Supporting information

Leaching of iron from copper tailings by sulfuric acid: behavior, kinetics and mechanism

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Fig. S1 Effect of temperature on leaching of iron from primary Fe_3O_4-containing mineral and pure Fe_3O_4.

Fig. S2 S 2p spectra for the raw and leached copper tailings.

Fig. S3 Flow diagram of recovery Fe, Zn, and copper from copper tailing by sulfuric acid leaching.

Table S1 Peak positions, FWHW, and relative abundance from curve fitting of O 1s for raw and leached copper tailings.

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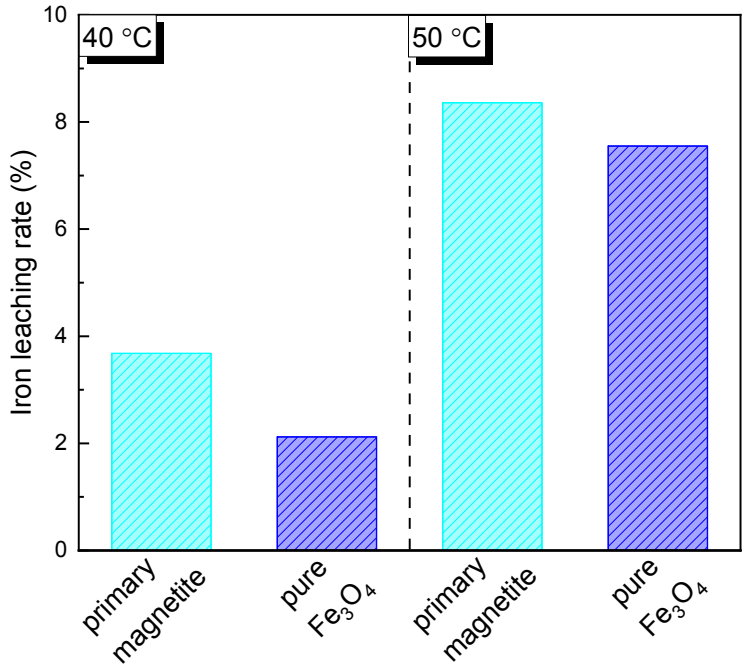

Fig. S1 Effect of temperature on Leaching of iron from primary Fe_3O_4-containing mineral and pure Fe_3O_4. Experimental conditions: S/L ratio, 1: 10; sulfuric acid, 5%; stirring ratio, 400 rpm, and reaction time, 120 min.

To demonstrate the effect of temperature on the leaching of iron from Fe_3O_4, primary Fe_3O_4-containing mineral and pure Fe_3O_4 was used to study the leaching behavior. XRF analysis of the primary Fe_3O_4-containing mineral is as follows: Fe_2O_3, 57.26 wt.%, SiO_2, 21.29 wt.%, MgO, 8.97 wt.%, CaO, 7.48 wt.%, SO_3, 2.47 wt.%, Al_2O_3, 1.61 wt.%, MnO, 0.350 wt.%, P_2O_5, 0.153 wt.%, and CuO, 0.107 wt.%. As Fig. S1 shows, increased temperature would increase the leaching of iron from Fe_3O_4.

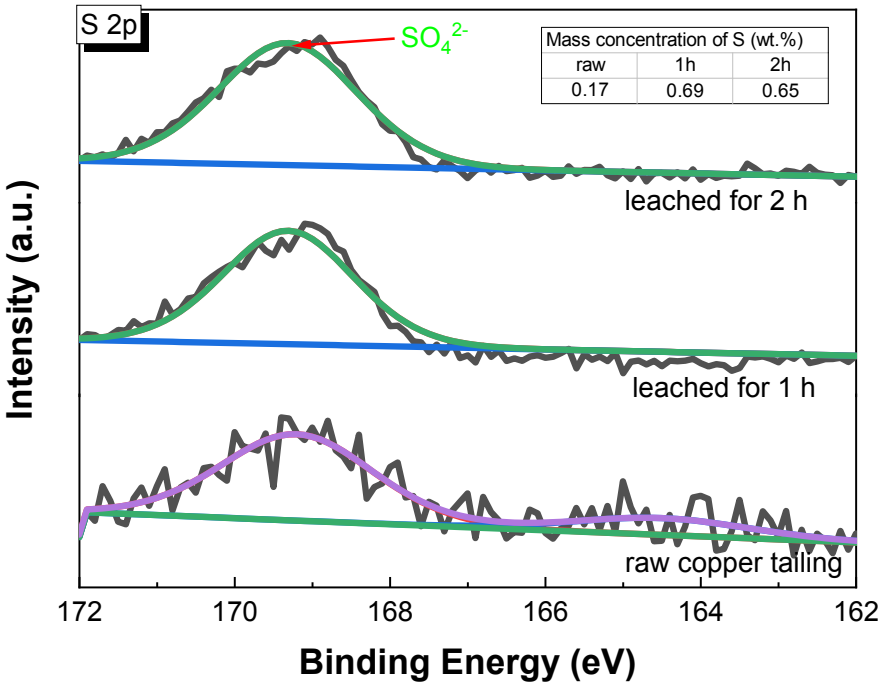

Fig. S2 S 2p spectra for the raw and leached copper tailings.

Table S1 Peak positions, FWHW, and relative abundance from curve fitting of O 1s for raw and leached copper tailings.

Sample	BE (eV)	FWHM (eV)	State of oxygen	Percentage (%)
Raw copper	530.85	1.85	Si-O-Fe (II)	51.82
tailing	532.50	4.42	Fe-O-Fe (II)/Si	10.49
	531.98	2.06	Fe (II)-O-Fe (III)	37.70
copper tailing	531.07	1.99	Si-O-Fe (II)	36.79
after leaching	532.84	1.45	Si-O-Si	16.13
1 h	533.30	2.58	Si-O-Si	10.97
	532.16	1.55	Fe-O-Fe (II)/Si	36.11
copper tailing	532.16	2.13	Fe-O-Fe (II)/Si	78.77
after leaching	530.38	1.52	$Fe(II)_{1-x}$-O-Fe (III)	12.28
2 h	533.08	3.22	Si-O-Si	8.95

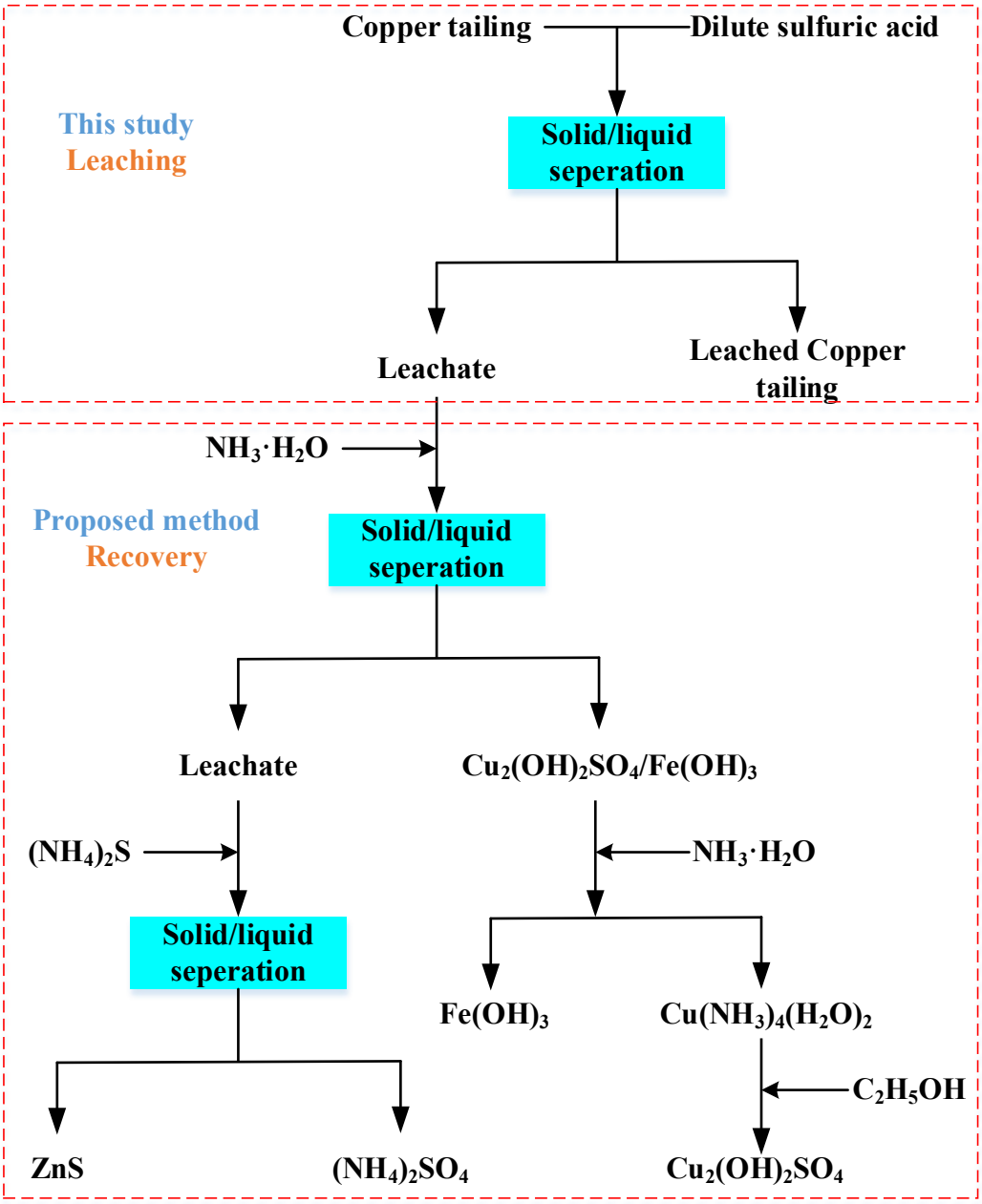

Fig. S3 Flow diagram of recovery Fe, Zn, and copper from copper tailing by sulfuric acid leaching.