Supplementary Information for

Adsorption and bonding strength of chromium species by ferrihydrite from acidic aqueous solutions

Agnieszka Dzieniszewska, Joanna Kyziol-Komosinska, Magdalena Pająk

Institute of Environmental Engineering Polish Academy of Sciences,
34 M. Skłodowska-Curie St., 41-819 Zabrze, Poland;

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**This supporting information has 5 pages, including 3 tables and 2 figures**

**Table S1:**

**List of adsorption isotherm models.**

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| Adsorption isotherms models |
| Isotherm | Isotherm form | Equation number | Parameters | Ref. |
| Freundlich  | Nonlinear$q=K\_{F}∙C\_{eq}^{{1}/{n\_{F}}}$ Linear$logq=logK\_{F}∙^{1}/\_{n}logC\_{eq}$  | (S1.1)(S1.2) | *KF* – Freundlich equilibrium constant related to the adsorption capacity and adsorption intensity of the system (mg g-1(L mg-1)1/*nF*),*1/nF* – expresses favorability of adsorption (dimensionless) | *Freundlich, 1906* |
| Langmuir  | Nonlinear$q=\frac{q\_{max}K\_{L}C\_{eq}}{1+K\_{L}C\_{eq}}$ Linear$\frac{C\_{eq}}{q}=\frac{C\_{eq}}{q\_{max}}+\frac{1}{K\_{L}q\_{max}}$  | (S2.1)(S2.2) | *qmax* – maximum adsorption capacity (mg g-1),*KL* – Langmuir constant related to the affinity of the binding sites and the energy of adsorption (L mg-1) | *Langmuir, 1916* |
| Dubinin-Radushkevich  | Nonlinear$q=q\_{D}∙exp⁡\left(–βε^{2}\right)$ Linear$lnq=lnq\_{D}-βε^{2}$  | (S3.1)(S3.2) | *qD*– theoretical saturation capacity (mmol g-1), *β* – constant related to the adsorption energy (mol2 kJ-2), *ε* – Polanyi potential, $ ε=RTln\left(1+{1}/{C\_{eq}}\right)$ (S4), *R* – gas constant (J mol-1 K-1), *T* – temperature (K) | *Dubinin, 1960* |
| Sips  | Nonlinear$q=\frac{q\_{max}K\_{S}C\_{eq}^{{1}/{n\_{S}}}}{1+K\_{S}C\_{eq}^{{1}/{n\_{S}}}}$  | (S5) | *KS* – Sips constant related with affinity constant ((L mg-1)1/*nS*),1/*nS* – Sips exponent which represents the surface heterogeneity (dimensionless) | *Sips, 1948* |

**Table S2:**

**List of error functions.**

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| Error functions |
| Abbreviation | Definition/expression | Equation number | Parameters | Ref. |
| SSE |  $\sum\_{i=1}^{n}\left(q\_{e,cal}-q\_{e,exp}\right)\_{i}^{2}$  | (S6) | *qe,cal* – calculated value of the adsorption capacity, *qe,exp* – experimental value of the adsorption capacity, *n* – number of observations in the experimental data | *Foo & Hameed, 2010* |
| *RMSE* |  $\sqrt{\frac{1}{n}\sum\_{i=1}^{n}\left(q\_{e,exp}-q\_{e,cal}\right)\_{i}^{2}}$  | (S7) | *Terdputtakun et al., 2017* |
| *χ2* |  $\sum\_{i=1}^{n}\frac{\left(q\_{e,exp}-q\_{e,cal}\right)^{2}}{q\_{e,cal}}$  | (S8) | *Terdputtakun et al., 2017* |

**Table S3:**

**Modified BCR sequential extraction scheme.**

|  |  |  |  |
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| Stage of extraction  | Fraction | Extractant | Conditions |
| E0 | Soluble in water | Double distilled H2O | S:L = 1:40, 2 h, T = 20 °C |
| E1 | (Acid soluble/ Exchangeable) – bound to carbonates | 0.11 M CH3COOH(pH 2.85) | S:L = 1:40, 16 h, T = 20 °C |
| E2 | Reducible – bound to Mn and Fe oxides | 0.5 M NH2OH·HCl (pH 1.5) | S:L = 1:40, 16 h, T = 20 °C |
| E3 | Oxidizable – bound to organic matter and sulfides | 8.8 M H2O2, then 1 M CH3COONH4 (pH 2.0) | S:L = 1:10, 1 h, T = 80 °CS:L = 1:50, 16 h, T = 20 °C |
| E4 | Residual | Aqua regia (HCl/HNO3 3/1),then 0.1 M HNO3 | S:L = 1:25, T = 80 °C S:L = 1:50 |

Diagram of chromium speciation for Cr(III) from chloride and sulfate solution as well as for Cr(VI) at *C*0 = 1000 mg L-1 was generated using the software Visual MINTEQ version 3.1 [http://vminteq.lwr.kth.se/download/].



**Figure S1: Cr(III) speciation in chloride (A) and sulfate (B) solutions at *C*0 = 1000 mgCr L-1 as a function of pH.**



**Figure S2: Cr(VI) speciation depending on the pH in the solution at *C*0 = 1000 mgCr L-1.**