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## Structure Reports

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## (S)-Trichlormethiazide

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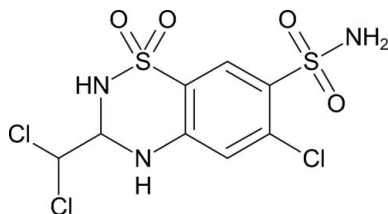
Received 9 July 2007; accepted 12 July 2007

Key indicators: single-crystal X-ray study;  $T = 150$  K; mean  $\sigma(\text{C}-\text{C}) = 0.004$  Å;  $R$  factor = 0.032;  $wR$  factor = 0.079; data-to-parameter ratio = 12.8.

In the title compound [systematic name: 6-chloro-3-(dichloromethyl)-3,4-dihydro-2*H*-1,2,4-benzothiadiazine-7-sulfonamide 1,1-dioxide],  $\text{C}_8\text{H}_8\text{Cl}_3\text{N}_3\text{O}_4\text{S}_2$ ,  $\text{N}-\text{H}\cdots\text{O}$  and  $\text{N}-\text{H}\cdots\text{N}$  interactions combine to create a three-dimensional hydrogen-bonded network.

## Related literature

For details on the experimental methods used to obtain this form, see: Florence *et al.* (2003, 2006). For crystal structures of polymorphs and solvates of the related thiazide compounds chlorothiazide and hydrochlorothiazide, see: Fernandes *et al.* (2007); Johnston *et al.* (2007). For related literature, see: Etter (1990).



## Experimental

## Crystal data

 $\text{C}_8\text{H}_8\text{Cl}_3\text{N}_3\text{O}_4\text{S}_2$  $M_r = 380.64$ Orthorhombic,  $P2_12_12_1$  $a = 8.7881$  (2) Å $b = 9.7924$  (2) Å $c = 15.8527$  (3) Å $V = 1364.23$  (5) Å<sup>3</sup> $Z = 4$ Mo  $K\alpha$  radiation $\mu = 0.99$  mm<sup>-1</sup> $T = 150$  (2) K $0.18 \times 0.09 \times 0.08$  mm

## Data collection

Oxford Diffraction Gemini diffractometer

Absorption correction: multi-scan (*CrysAlis RED*; Oxford

Diffraction, 2006)

 $T_{\min} = 0.930$ ,  $T_{\max} = 1.000$ 

(expected range = 0.859–0.924)

16293 measured reflections

2426 independent reflections  
2345 reflections with  $I > 2\sigma(I)$  $R_{\text{int}} = 0.030$ 

## Refinement

 $R[F^2 > 2\sigma(F^2)] = 0.032$  $wR(F^2) = 0.079$  $S = 1.06$ 

2426 reflections

190 parameters

2 restraints

H atoms treated by a mixture of independent and constrained refinement

 $\Delta\rho_{\text{max}} = 1.09$  e Å<sup>-3</sup> $\Delta\rho_{\text{min}} = -0.43$  e Å<sup>-3</sup>

Absolute structure: Flack (1983), with 1013 Friedel pairs

Flack parameter:  $-0.02$  (9)

Table 1

Hydrogen-bond geometry (Å, °).

$D-\text{H}\cdots A$	$D-\text{H}$	$\text{H}\cdots A$	$D\cdots A$	$D-\text{H}\cdots A$
$\text{N1}-\text{H3}\cdots\text{N3}^{\text{i}}$	0.88	2.30	3.127 (4)	156
$\text{N2}-\text{H5}\cdots\text{O4}^{\text{ii}}$	0.91 (4)	2.24 (4)	3.099 (4)	157 (3)
$\text{N3}-\text{H7}\cdots\text{O3}^{\text{iii}}$	0.88 (3)	2.24 (3)	2.899 (4)	132 (3)
$\text{N3}-\text{H8}\cdots\text{O1}^{\text{ii}}$	0.88 (3)	2.05 (3)	2.900 (4)	164 (3)

Symmetry codes: (i)  $-x + \frac{1}{2}, -y + 1, z + \frac{1}{2}$ ; (ii)  $x + \frac{1}{2}, -y + \frac{1}{2}, -z$ ; (iii)  $x + \frac{1}{2}, -y + \frac{3}{2}, -z$ .

Data collection: *CrysAlis CCD* (Oxford Diffraction, 2006); cell refinement: *CrysAlis RED* (Oxford Diffraction, 2006); data reduction: *CrysAlis RED*; program(s) used to solve structure: *SHELXS97* (Sheldrick, 1997); program(s) used to refine structure: *SHELXL97* (Sheldrick, 1997); molecular graphics: *PLATON* (Spek, 2003) and *ORTEP-3* (Farrugia, 1997); software used to prepare material for publication: *enCIFer* (Allen *et al.*, 2004) and *publCIF* (Westrip, 2007).

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Supplementary data and figures for this paper are available from the IUCr electronic archives (Reference: LH2457).

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**supplementary materials**

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## (S)-Trichlormethiazide

P. Fernandes, C. K. Leech, A. Johnston, K. Shankland, W. I. F. David, N. Shankland and A. J. Florence

### Comment

Trichlormethiazide (TCMT) is a thiazide diuretic used in the treatment of hypertension and here we report the single-crystal structure at 150 K (Fig. 1). This work forms part of a wider investigation that couples automated parallel crystallization (Florence *et al.*, 2006) with crystal structure prediction methodology to investigate the basic science underlying solid-state diversity in a range of thiazide diuretic compounds (Johnston *et al.*, 2007; Fernandes *et al.*, 2007).

Molecules crystallize in orthorhombic space group  $P2_12_12_1$  with one molecule in the asymmetric unit. One N—H $\cdots$ N and three N—H $\cdots$ O intermolecular interactions combine to create a three-dimensional hydrogen-bonded network. The N—H $\cdots$ N contact links molecules to form an infinite hydrogen bonded chain along [001]. Contacts N2—H5 $\cdots$ O4 and N3—H8 $\cdots$ O1 combine to form an  $R_2^2(16)$  (Etter, 1990) motif (Fig. 2) that stacks along the direction [100] with adjacent stacks connected *via* N3—H7 $\cdots$ O3.

### Experimental

The compound was sourced from Sigma-Aldrich and a single-crystal sample was recrystallized from a saturated acetonitrile solution by isothermal solvent evaporation at room temperature.

### Refinement

The positions of all the H atoms were obtained from the use of difference Fourier maps. In the final refinement, all H atoms were constrained to geometrically sensible positions with a riding model [C—H = 0.95–1.00Å and  $U_{\text{iso}}(\text{H}) = 1.2U_{\text{eq}}(\text{C})$ ], except for H5, which was allowed to refine freely, and H7 and H8, which were allowed to refine subject to a distance restraint [N—H = 0.88 (1)Å and  $U_{\text{iso}}(\text{H}) = 1.2U_{\text{eq}}(\text{N})$ ]. The highest density peak in the final difference Fourier is 1.07Å from atom Cl3.

### Figures

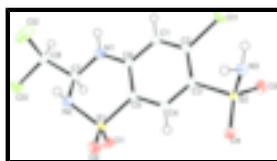


Fig. 1. The molecular structure showing 50% probability displacement ellipsoids.

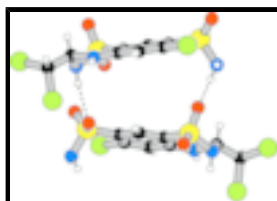


Fig. 2. The  $R_2^2(16)$  hydrogen-bond motif in the crystal structure. Hydrogen bonds are indicated by dashed lines.

## 6-chloro-3-(dichloromethyl)-3,4-dihydro-2H-1,2,4-benzothiadiazine-7-sulfonamide 1,1-dioxide

### Crystal data

$C_8H_8Cl_3N_3O_4S_2$	$F_{000} = 768$
$M_r = 380.64$	$D_x = 1.853 \text{ Mg m}^{-3}$
Orthorhombic, $P2_12_12_1$	Mo $K\alpha$ radiation
Hall symbol: P 2ac 2ab	$\lambda = 0.71073 \text{ \AA}$
$a = 8.7881 (2) \text{ \AA}$	Cell parameters from 10438 reflections
$b = 9.7924 (2) \text{ \AA}$	$\theta = 2.4\text{--}28.5^\circ$
$c = 15.8527 (3) \text{ \AA}$	$\mu = 0.99 \text{ mm}^{-1}$
$V = 1364.23 (5) \text{ \AA}^3$	$T = 150 (2) \text{ K}$
$Z = 4$	Block, colourless
	$0.18 \times 0.09 \times 0.08 \text{ mm}$

### Data collection

Oxford Diffraction Gemini diffractometer	2426 independent reflections
Radiation source: Enhance (Mo) X-ray Source	2345 reflections with $I > 2\sigma(I)$
Monochromator: graphite	$R_{\text{int}} = 0.030$
$T = 150(2) \text{ K}$	$\theta_{\text{max}} = 28.5^\circ$
$\omega$ and $\pi$ scans	$\theta_{\text{min}} = 2.4^\circ$
Absorption correction: multi-scan (CrysAlis RED; Oxford Diffraction, 2006)	$h = -11 \rightarrow 11$
$T_{\text{min}} = 0.930$ , $T_{\text{max}} = 1.000$	$k = -12 \rightarrow 12$
16293 measured reflections	$l = -20 \rightarrow 21$

### Refinement

Refinement on $F^2$	Hydrogen site location: difference Fourier map
Least-squares matrix: full	H atoms treated by a mixture of independent and constrained refinement
$R[F^2 > 2\sigma(F^2)] = 0.032$	$w = 1/[\sigma^2(F_o^2) + (0.0406P)^2 + 1.852P]$
$wR(F^2) = 0.079$	where $P = (F_o^2 + 2F_c^2)/3$
$S = 1.06$	$(\Delta/\sigma)_{\text{max}} < 0.001$
2426 reflections	$\Delta\rho_{\text{max}} = 1.09 \text{ e \AA}^{-3}$
190 parameters	$\Delta\rho_{\text{min}} = -0.43 \text{ e \AA}^{-3}$
2 restraints	Extinction correction: none
Primary atom site location: structure-invariant direct methods	Absolute structure: Flack (1983), 1013 Friedel pairs
Secondary atom site location: structure-invariant direct methods	Flack parameter: $-0.02 (9)$

*Special details*

**Geometry.** All e.s.d.'s (except the e.s.d. in the dihedral angle between two l.s. planes) are estimated using the full covariance matrix. The cell e.s.d.'s are taken into account individually in the estimation of e.s.d.'s in distances, angles and torsion angles; correlations between e.s.d.'s in cell parameters are only used when they are defined by crystal symmetry. An approximate (isotropic) treatment of cell e.s.d.'s is used for estimating e.s.d.'s involving l.s. planes.

**Refinement.** Refinement of  $F^2$  against ALL reflections. The weighted  $R$ -factor  $wR$  and goodness of fit  $S$  are based on  $F^2$ , conventional  $R$ -factors  $R$  are based on  $F$ , with  $F$  set to zero for negative  $F^2$ . The threshold expression of  $F^2 > 2\sigma(F^2)$  is used only for calculating  $R$ -factors(gt) *etc.* and is not relevant to the choice of reflections for refinement.  $R$ -factors based on  $F^2$  are statistically about twice as large as those based on  $F$ , and  $R$ -factors based on ALL data will be even larger.

*Fractional atomic coordinates and isotropic or equivalent isotropic displacement parameters ( $\text{\AA}^2$ )*

	<i>x</i>	<i>y</i>	<i>z</i>	$U_{\text{iso}}^*/U_{\text{eq}}$
S1	0.14654 (10)	0.06986 (8)	0.09856 (5)	0.01639 (18)
Cl1	0.16750 (10)	0.70063 (8)	0.14482 (5)	0.0227 (2)
S2	0.10072 (9)	0.57477 (8)	-0.04076 (5)	0.01492 (18)
Cl3	0.22251 (13)	-0.16217 (10)	0.34050 (6)	0.0351 (3)
Cl2	0.46909 (11)	0.03493 (14)	0.33187 (7)	0.0439 (3)
O3	-0.0121 (3)	0.6738 (2)	-0.02101 (14)	0.0219 (5)
O4	0.0781 (3)	0.4843 (2)	-0.11050 (14)	0.0208 (5)
O2	0.2201 (3)	0.0264 (2)	0.02376 (15)	0.0268 (6)
O1	-0.0074 (3)	0.0296 (3)	0.11374 (16)	0.0265 (6)
N3	0.2576 (3)	0.6584 (3)	-0.05901 (17)	0.0173 (6)
H7	0.276 (4)	0.716 (3)	-0.0177 (16)	0.021*
H8	0.339 (3)	0.608 (3)	-0.067 (2)	0.021*
C6	0.1876 (4)	0.3021 (3)	0.19017 (19)	0.0152 (7)
C5	0.1573 (4)	0.2474 (3)	0.1092 (2)	0.0154 (7)
C2	0.1626 (4)	0.5259 (3)	0.1290 (2)	0.0156 (7)
N1	0.2182 (4)	0.2223 (3)	0.25852 (17)	0.0199 (6)
H3	0.2533	0.2612	0.3047	0.024*
C3	0.1318 (4)	0.4710 (3)	0.0488 (2)	0.0147 (7)
C4	0.1312 (4)	0.3306 (3)	0.0401 (2)	0.0152 (6)
H2	0.1127	0.2909	-0.0137	0.018*
C7	0.1953 (4)	0.0768 (4)	0.25786 (19)	0.0180 (7)
H4	0.0835	0.0595	0.2626	0.022*
N2	0.2475 (4)	0.0172 (3)	0.17859 (17)	0.0195 (6)
H5	0.350 (5)	0.023 (4)	0.174 (2)	0.023*
C1	0.1896 (4)	0.4449 (3)	0.1979 (2)	0.0174 (7)
H1	0.2098	0.4857	0.2511	0.021*
C8	0.2723 (4)	0.0121 (4)	0.3342 (2)	0.0232 (8)
H6	0.2325	0.0585	0.3859	0.028*

*Atomic displacement parameters ( $\text{\AA}^2$ )*

$U^{11}$	$U^{22}$	$U^{33}$	$U^{12}$	$U^{13}$	$U^{23}$
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## supplementary materials

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S1	0.0245 (4)	0.0128 (4)	0.0119 (4)	-0.0004 (3)	-0.0028 (3)	-0.0011 (3)
Cl1	0.0364 (5)	0.0130 (4)	0.0188 (4)	-0.0022 (3)	0.0006 (4)	-0.0032 (3)
S2	0.0146 (4)	0.0154 (4)	0.0147 (4)	0.0011 (3)	-0.0014 (3)	0.0012 (3)
Cl3	0.0606 (7)	0.0201 (4)	0.0247 (5)	-0.0014 (4)	-0.0097 (5)	0.0023 (4)
Cl2	0.0219 (5)	0.0729 (8)	0.0369 (6)	-0.0006 (5)	-0.0066 (4)	0.0091 (5)
O3	0.0193 (12)	0.0203 (12)	0.0261 (13)	0.0043 (10)	-0.0020 (10)	0.0001 (10)
O4	0.0275 (13)	0.0194 (12)	0.0156 (12)	0.0013 (10)	-0.0049 (10)	0.0012 (10)
O2	0.0429 (15)	0.0216 (12)	0.0158 (12)	0.0063 (12)	-0.0006 (12)	-0.0049 (10)
O1	0.0265 (14)	0.0222 (13)	0.0309 (14)	-0.0077 (11)	-0.0065 (11)	0.0008 (11)
N3	0.0178 (15)	0.0175 (14)	0.0165 (14)	0.0002 (12)	0.0020 (12)	0.0003 (12)
C6	0.0165 (17)	0.0169 (16)	0.0121 (15)	-0.0005 (14)	0.0008 (12)	0.0008 (13)
C5	0.0173 (16)	0.0142 (16)	0.0147 (16)	-0.0031 (13)	0.0023 (13)	0.0003 (13)
C2	0.0146 (16)	0.0140 (15)	0.0183 (16)	-0.0022 (13)	0.0045 (13)	-0.0039 (13)
N1	0.0323 (16)	0.0167 (14)	0.0106 (13)	-0.0011 (13)	-0.0017 (12)	-0.0002 (11)
C3	0.0141 (16)	0.0154 (15)	0.0146 (16)	-0.0013 (13)	0.0009 (13)	0.0022 (13)
C4	0.0167 (16)	0.0168 (15)	0.0122 (14)	-0.0005 (13)	-0.0002 (13)	-0.0019 (14)
C7	0.0223 (16)	0.0184 (16)	0.0134 (15)	0.0004 (14)	0.0001 (13)	-0.0007 (14)
N2	0.0241 (16)	0.0206 (14)	0.0137 (14)	0.0017 (13)	-0.0006 (12)	0.0004 (11)
C1	0.0204 (17)	0.0178 (17)	0.0141 (15)	-0.0013 (14)	0.0005 (13)	-0.0030 (14)
C8	0.033 (2)	0.0216 (17)	0.0151 (17)	-0.0007 (16)	-0.0071 (16)	0.0023 (14)

### Geometric parameters ( $\text{\AA}$ , $^\circ$ )

S1—O2	1.416 (3)	C6—C5	1.416 (4)
S1—O1	1.429 (3)	C5—C4	1.385 (4)
S1—N2	1.632 (3)	C2—C1	1.371 (5)
S1—C5	1.749 (3)	C2—C3	1.406 (5)
Cl1—C2	1.730 (3)	N1—C7	1.439 (5)
S2—O3	1.422 (2)	N1—H3	0.8800
S2—O4	1.430 (2)	C3—C4	1.382 (4)
S2—N3	1.630 (3)	C4—H2	0.9500
S2—C3	1.767 (3)	C7—N2	1.460 (4)
Cl3—C8	1.765 (4)	C7—C8	1.525 (5)
Cl2—C8	1.744 (4)	C7—H4	1.0000
N3—H7	0.877 (10)	N2—H5	0.91 (4)
N3—H8	0.876 (10)	C1—H1	0.9500
C6—N1	1.362 (4)	C8—H6	1.0000
C6—C1	1.405 (5)		
O2—S1—O1	119.33 (17)	C7—N1—H3	118.9
O2—S1—N2	107.96 (15)	C4—C3—C2	118.1 (3)
O1—S1—N2	107.23 (16)	C4—C3—S2	119.4 (3)
O2—S1—C5	110.78 (15)	C2—C3—S2	122.4 (2)
O1—S1—C5	108.02 (15)	C3—C4—C5	120.3 (3)
N2—S1—C5	102.10 (16)	C3—C4—H2	119.8
O3—S2—O4	119.70 (14)	C5—C4—H2	119.8
O3—S2—N3	106.65 (15)	N1—C7—N2	111.0 (3)
O4—S2—N3	106.95 (15)	N1—C7—C8	110.1 (3)
O3—S2—C3	108.84 (15)	N2—C7—C8	112.2 (3)
O4—S2—C3	106.65 (14)	N1—C7—H4	107.8

N3—S2—C3	107.51 (14)	N2—C7—H4	107.8
S2—N3—H7	110 (3)	C8—C7—H4	107.8
S2—N3—H8	116 (3)	C7—N2—S1	111.9 (2)
H7—N3—H8	109 (4)	C7—N2—H5	111 (2)
N1—C6—C1	119.9 (3)	S1—N2—H5	117 (2)
N1—C6—C5	122.8 (3)	C2—C1—C6	120.3 (3)
C1—C6—C5	117.3 (3)	C2—C1—H1	119.9
C4—C5—C6	121.8 (3)	C6—C1—H1	119.9
C4—C5—S1	119.9 (2)	C7—C8—C12	111.7 (3)
C6—C5—S1	118.3 (2)	C7—C8—C13	109.7 (2)
C1—C2—C3	122.2 (3)	C12—C8—C13	111.8 (2)
C1—C2—C11	116.9 (2)	C7—C8—H6	107.8
C3—C2—C11	120.9 (3)	C12—C8—H6	107.8
C6—N1—C7	122.3 (3)	C13—C8—H6	107.8
C6—N1—H3	118.9		

*Hydrogen-bond geometry* ( $\text{\AA}$ ,  $^\circ$ )

<i>D</i> —H $\cdots$ <i>A</i>	<i>D</i> —H	H $\cdots$ <i>A</i>	<i>D</i> $\cdots$ <i>A</i>	<i>D</i> —H $\cdots$ <i>A</i>
N1—H3 $\cdots$ N3 <sup>i</sup>	0.88	2.30	3.127 (4)	156
N2—H5 $\cdots$ O4 <sup>ii</sup>	0.91 (4)	2.24 (4)	3.099 (4)	157 (3)
N3—H7 $\cdots$ O3 <sup>iii</sup>	0.88 (3)	2.24 (3)	2.899 (4)	132 (3)
N3—H8 $\cdots$ O1 <sup>ii</sup>	0.88 (3)	2.05 (3)	2.900 (4)	164 (3)

Symmetry codes: (i)  $-x+1/2, -y+1, z+1/2$ ; (ii)  $x+1/2, -y+1/2, -z$ ; (iii)  $x+1/2, -y+3/2, -z$ .

Fig. 1

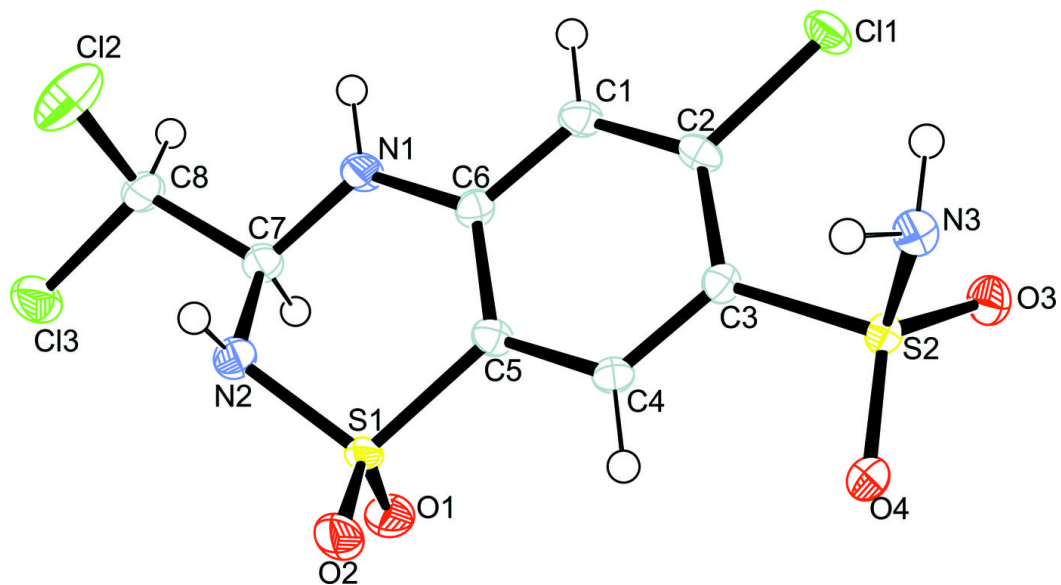




Fig. 2

