

## Supplementary Material

### **Facile preparation of iron-manganese oxide @ diatomite composite with effective remove of vanadium from wastewater**

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## 1. Adsorption kinetics

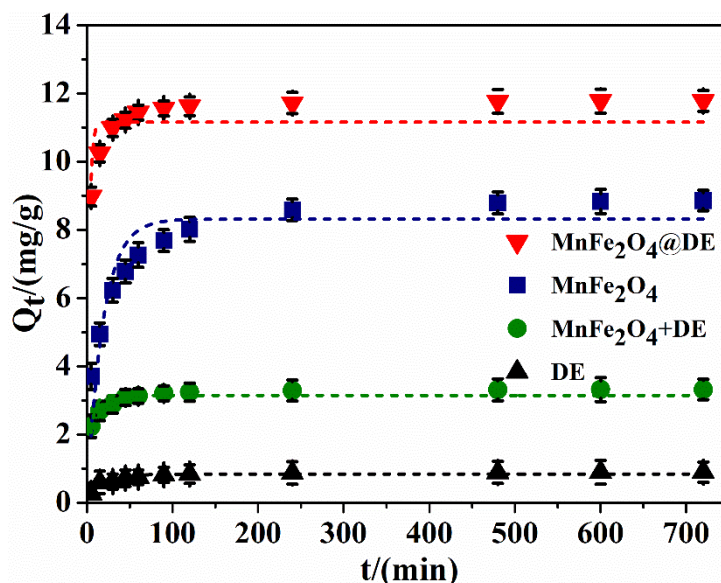


Figure S1. Pseudo-first order model for the adsorption of V (V) by adsorbents.

## 2. Adsorption isotherm

In this work, the Dubinin-Radushkevich (D-R) isotherm model and Temkin isotherm model were also applied to depict the adsorption properties between the adsorbed V (V) species and the adsorbents. The D-R isotherm model (Eq. S1) and Temkin isotherm model (Eq. S2) can be described as follows:

$$\log Q_e = \log Q_{\max} - B\varepsilon^2 \quad (\text{Eq. S1})$$

$$Q_e = A_T + B_T \log C_e \quad (\text{Eq. S2})$$

Where;  $Q_e$  and  $Q_{\max}$  are the equilibrium and maximum adsorption capacities (mg/ g), respectively;  $C_e$  (mg/L) is the vanadium concentration at equilibrium and  $B$  ( $\text{mol}^2/\text{kJ}^2$ ) is the D-R constant,  $\varepsilon = RT \ln(1 + 1/C_e)$ ;  $A_T$  refers to the maximum binding energy and  $B_T$  is the Temkin isotherm constant. The V (V) adsorption isotherms and the fitted curves of the two kinds of models at different temperatures by  $\text{MnFe}_2\text{O}_4@DE$  are shown in Figure S2 (a) and (b). Besides, the adsorption isotherm

parameters can be calculated from the fitted plot of  $Q_e$  versus  $C_e$  and summarized in Table S1.

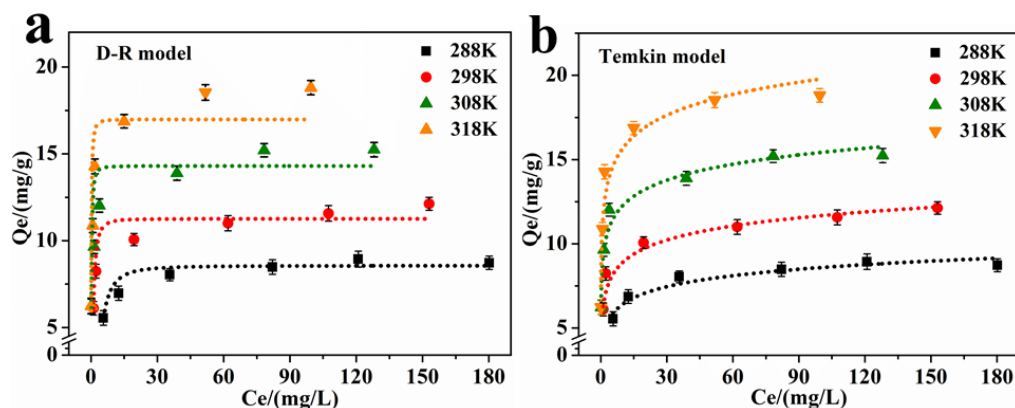


Figure.S2. Dubinin–Radushkevich (a) and Temkin (b) isotherms by nonlinear models for V (V) onto MnFe<sub>2</sub>O<sub>4</sub>@DE

Table S1. Parameters of D-R and Temkin isotherms for V (V) adsorption.

T/(K)	D-R			Temkin		
	$Q_{max}$ (mg/g)	$B$ (mol <sup>2</sup> KJ <sup>-2</sup> )	$R^2$	$A_T$	$B_T$	$R^2$
288	8.56	2.795	0.904	4.246	0.943	0.928
298	11.26	0.247	0.886	6.128	1.204	0.975
308	14.30	0.039	0.821	9.132	1.366	0.949
318	16.98	0.026	0.859	11.563	1.785	0.934

Based on the  $R^2$  values ( $R^2 \leq 0.904$ ) of D-R model, it is clear that the experimental data are not well fitted with D-R isotherm model.  $R^2$  values ( $0.928 \leq R^2 \leq 0.975$ ) of Temkin model are relatively high, indicating that there might be chemical adsorption in the adsorption process of V(V) by MnFe<sub>2</sub>O<sub>4</sub>@DE composite<sup>[1]</sup>.

## References

[1] S. Zaidi, V. Sivasankar, T. Chaabane, V. Alonzo, K. Omine, R. Maachi, et al. Separate and simultaneous removal of doxycycline and oxytetracycline antibiotics by electro-generated adsorbents (EGAs). *Journal of Environmental Chemical Engineering*. **2019**, 7, 102876.