

Supporting Information for

Application of Dithiocarbamate Chitosan Modified SBA-15 for Catalytic Reductive Removal of Vanadium(V)

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Text S1 Details of synthesis procedures of SBA-15

SBA-15 was synthesized by the following method. Typically, 14.98 g Poly(ethylene glycol)-block-poly(propylene glycol)-block-poly(ethylene glycol) (Pluronic P123) was dissolved in HCl solution ($\text{HCl}:\text{H}_2\text{O}=8.00\text{g}:266.50\text{g}$) in a polypropylene bottle. After stirring the mixture at 311 K overnight, 28.95 g tetraethyl orthosilicate (TEOS) was added to the mixture and stirred for 24 h at 311 K. And then, the sample was kept for 24 h at 363 K. Finally, the solids were separated, dried at 363 K overnight and calcined at 823 K for 5 h.

Text S2 Details of synthesis procedures of CS₂-chitosan

0.05 mol NH₃·H₂O and 8.00 g chitosan were mixed in (95.0 % v/v) ethanol for 1.5 h at 333 K, and then added 4.00 ml CS₂ into the mixture further stirred for 2 h. Finally, the mixture was filtered, washed several times with ethanol and dried at 333K overnight.

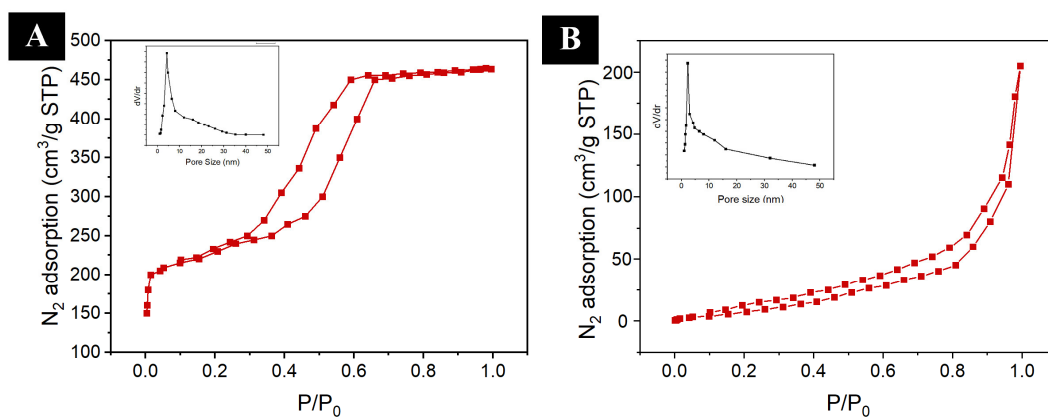


Figure S1 Nitrogen sorption isotherms of SBA-15 (A) and $CS_2C@SBA-1$ (B).

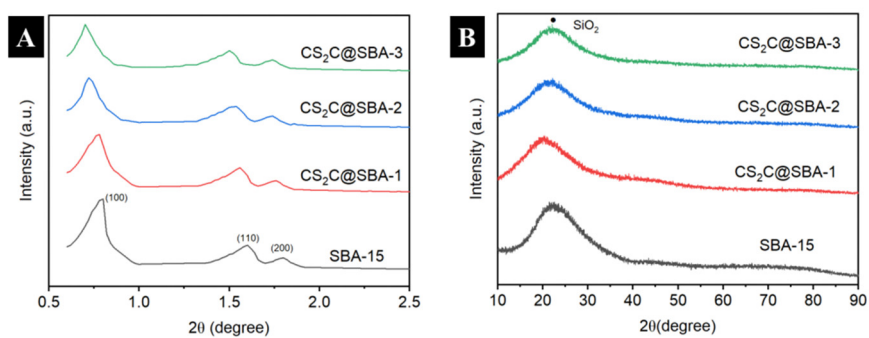


Figure S2 The XRD pattern of preparation composite

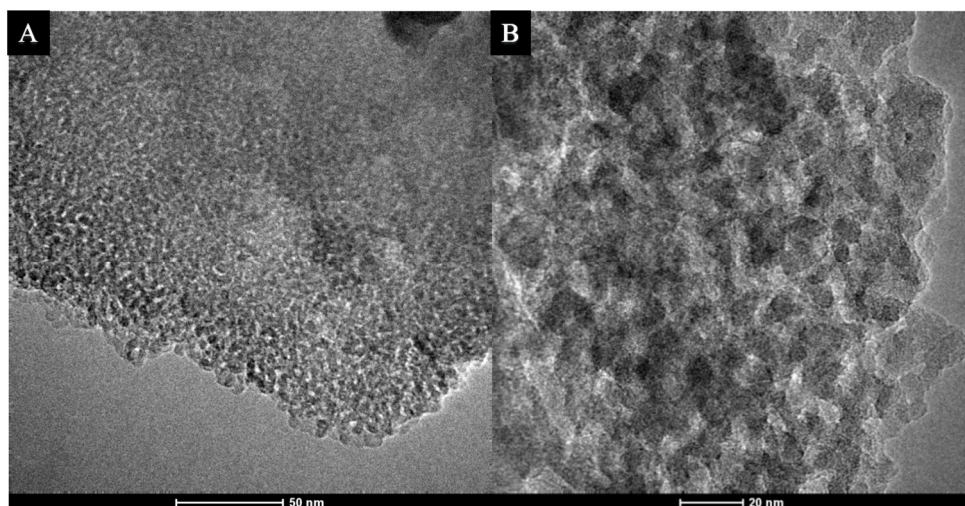


Figure S3 TEM images of SBA-15 (**A**) and CS₂C@SBA-3 (**B**).

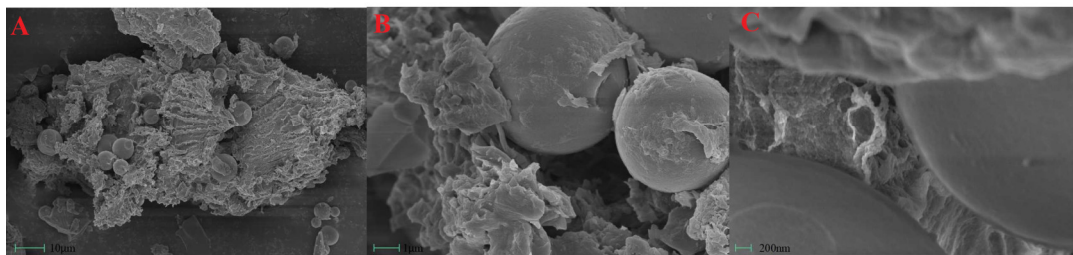


Figure S4 SEM images of CS₂C@SBA-3 after reaction with V(V) (A - C). Conditions: Conditions: V(V) initial concentration = 100 ppm, CS₂C@SBA-3 dosage = 1.0 g/L, pH value = 3.0, experimental temperature = 298 K, contact time = 24 h.

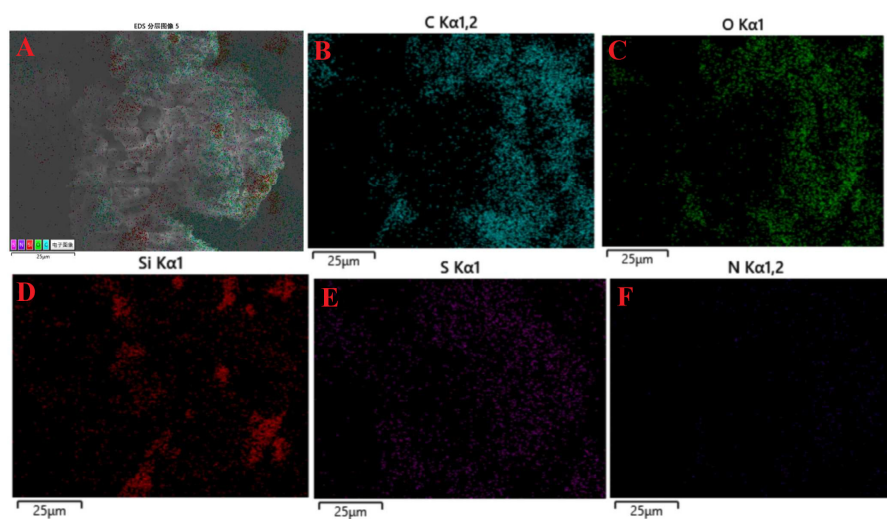


Figure S5 EDS elemental mapping images of $\text{CS}_2\text{C@SBA-3}$ before reaction with V(V) (A - F)

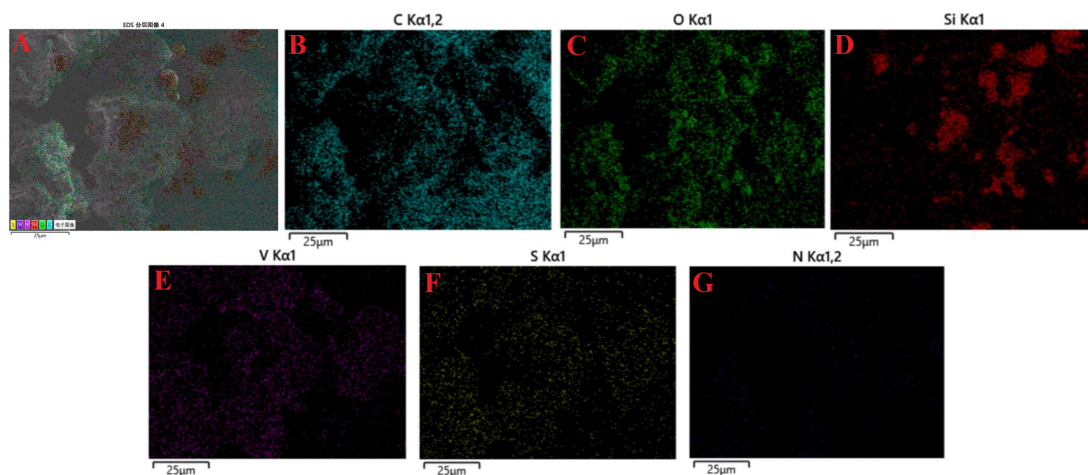


Figure S6 EDS elemental mapping images of CS₂C@SBA-3 after reaction with V(V). Conditions: Conditions: V(V) initial concentration = 100 ppm, CS₂C@SBA-3 dosage = 1.0 g/L, pH value = 3.0, experimental temperature = 298 K, contact time = 24 h.

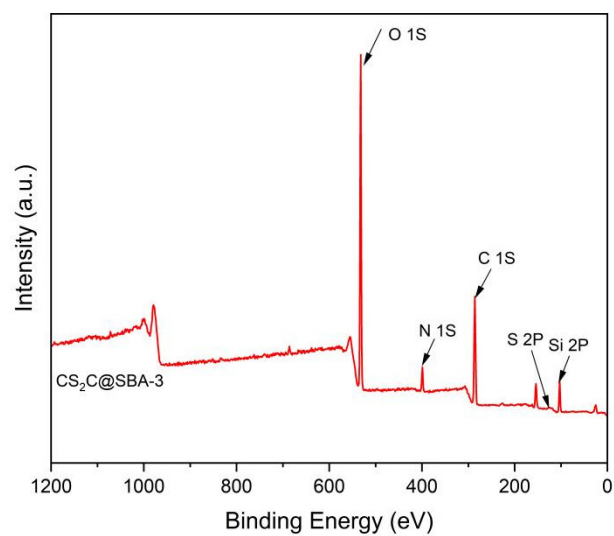


Figure S7 The XPS survey spectra of CS₂C@SBA-3 before reaction.

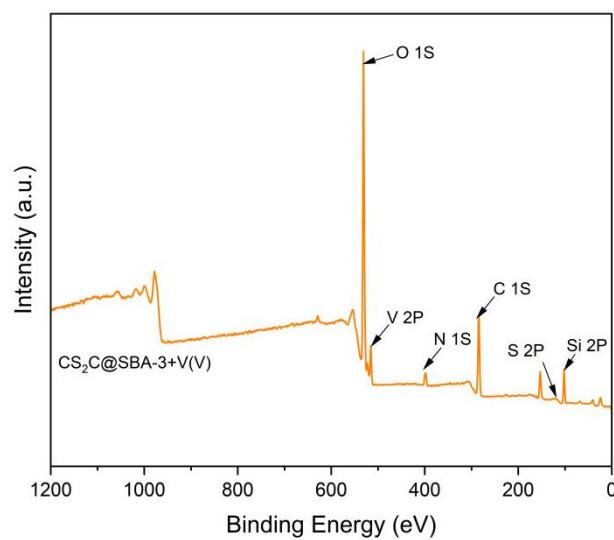


Figure S8 The XPS survey spectra of $\text{CS}_2\text{C@SBA-3}$ after reaction. Conditions: Conditions: V(V) initial concentration = 100 ppm, $\text{CS}_2\text{C@SBA-3}$ dosage = 1.0 g/L, pH value = 3.0, experimental temperature = 298 K, contact time = 24 h.

Table S1 Porous properties of SBA-15 and CS₂C@SBA-3.

Adsorbent	N ₂ Adsorption		
	S _{BET} (m ² ·g ⁻¹)	Pore volume (cm ³ ·g ⁻¹)	Pore width (nm)
SBA-15	632.6	0.5743	4.2856
CS ₂ CSBA-1	121.4	0.1631	2.0357
CS ₂ CSBA-2	223.4	0.1698	2.1765
CS ₂ CSBA-3	309.2	0.1762	2.2796

Table S2 Physico-chemical properties of water samples used in this study

Parameter	Lake	Pond	Tap
pH	7.93	8.04	7.34
COD(mg/L)	12.3	13.4	1.02
Electrical conductivity (mS/cm)	0.38	0.21	0.077
Ca ²⁺ (mg/L)	16.8	15.4	9.6
SO ₄ ²⁻ (mg/L)	9.2	8.14	3.9
NO ₃ ²⁻ (mg/L)	32.2	31.6	15.4
Cl ⁻ (mg/L)	22.5	20.4	7.1
PO ₄ ³⁻ (mg/L)	25.7	27.8	12.9