

*Supporting Information for*

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

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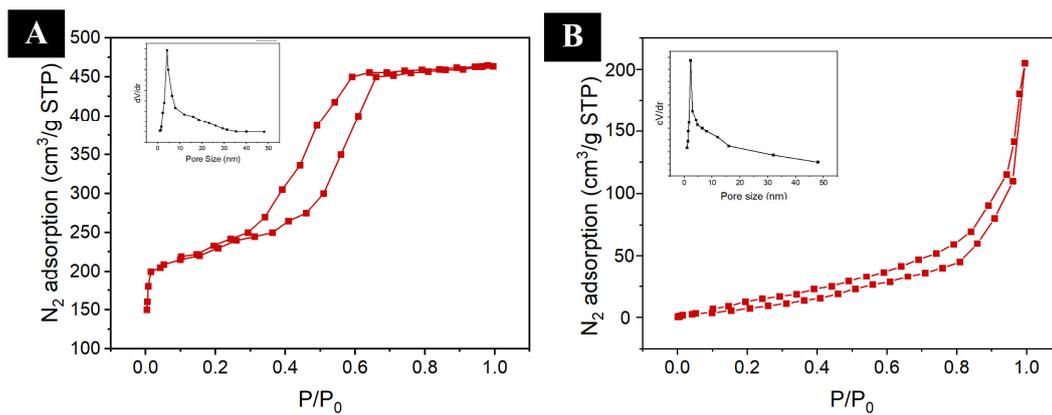
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**Text S1** Details of synthesis procedures of SBA-15

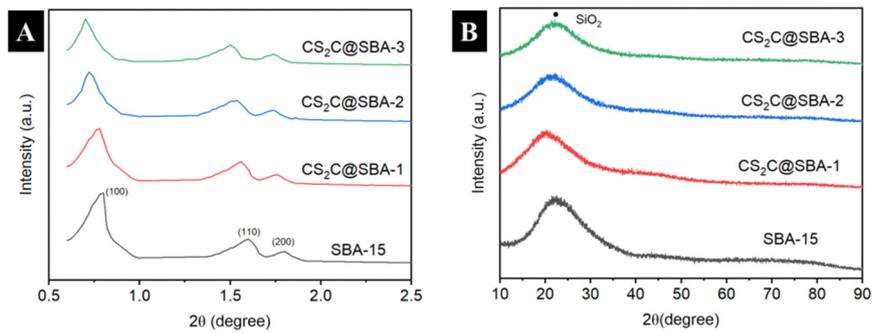
SBA-15 was synthesized by the following method. Typically, 14.98 g Poly(ethylene glycol)-block-poly(propylene glycol)-block-poly(ethylene glycol) (Pluronic P123) was dissolved in HCl solution (HCl:H<sub>2</sub>O=8.00g:266.50g) in a polypropylene bottle. After stirring the mixture at 311 K overnight, 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 CS<sub>2</sub>-chitosan

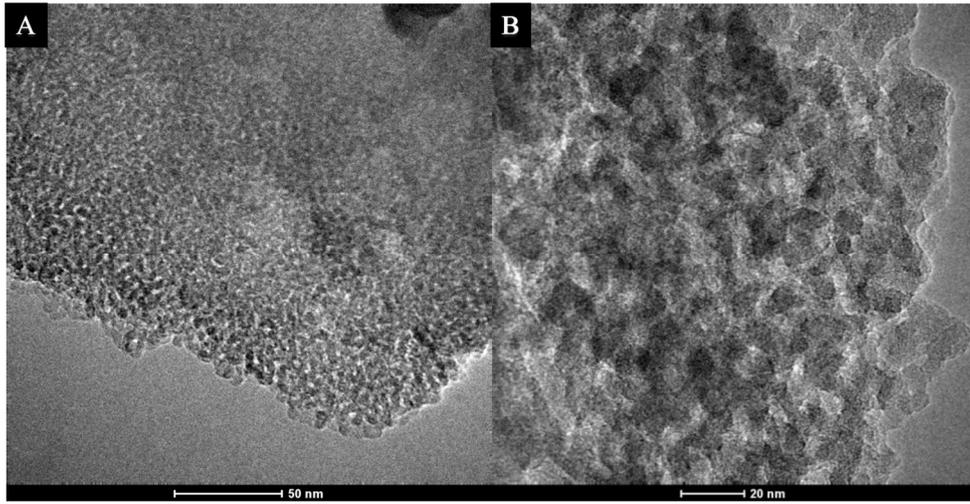
0.05 mol NH<sub>3</sub>·H<sub>2</sub>O and 8.00 g chitosan were mixed in (95.0 % v/v) ethanol for 1.5 h at 333 K, and then added 4.00 ml CS<sub>2</sub> into the mixture further stirred for 2 h. Finally, the mixture was filtered, washed several times with ethanol and dried at 333K overnight.



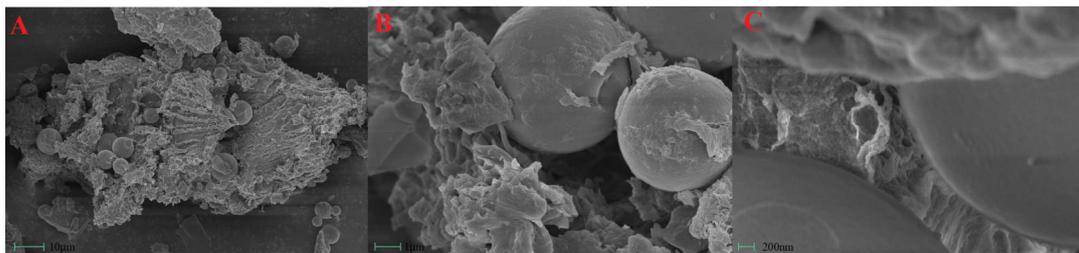
**Figure S1** Nitrogen sorption isotherms of SBA-15 (A) and  $CS_2C@SBA-1$  (B).



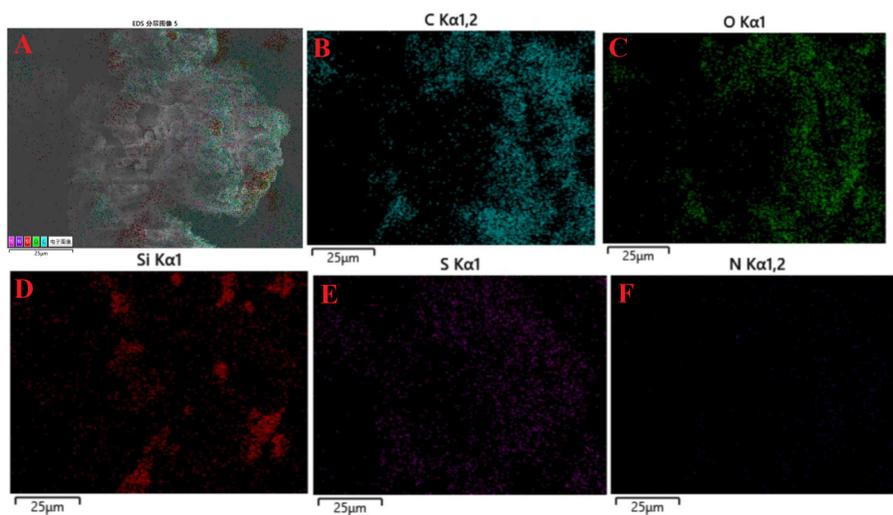
**Figure S2** The XRD pattern of preparation composite



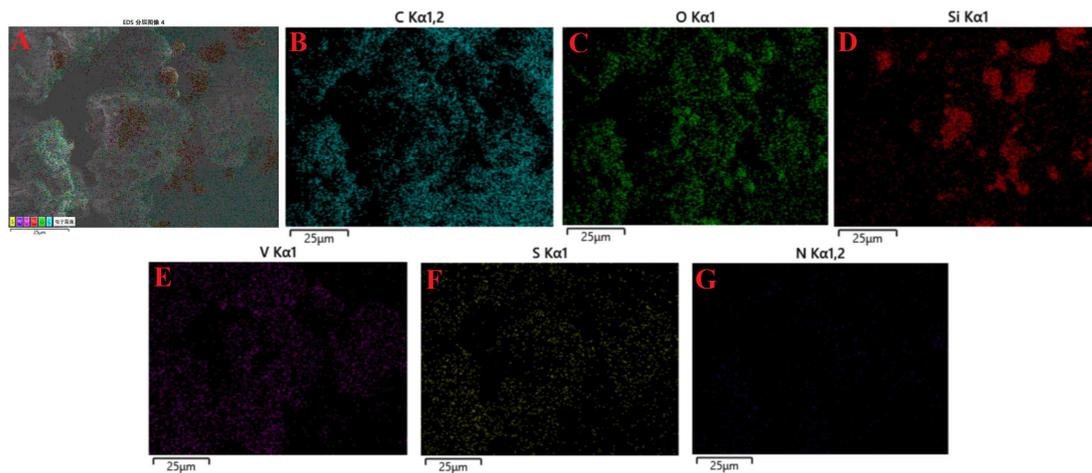
**Figure S3** TEM images of SBA-15 (**A**) and CS<sub>2</sub>C@SBA-3 (**B**).



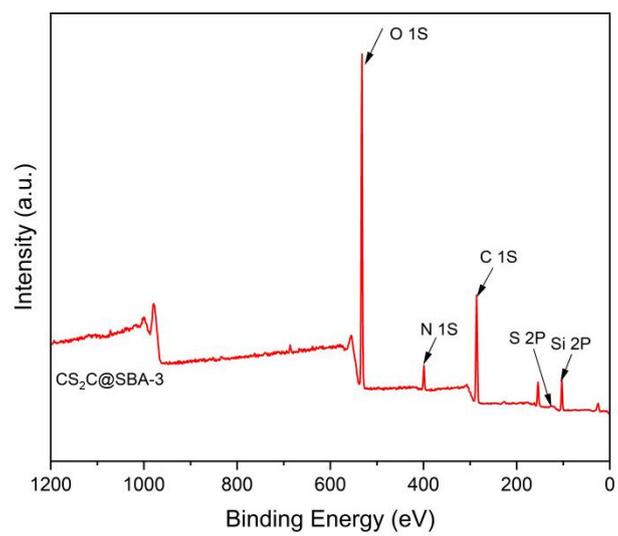
**Figure S4** SEM images of CS<sub>2</sub>C@SBA-3 after reaction with V(V) (A - C). Conditions: Conditions: V(V) initial concentration = 100 ppm, CS<sub>2</sub>C@SBA-3 dosage = 1.0 g/L, pH value = 3.0, experimental temperature = 298 K, contact time = 24 h.



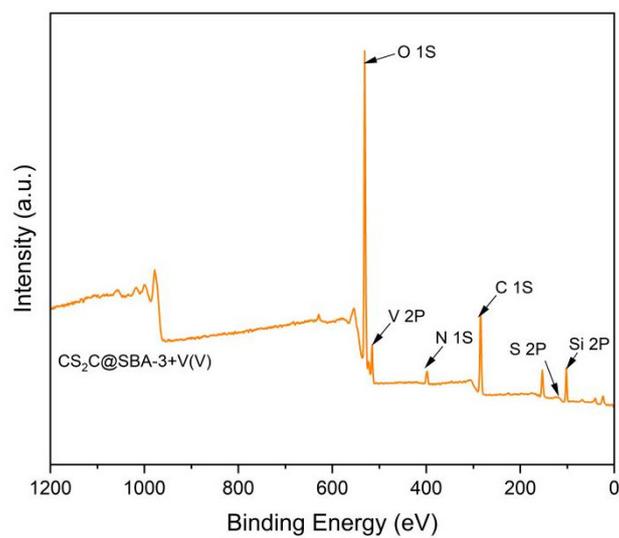
**Figure S5** EDS elemental mapping images of CS<sub>2</sub>C@SBA-3 before reaction with V(V) (A - F)



**Figure S6** EDS elemental mapping images of CS<sub>2</sub>C@SBA-3 after reaction with V(V). Conditions: Conditions: V(V) initial concentration = 100 ppm, CS<sub>2</sub>C@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 CS<sub>2</sub>C@SBA-3 before reaction.



**Figure S8** The XPS survey spectra of CS<sub>2</sub>C@SBA-3 after reaction. Conditions: Conditions: V(V) initial concentration = 100 ppm, CS<sub>2</sub>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 CS<sub>2</sub>C@SBA-3.

Adsorbent	N <sub>2</sub> Adsorption		
	S <sub>BET</sub> (m <sup>2</sup> ·g <sup>-1</sup> )	Pore volume (cm <sup>3</sup> ·g <sup>-1</sup> )	Pore width (nm)
SBA-15	632.6	0.5743	4.2856
CS <sub>2</sub> CSBA-1	121.4	0.1631	2.0357
CS <sub>2</sub> CSBA-2	223.4	0.1698	2.1765
CS <sub>2</sub> 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 <sup>2+</sup> (mg/L)	16.8	15.4	9.6
SO <sub>4</sub> <sup>2-</sup> (mg/L)	9.2	8.14	3.9
NO <sub>3</sub> <sup>2-</sup> (mg/L)	32.2	31.6	15.4
Cl <sup>-</sup> (mg/L)	22.5	20.4	7.1
PO <sub>4</sub> <sup>3-</sup> (mg/L)	25.7	27.8	12.9