | 361.94 | 27.70 | 0.0012 |  |
| B-melamine | 1.81 | 1 | 1.81 | 0.1389 | 0.7204 |  |
| C-phenylenediamine | 5.41 | 1 | 5.41 | 0.4143 | 0.5403 |  |
| AB | 15.76 | 1 | 15.76 | 1.21 | 0.3084 |  |
| AC | 54.10 | 1 | 54.10 | 4.14 | 0.0813 |  |
| BC | 0.0110 | 1 | 0.0110 | 0.0008 | 0.9776 |  |
| A² | 487.08 | 1 | 487.08 | 37.28 | 0.0005 |  |
| B² | 33.50 | 1 | 33.50 | 2.56 | 0.1534 |  |
| C² | 87.67 | 1 | 87.67 | 6.71 | 0.0359 |  |
| **Residual** | 91.45 | 7 | 13.06 |  |  |  |
| Lack of Fit | 27.56 | 3 | 9.19 | 0.5751 | 0.6612 | **Not significant** |
|  |  |  |  |  |  |  |
| Pure Error | 63.89 | 4 | 15.97 |  |  |  |
| **Cor Total** | 1185.73 | 16 |  |  |  |  |

**Table S2.** Final equation in terms of coded factors.

|  |  |
| --- | --- |
| Remove of heavy metal | = |
| +74.99 |  |
| +6.73 | A |
| +0.4763 | B |
| +0.8225 | C |
| -1.98 | AB |
| +3.68 | AC |
| -0.0525 | BC |
| -12.36 | A² |
| -4.42 | B² |
| -6.17 | C² |

**Table S3.**Final equation in terms of actual factors.

|  |  |
| --- | --- |
| Remove of heavy metal | = |
| +45.66000 |  |
| +1.98325 | Expanded graphite |
| +1.51450 | Melamine |
| +9.52750 | phenylenediamine |
| -0.017644 | Expanded graphite \* melamine |
| +0.245167 | Expanded graphite \* phenylenediamine |
| -0.007000 | melamine \* phenylenediamine |
| -0.054922 | Expanded graphite² |
| -0.078622 | Melamine² |
| -6.16500 | Phenylenediamine² |