# Efficient removal of cadmium (II) and arsenic (V) from water by the composite of iron manganese oxides loaded muscovite

## S1. Preparation of muscovite supported iron oxides

Weighed 10 g muscovite and add it into 75ml of $FeSO_4 \cdot 7H_2O$ solution with a concentration of 0.32 mol/L was added. After 1h, 110ml of KOH solution with a concentration of 0.5mol/L was added, the mixture was stirred for 1h and placed at 70-80°C for 12h, and then the solid-liquid was separated and the solid was dried, that is, the muscovite supported iron oxides (FM) was obtained.

## S2. Preparation of muscovite supported manganese oxides

Weighed 10 g muscovite and add it into 100 ml $KMnO_4$ solution with a concentration of 0.08 mol/L, and stired thoroughly for 0.5 h. After, 35 ml of KOH solution with a concentration of 0.5 mol/L was added, the mixture was stirred for 1h and placed at 70-80°C for 12 h, and then the solid-liquid was separated and the solid was dried, that is, the muscovite supported manganese oxides material (MM) was obtained.

## S3. The amount of Cd(II) / As(V) adsorbed by the material was calculated by formula

$$Q_e = (C_o - C_e) * V / W \quad (S1)$$

$Q_e$ (mg/g) is the adsorption capacity of Cd(II) / As(V), $C_o$ is the initial Cd(II) / As(V) concentration of the solution, $C_e$ is the initial Cd(II) / As(V) concentration of the solution, V (mL) is the volume of the solution, W (mg) is the mass of the adsorption material.

## S4. Adsorption kinetics

The pseudo-first-order model (Eq. (S2)) and the pseudo-second-order model (Eq. (S3)) were used to fit the adsorption process.

$$q = Q_e(1-\exp(-k_1 t)) \quad (S2)$$

$$t/q = t/Q_e + 1/(k_2 Q_e^2) \quad (S3)$$

$Qe$ (mg/g) is the equilibrium adsorption capacity; $q$ (mg/g) is the adsorption capacity at adsorption time $t$ , and; $k_1$ and $k_2$ are the coefficients.

## S5. Adsorption Isotherms

The Langmuir equation (S4) and the Freundlich equation (S5) can be described as below:

$$Qe = Q_m K_L Ce /(1+K_L C_e) \quad (S4)$$

$$Qe = K_F C_e^{1/n} \quad (S5)$$

where $Q_m$ (mg/g) is the maximum adsorption capacity; $K_L$, $n$, and $K_F$ are the constant; $Ce$ is the equilibrium concentration (mg/L); $Qe$ is the adsorption capacity at equilibrium (mg/g).

## S6. XRD analysis

XRD (X-ray diffraction) (Bruker D8, Germany) characterized the crystal structure of the materials under the following conditions: voltage of 30 kV, current of 10 mA, scanning speed of 1°/min, scanning range from 5° to 90°.

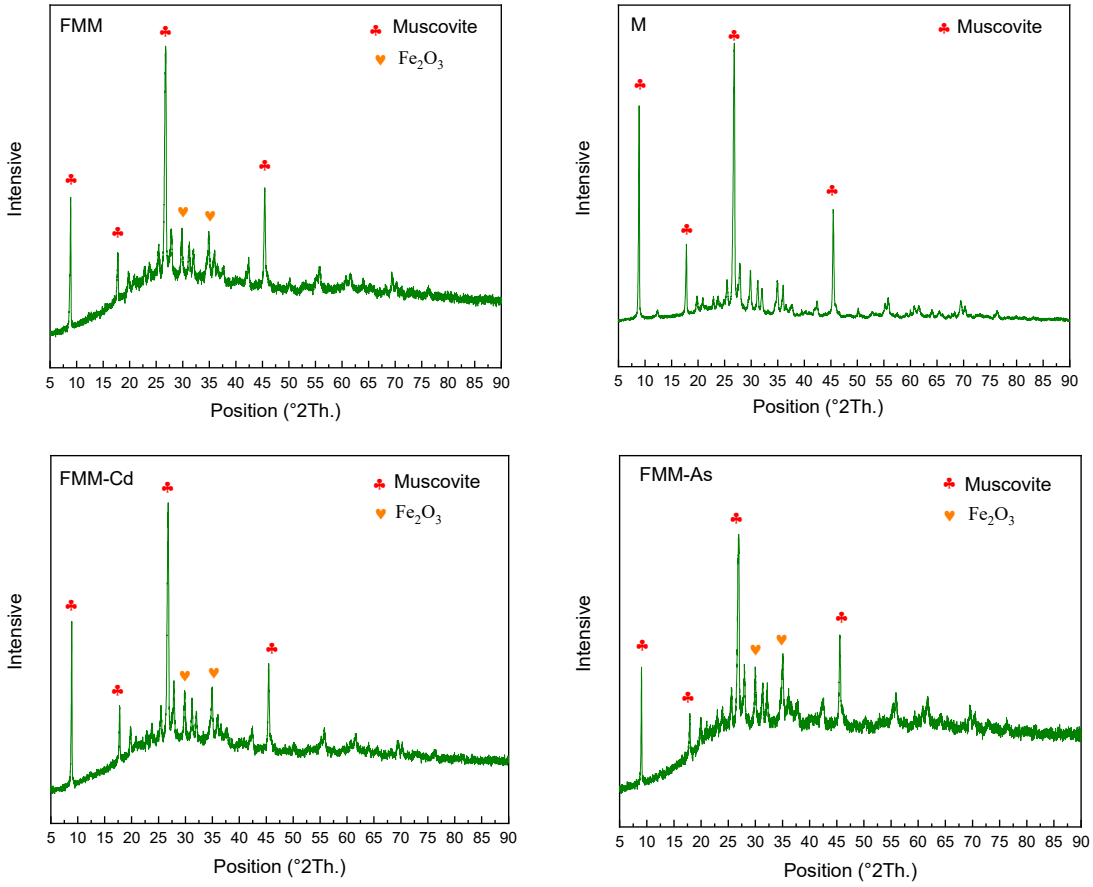


**Figure S1.** The XRD pattern of M, FMM, FMM after Cd(II) adsorption(FMM-Cd), FMM after As(V) adsorption(FMM-As).

Figure S1 shows the XRD result of M, FMM, FMM-Cd, FMM-As. Muscovite have

five diffraction peaks (2 theta = 8.80, 17.75, 26.76, and 62.7, respectively), referring to the PDF 06-0263. FMM have two diffraction peaks (2 theta = 29.72, and 35.02, respectively), referring to the PDF 01-089-0951, it indicated that $Fe_2O_3$ loaded on nature muscovite. No diffraction peak of $MnO_2$ was found, indicating that Mn oxides exists as amorphous on the nature muscovite.