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w.harrison@abdn.ac.uk**Key indicators**Single-crystal X-ray study
 $T = 120$ K
Mean $\sigma(\text{N-N}) = 0.004$ Å
 R factor = 0.032
 wR factor = 0.076
Data-to-parameter ratio = 11.2For details of how these key indicators were automatically derived from the article, see <http://journals.iucr.org/e>.**Iron(II) hydrazinium sulfate**

The title compound, poly[[dihydraziniumiron(II)]-di- μ -sulfato- $\kappa^4 O:O'$], $[\text{Fe}(\text{SO}_4)_2(\text{N}_2\text{H}_5)_2]_n$, contains fairly regular *trans*- FeN_2O_4 octahedra. The Fe atoms (site symmetry $\bar{1}$) are bridged by pairs of sulfate groups into infinite [100] chains, which are cross-linked by a network of $\text{N-H}\cdots\text{O}$ hydrogen bonds. $\text{Fe}(\text{N}_2\text{H}_5)_2(\text{SO}_4)_2$ is isostructural with its zinc, chromium(II) and cadmium-containing analogues.

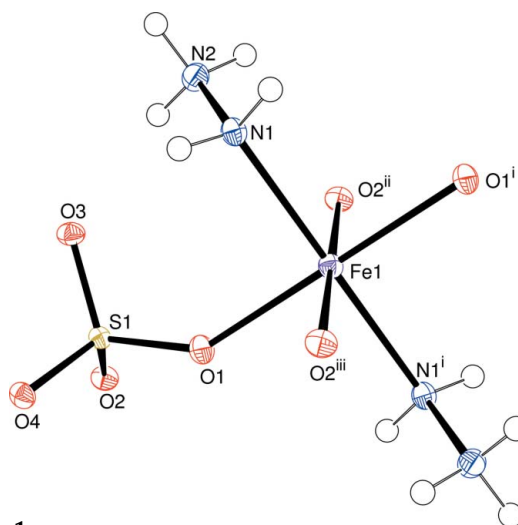
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Comment

The divalent-metal-hydrazinium sulfates of general formula $M(\text{N}_2\text{H}_5)_2(\text{SO}_4)_2$, where $M = \text{Cr}, \text{Mn}, \text{Fe}, \text{Co}, \text{Ni}, \text{Cu}, \text{Zn}$ and Cd can be readily prepared by reacting a salt of the respective metal with hydrazinium sulfate in dilute sulfuric acid (Hand & Prout, 1966), although this method usually results in a microcrystalline product. Recently, we described the single-crystal structure of $\text{Cd}(\text{N}_2\text{H}_5)_2(\text{SO}_4)_2$ (Srinivasan *et al.*, 2006) and we now report the isostructural title compound, (I), $\text{Fe}(\text{N}_2\text{H}_5)_2(\text{SO}_4)_2$. The compounds $\text{Zn}(\text{N}_2\text{H}_5)_2(\text{SO}_4)_2$ (Prout & Powell, 1961) and $\text{Cr}(\text{N}_2\text{H}_5)_2(\text{SO}_4)_2$ (Parkins *et al.*, 2001) also share the same structure.

Compound (I) contains *trans*- FeN_2O_4 octahedra (Fig. 1), in which the N atom is part of a hydrazinium (N_2H_5^+) cation. The Fe atoms (site symmetry $\bar{1}$) are connected by pairs of sulfate groups into infinite chains that propagate in [100]. The intra-chain $\text{Fe}\cdots\text{Fe}$ separation in (I) is equal to the a unit-cell dimension, *i.e.* 5.3306 (3) Å. The two distinct Fe—O bond lengths in (I) are similar (Table 1) and do not show the gross differences seen in the chromium and zinc analogues.

**Figure 1**

The asymmetric unit of (I) expanded to show the iron coordination (50% displacement ellipsoids; arbitrary spheres for the H atoms). Symmetry codes: (i) $-x, -y, -z$; (ii) $x - 1, y, z$; (iii) $1 - x, -y, -z$.

The iron–sulfate chains in (I) are cross-linked by N–H···O hydrogen bonds (Table 2), resulting in the same hydrogen-bonding network seen in the other analogues noted above. A well defined trifurcated N2–H3C···(O,O,O) interaction occurs (mean bond angle about H3C = 107.3°).

Experimental

The reaction of hydrazine monohydrate (N₂H₄·H₂O; 0.50 g, 10 mmol) and ethyl bromoacetate (1.671 g, 10 mmol) in 5 ml of dry ethanol resulted in the formation of a white solid containing hydrazinium bromide and ethyl hydrazinoacetate, as reported earlier (Srinivasan *et al.*, 2006). This white solid (0.236 g) was dissolved in water (30 ml) and mixed with an aqueous solution (30 ml) of FeSO₄·7H₂O (0.278 g, 1 mmol) and a few drops of conc. H₂SO₄. The resulting clear solution, with a pH of 2, was concentrated over a water bath to 20 ml and kept for crystallization at room temperature. After three days, many block-shaped light-green crystals of (I) had formed. These were recovered by filtration, washed with cold water and dried in air.

Crystal data

[Fe(SO ₄) ₂ (N ₂ H ₅) ₂]	<i>V</i> = 219.41 (2) Å ³
<i>M_r</i> = 314.08	<i>Z</i> = 1
Triclinic, <i>P</i> 1̄	<i>D_x</i> = 2.377 Mg m ⁻³
<i>a</i> = 5.3306 (3) Å	Mo <i>K</i> α radiation
<i>b</i> = 5.8205 (3) Å	<i>μ</i> = 2.23 mm ⁻¹
<i>c</i> = 7.3835 (4) Å	<i>T</i> = 120 (2) K
<i>α</i> = 92.034 (3)°	Lath, pale green
<i>β</i> = 103.313 (3)°	0.05 × 0.02 × 0.01 mm
<i>γ</i> = 99.237 (3)°	

Data collection

Nonius KappaCCD diffractometer	3957 measured reflections
<i>ω</i> and <i>φ</i> scans	1004 independent reflections
Absorption correction: multi-scan (SADABS; Bruker, 2003)	911 reflections with <i>I</i> > 2σ(<i>I</i>)
<i>T_{min}</i> = 0.897, <i>T_{max}</i> = 0.978	<i>R_{int}</i> = 0.043
	<i>μ_{max}</i> = 28.0°

Refinement

Refinement on <i>F</i> ²	$w = 1/[\sigma^2(F_o^2) + (0.0127P)^2 + 0.6538P]$
$R[F^2 > 2\sigma(F^2)] = 0.032$	where $P = (F_o^2 + 2F_c^2)/3$
$wR(F^2) = 0.076$	(Δ/σ) _{max} < 0.001
<i>S</i> = 1.12	$\Delta\rho_{max} = 0.37 \text{ e } \text{Å}^{-3}$
1004 reflections	$\Delta\rho_{min} = -0.58 \text{ e } \text{Å}^{-3}$
90 parameters	
All H-atom parameters refined	

Table 1

Selected geometric parameters (Å, °).

Fe1–O1	2.109 (2)	Fe1–N1	2.184 (2)
Fe1–O2 ⁱ	2.147 (2)		
S1–O1–Fe1	142.94 (13)	S1–O2–Fe1 ⁱⁱ	128.85 (12)

Symmetry codes: (i) *x* – 1, *y*, *z*; (ii) *x* + 1, *y*, *z*.

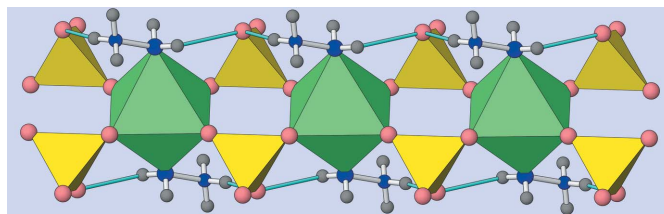


Figure 2

Polyhedral view of a fragment of the chain structure of (I). Colour key: Fe octahedra green, S tetrahedra yellow, O pink, N blue, H grey. The H···O portions of the hydrogen bonds are coloured light blue.

Table 2

Hydrogen-bond geometry (Å, °).

<i>D</i> –H··· <i>A</i>	<i>D</i> –H	H··· <i>A</i>	<i>D</i> ··· <i>A</i>	<i>D</i> –H··· <i>A</i>
N1–H1A···O3 ⁱⁱⁱ	0.82 (4)	2.37 (4)	3.070 (3)	143 (3)
N1–H1B···O4 ^{iv}	0.82 (4)	2.12 (4)	2.867 (3)	151 (4)
N2–H2A···O4 ⁱⁱⁱ	0.88 (4)	1.96 (4)	2.799 (3)	160 (4)
N2–H2B···O3	0.80 (4)	2.02 (4)	2.769 (4)	156 (4)
N2–H2C···O2 ^v	0.82 (4)	2.51 (4)	2.849 (3)	106 (3)
N2–H2C···O2 ^{iv}	0.82 (4)	2.32 (4)	3.011 (4)	141 (4)
N2–H2C···O1 ^{vi}	0.82 (4)	2.45 (4)	3.073 (3)	133 (4)

Symmetry codes: (iii) –*x* + 1, –*y*, –*z* + 1; (iv) *x* – 1, *y* – 1, *z*; (v) –*x* + 1, –*y*, –*z*; (vi) *x*, *y* – 1, *z*.

The H atoms were located in difference maps and their positions and *U*_{iso} values were freely refined.

Data collection: Collect (Nonius, 1998); cell refinement: *HKL SCALEPACK* (Otwinowski & Minor 1997); data reduction: *HKL DENZO* and *SCALEPACK* (Otwinowski & Minor 1997) & *SORTAV* (Blessing 1995); program(s) used to solve structure: *SHELXS97* (Sheldrick, 1997); program(s) used to refine structure: *SHELXL97* (Sheldrick, 1997); molecular graphics: *ORTEP-3* (Farrugia, 1997); software used to prepare material for publication: *SHELXL97*.

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