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Disodium dimanganese(II) trioxalate dihydrate

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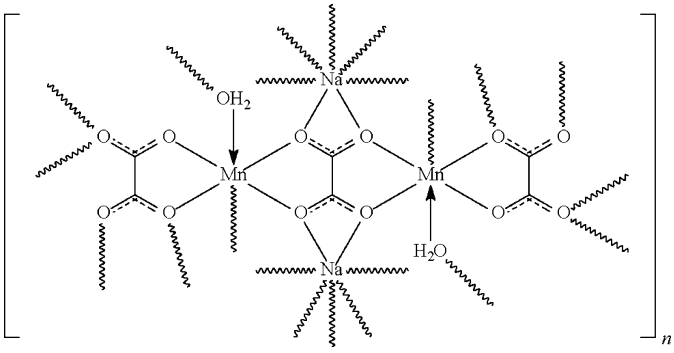
Key indicators: single-crystal X-ray study; T = 130 K; mean σ(C–C) = 0.003 Å; R factor = 0.024; wR factor = 0.054; data-to-parameter ratio = 13.2.

In the crystal structure of the title compound, poly[di-μ_2-aqua-di-μ_5-oxalato-μ_4-oxalato-disodiumdimanganese(II)], $[Na_2Mn_2(C_2O_4)_3(H_2O)_2]_n$, one of the oxalate ions lies on an inversion centre. The Mn atom is six-coordinate and Na is seven-coordinate; two of the oxalate ions bridge in a μ_5 mode and the third in a μ_4 mode. The Mn atoms are bridged into a ladder motif; neighbouring ladders are bridged by the water molecules and Na atoms into a three-dimensional network structure. Water–oxalate hydrogen bonds exist in the structure.

Related literature

For related literature on metal oxalates, see: Bataille & Louër (1999); Castillo *et al.* (2001); Moulton & Zaworotko (2001); Naumov *et al.* (1995); Price *et al.* (2000); Wu *et al.* (2005); Yaghi *et al.* (1996).



Experimental

Crystal data

$[Na_2Mn_2(C_2O_4)_3(H_2O)_2]$
M_r = 455.95
Monoclinic, $P2_1/c$
a = 5.937 (2) Å
b = 15.785 (6) Å
c = 7.167 (3) Å
β = 100.416 (4)°
V = 660.6 (4) Å^3
Z = 2
Mo $K\alpha$ radiation
μ = 2.06 mm^{-1}
T = 130 K
0.20 × 0.18 × 0.10 mm

Data collection

Rigaku Mercury70 diffractometer
Absorption correction: multi-scan (*CrystalClear*; Rigaku/MSC, 2000)
T_{min} = 0.684, T_{max} = 0.821
5047 measured reflections
1514 independent reflections
1415 reflections with $I > 2\sigma(I)$
R_{int} = 0.022

Refinement

$R[F^2 > 2\sigma(F^2)]$ = 0.024
$wR(F^2)$ = 0.054
S = 1.03
1514 reflections
115 parameters
2 restraints
H atoms treated by a mixture of independent and constrained refinement
$\Delta\rho_{max}$ = 0.48 e Å^{-3}
$\Delta\rho_{min}$ = −0.33 e Å^{-3}

Table 1
Hydrogen-bond geometry (Å, °).

D—H···A	D—H	H···A	D···A	D—H···A
O7—H7A···O2^{i}	0.887 (10)	1.833 (11)	2.6877 (19)	161 (2)
O7—H7B···O3^{ii}	0.889 (10)	1.947 (11)	2.8237 (19)	168 (2)

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

Data collection: *CrystalClear* (Rigaku/MSC, 2000); cell refinement: *CrystalClear*; data reduction: *CrystalClear*; program(s) used to solve structure: *SHELXS97* (Sheldrick, 1997*a*); program(s) used to refine structure: *SHELXL97* (Sheldrick, 1997*a*); molecular graphics: *SHELXTL* (Sheldrick, 1997*b*) and *DIAMOND* (Brandenburg, 2005); software used to prepare material for publication: *SHELXTL*.

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Supplementary data and figures for this paper are available from the IUCr electronic archives (Reference: NG2327).

References

Bataille, T. & Louër, D. (1999). *Acta Cryst.* C**55**, 1760–1762.
Brandenburg, K. (2005). *DIAMOND*. Version 3.0. Crystal Impact GbR, Bonn, Germany.
Castillo, O., Luque, A., Lloret, F. & Romàn, P. (2001). *Inorg. Chem. Commun.* **4**, 350–353.
Moulton, B. & Zaworotko, M. J. (2001). *Chem. Rev.* **101**, 1629–1658.
Naumov, D. Y., Virovets, A. V., Podberezskaya, N. V. & Boldyreva, E. V. (1995). *Acta Cryst.* C**51**, 60–62.
Price, D. J., Powell, A. K. & Wood, P. T. (2000). *J. Chem. Soc. Dalton Trans.* pp. 3566–3569.
Rigaku/MSC (2000). *CrystalClear*. Version 1.3. Rigaku Corporation, Tokyo, Japan, and MSC, The Woodlands, Texas, USA.
Sheldrick, G. M. (1997*a*). *SHELXS97* and *SHELXL97*. University of Göttingen, Germany.
Sheldrick, G. M. (1997*b*). *SHELXTL*. Version 5.10. Bruker AXS Inc., Madison, Wisconsin, USA.
Wu, W. Y., Song, Y., Li, Y. Z. & You, X. Z. (2005). *Inorg. Chem. Commun.* **8**, 732–736.
Yaghi, O. M., Davis, C. E., Li, G. M. & Li, H. (1996). *J. Am. Chem. Soc.* **119**, 9096–9101.

supplementary materials

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Disodium dimanganese(II) trioxalate dihydrate

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Comment

Carboxylate ligands have been extensively studied because of their versatile coordinating modes in the coordination chemistry (Moulton & Zaworotko, 2001; Yaghi *et al.*, 1996). Oxalate (ox) ligand is an important carboxylate ligand as it has a multiple coordinating modes, which together with the varied coordination geometry of metal ions has led to the generation of products containing one-dimensional chains, two-dimensional layers and three-dimensional frameworks (Castillo *et al.*, 2005; Naumov *et al.*, 1995; Bataille & Louër, 1999). The hydrothermal reaction of $MnCl_2$ with Na_2(ox) and oxalic acid yields the title complex, (I). We present its structure here.

The asymmetric unit of (I) consists of one manganese(II) ion, one sodium(I) ion, one and half ox dianions, and one coordinated water molecule. As depicted in Fig. 1, the Mn atom is six-coordinated by four oxygen atoms from three dianionic ox ligands in a distorted square planar geometry, and two oxygen atoms from water molecule and ox ligand in the apical positions. The bond dimensions involving Mn are normal (Table 1), and are comparable to the values in related manganese (II) complexes (Wu *et al.*, 2005). The Na atom is seven-coordinated by seven O atom from four dianionic ox ligands, and one water molecule with the Na—O bond lengths varying from 2.302 (2)–2.712 (2) Å, which are comparable to the values in the $[Na_2Co_2(ox)_3(H_2O)_2]_n$ compound (Price *et al.*, 2000).

It is interesting that the coordinated water molecule displays a μ_2 coordinating mode bridgeing the Mn1 and Na1 atoms, which further bridge by a $\mu_2$carboxlate O atom to form a 4-membered $NaMnO_2$ ring with a Na···Mn separation of 3.55 Å (Fig. 1). Two types of ox ligands are observed in this structure. One is located on an inversion centre with a coplanar conformation and bridgs two Mn atoms and two Na atoms, in which each O atom is exhibits a μ_2 coordinating fashion. The other displays a nonplanar conformation with the two carboxylate groups twisted with a dihedral angle of 19.8 (5) °. It bridgs two Mn atoms and three Na atoms using its two mondentate O atoms, one μ_2-O atom and one μ_3-O atom. The Mn ions are linked by the ox lignads to form a one-dimensional ladder structure propagating along *a* axis, as shown in Fig.2. The ladder is repeated by translation about every 5.9 Å along the a direction, comparable to the length of the *a* axis. The ladders are further connected by the Na ions and water molecules through the Na—O bonds to produce a three-dimensional structure, as shown in Fig. 3. The O—H···O hydrogen bonds between the water molecules and oxalate O atoms are observed in the three-dimensional structure with a O···O distances of 2.688 (2) and 2.824 (2) Å, respectively (Table 2).

Experimental

The title compound was synthesized by a hydrothermal method under autogenous pressure. A mixture of $MnCl_2{\cdot}4H_2O$ (0.269 g,1 mmol), $Na_2C_2O_4$ (0.268 g, 2 mmol), $H_2C_2O_4$ (0.180 g, 2 mmol), and 15 ml distilled water was stirred under ambient conditions. The final mixture was sealed in a 25 ml Teflon-lined steel autoclave and heated at 423 K for 3 days, and then cooled to room temperature. Colorless prism crystals of (I) were obtained, and these were recovered by filtration, washed with distilled water and dried in air (yield 32%). Analysis calculated for $C_6H_4O_{14}Mn_2Na_2$: C 15.81, H 0.88%; found: C 15.92, H 0.90%.

Refinement

The H atoms bonded to O atoms were visible in difference maps and refined with a *DFIX* restraint (*SHELXTL*; Sheldrick, 1997*b*) of O—H = 0.90 Å and with U_{iso}(H) = 1.5U_{eq}(O).

Figures

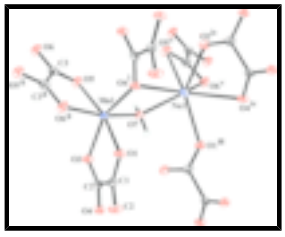

Fig. 1. *ORTEP* drawing of the title compound. Thermal ellipsoids are drawn at the 60% probability level and H atoms are shown as small spheres of arbitrary radii. [Symmetry codes: (i) $x+1, y, z$; (ii) $-x+2, -y+1, -z+2$; (iii) $x, -y+1/2, z-1/2$; (iv) $x+1, -y+1/2, z-1/2$; (v) $-x+2, -y+1, -z+1$.]

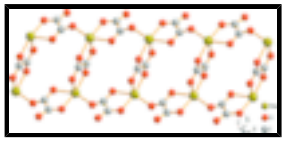

Fig. 2. A view of the one-dimensional $Mn_2(ox)_3$ ladder-like structure.

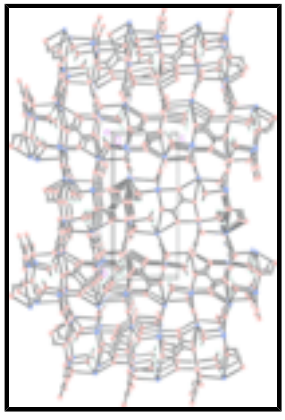

Fig. 3. A perspective view of the three-dimensional structure of (I) (viewed down the *a* axis).

poly[di-μ$_2$-aqua-di-μ$_5$-oxalato-μ$_4$-oxalato-disodiumdimanganese(II)],

Crystal data

$[Na_2Mn_2(C_2O_4)_3(H_2O)_2]$	F_{000} = 448
M_r = 455.95	D_x = 2.292 Mg m^{-3}
Monoclinic, $P2_1/c$	Mo $K\alpha$ radiation λ = 0.71073 Å
Hall symbol: -P 2ybc	Cell parameters from 2218 reflections
a = 5.937 (2) Å	θ = 2.6–27.5º
b = 15.785 (6) Å	μ = 2.06 mm^{-1}
c = 7.167 (3) Å	T = 130 K
β = 100.416 (4)º	Prism, white
V = 660.6 (4) Å^3	0.20 × 0.18 × 0.10 mm
Z = 2	

Data collection

Rigaku Mercury70 diffractometer	R_{int} = 0.022
Radiation source: fine-focus sealed tube	θ_{max} = 27.5º
Monochromator: graphite	θ_{min} = 2.6º
T = 130 K	h = −7→7
ω scans	k = −20→17
Absorption correction: multi-scan (CrystalClear; Rigaku/MSC, 2000)	l = −9→7
T_{min} = 0.684, T_{max} = 0.821	Standard reflections: .;
5047 measured reflections	every . reflections
1514 independent reflections	intensity decay: .
1415 reflections with $I > 2\sigma(I)$	

Refinement

Refinement on F^2	Secondary atom site location: difference Fourier map
Least-squares matrix: full	Hydrogen site location: inferred from neighbouring sites
$R[F^2 > 2\sigma(F^2)]$ = 0.024	H atoms treated by a mixture of independent and constrained refinement
$wR(F^2)$ = 0.054	$w = 1/[\sigma^2(F_o^2) + (0.0234P)^2 + 0.5936P]$ where $P = (F_o^2 + 2F_c^2)/3$
S = 1.03	$(\Delta/\sigma)_{max}$ = 0.001
1514 reflections	$\Delta\rho_{max}$ = 0.48 e Å^{-3}
115 parameters	$\Delta\rho_{min}$ = −0.33 e Å^{-3}
2 restraints	Extinction correction: none
Primary atom site location: structure-invariant direct methods	

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 $F^2 > 2\text{sigma}(F^2)$ 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 (Å^2)

	x	*y*	*z*	U_{iso}*/U_{eq}
Na1	0.96700 (12)	0.32021 (4)	0.29951 (10)	0.01170 (16)

Mn1	0.77063 (4)	0.396970 (16)	0.70734 (4)	0.00868 (9)
O1	0.6514 (2)	0.27044 (7)	0.73592 (18)	0.0122 (3)
O2	0.3505 (2)	0.19589 (8)	0.7916 (2)	0.0153 (3)
O3	0.3964 (2)	0.41196 (8)	0.71439 (18)	0.0121 (3)
O4	0.0795 (2)	0.33091 (8)	0.66136 (18)	0.0126 (3)
O5	0.8909 (2)	0.52445 (8)	0.76226 (18)	0.0128 (3)
O6	1.0935 (2)	0.60435 (8)	0.98897 (19)	0.0140 (3)
O7	0.6836 (2)	0.41824 (8)	0.40310 (18)	0.0111 (3)
H7A	0.556 (3)	0.3905 (12)	0.357 (3)	0.017*
H7B	0.676 (4)	0.4710 (8)	0.359 (3)	0.017*
C1	0.4430 (3)	0.26164 (11)	0.7476 (2)	0.0101 (3)
C2	0.2918 (3)	0.34261 (11)	0.7036 (2)	0.0095 (3)
C3	0.9948 (3)	0.53706 (11)	0.9280 (3)	0.0106 (3)

Atomic displacement parameters (Å^2)

	U^{11}	U^{22}	U^{33}	U^{12}	U^{13}	U^{23}
Na1	0.0084 (3)	0.0128 (3)	0.0139 (3)	−0.0002 (3)	0.0021 (3)	0.0015 (3)
Mn1	0.00639 (14)	0.00773 (14)	0.01170 (14)	−0.00048 (9)	0.00103 (10)	−0.00016 (10)
O1	0.0066 (6)	0.0100 (6)	0.0203 (6)	−0.0002 (5)	0.0029 (5)	0.0017 (5)
O2	0.0094 (6)	0.0102 (6)	0.0262 (7)	−0.0014 (5)	0.0029 (5)	0.0042 (5)
O3	0.0088 (6)	0.0099 (6)	0.0177 (7)	0.0003 (5)	0.0024 (5)	0.0010 (5)
O4	0.0060 (6)	0.0142 (6)	0.0172 (6)	0.0008 (5)	0.0014 (5)	−0.0007 (5)
O5	0.0151 (7)	0.0101 (6)	0.0124 (6)	−0.0015 (5)	0.0000 (5)	0.0013 (5)
O6	0.0187 (7)	0.0098 (6)	0.0128 (6)	−0.0045 (5)	0.0008 (5)	0.0009 (5)
O7	0.0092 (6)	0.0096 (6)	0.0138 (6)	−0.0012 (5)	0.0001 (5)	0.0009 (5)
C1	0.0091 (8)	0.0091 (8)	0.0119 (8)	−0.0004 (6)	0.0010 (7)	−0.0007 (6)
C2	0.0082 (8)	0.0121 (8)	0.0087 (8)	0.0010 (6)	0.0026 (6)	−0.0002 (6)
C3	0.0094 (8)	0.0095 (8)	0.0132 (8)	0.0000 (6)	0.0030 (7)	0.0010 (7)

Geometric parameters (Å, °)

Na1—O2^{i}	2.3021 (17)	O2—Na1^{vii}	2.3021 (17)
Na1—O1^{ii}	2.3359 (15)	O3—C2	1.254 (2)
Na1—O6^{iii}	2.3565 (16)	O4—C2	1.256 (2)
Na1—O7	2.4958 (16)	O4—Mn1^{viii}	2.1856 (14)
Na1—O4^{iv}	2.5638 (17)	O4—Na1^{viii}	2.5638 (17)
Na1—O5^{iii}	2.6561 (16)	O4—Na1^{vii}	2.7121 (16)
Na1—O4^{i}	2.7121 (16)	O5—C3	1.251 (2)
Na1—C3^{iii}	2.814 (2)	O5—Na1^{iii}	2.6561 (16)
Mn1—O1	2.1411 (14)	O6—C3	1.253 (2)
Mn1—O5	2.1477 (14)	O6—Mn1^{v}	2.1803 (15)
Mn1—O7	2.1740 (15)	O6—Na1^{iii}	2.3565 (16)
Mn1—O6^{v}	2.1803 (15)	O7—H7B	0.889 (10)
Mn1—O4^{iv}	2.1856 (14)	O7—H7A	0.887 (10)
Mn1—O3	2.2444 (15)	C1—C2	1.561 (2)

O1—C1	1.263 (2)	C3—C3^{v}	1.554 (3)
O1—Na1^{vi}	2.3359 (15)	C3—Na1^{iii}	2.814 (2)
O2—C1	1.241 (2)		
O2^{i}—Na1—O1^{ii}	133.60 (6)	C1—O1—Mn1	116.98 (11)
O2^{i}—Na1—O6^{iii}	91.64 (5)	C1—O1—Na1^{vi}	132.89 (11)
O1^{ii}—Na1—O6^{iii}	98.56 (5)	Mn1—O1—Na1^{vi}	108.83 (6)
O2^{i}—Na1—O7	143.02 (5)	C1—O2—Na1^{vii}	125.70 (12)
O1^{ii}—Na1—O7	82.97 (5)	C2—O3—Mn1	112.82 (11)
O6^{iii}—Na1—O7	86.77 (5)	C2—O4—Mn1^{viii}	136.59 (12)
O2^{i}—Na1—O4^{iv}	87.38 (5)	C2—O4—Na1^{viii}	108.68 (11)
O1^{ii}—Na1—O4^{iv}	106.90 (5)	Mn1^{viii}—O4—Na1^{viii}	96.42 (5)
O6^{iii}—Na1—O4^{iv}	145.55 (5)	C2—O4—Na1^{vii}	110.12 (11)
O7—Na1—O4^{iv}	74.01 (5)	Mn1^{viii}—O4—Na1^{vii}	95.50 (5)
O2^{i}—Na1—O5^{iii}	75.66 (5)	Na1^{viii}—O4—Na1^{vii}	105.96 (5)
O1^{ii}—Na1—O5^{iii}	143.19 (5)	C3—O5—Mn1	114.42 (11)
O6^{iii}—Na1—O5^{iii}	52.40 (4)	C3—O5—Na1^{iii}	83.95 (10)
O7—Na1—O5^{iii}	74.26 (5)	Mn1—O5—Na1^{iii}	159.97 (6)
O4^{iv}—Na1—O5^{iii}	94.32 (4)	C3—O6—Mn1^{v}	113.92 (11)
O2^{i}—Na1—O4^{i}	65.42 (4)	C3—O6—Na1^{iii}	97.75 (11)
O1^{ii}—Na1—O4^{i}	68.39 (5)	Mn1^{v}—O6—Na1^{iii}	148.30 (6)
O6^{iii}—Na1—O4^{i}	97.62 (5)	Mn1—O7—Na1	98.73 (5)
O7—Na1—O4^{i}	151.36 (5)	Mn1—O7—H7B	119.2 (15)
O4^{iv}—Na1—O4^{i}	113.01 (4)	Na1—O7—H7B	118.0 (15)
O5^{iii}—Na1—O4^{i}	130.13 (5)	Mn1—O7—H7A	109.3 (15)
O1—Mn1—O5	163.98 (5)	Na1—O7—H7A	99.2 (15)
O1—Mn1—O7	102.55 (5)	H7B—O7—H7A	110 (2)
O5—Mn1—O7	92.86 (5)	O2—C1—O1	126.34 (16)
O1—Mn1—O6^{v}	87.97 (5)	O2—C1—C2	118.12 (16)
O5—Mn1—O6^{v}	77.01 (5)	O1—C1—C2	115.54 (15)
O7—Mn1—O6^{v}	168.70 (5)	O3—C2—O4	127.40 (16)
O1—Mn1—O4^{iv}	82.54 (5)	O3—C2—C1	116.24 (15)
O5—Mn1—O4^{iv}	102.38 (5)	O4—C2—C1	116.36 (15)
O7—Mn1—O4^{iv}	88.64 (5)	O5—C3—O6	125.80 (16)
O6^{v}—Mn1—O4^{iv}	88.67 (5)	O5—C3—C3^{v}	117.67 (19)
O1—Mn1—O3	75.55 (5)	O6—C3—C3^{v}	116.52 (19)
O5—Mn1—O3	101.24 (5)	O5—C3—Na1^{iii}	69.81 (10)
O7—Mn1—O3	87.11 (5)	O6—C3—Na1^{iii}	56.07 (9)
O6^{v}—Mn1—O3	99.66 (5)	C3^{v}—C3—Na1^{iii}	171.83 (16)
O4^{iv}—Mn1—O3	156.18 (5)		
O2^{i}—Na1—Mn1—O1	−109.75 (6)	O6^{v}—Mn1—O1—C1	98.97 (13)
O1^{ii}—Na1—Mn1—O1	34.66 (4)	O4^{iv}—Mn1—O1—C1	−172.11 (13)

O6^{iii}—Na1—Mn1—O1	134.71 (6)	O3—Mn1—O1—C1	−1.55 (12)
O7—Na1—Mn1—O1	113.12 (6)	Na1—Mn1—O1—C1	−126.08 (12)
O4^{iv}—Na1—Mn1—O1	−83.84 (6)	Na1^{vi}—Mn1—O1—C1	168.66 (16)
O5^{iii}—Na1—Mn1—O1	177.87 (5)	O5—Mn1—O1—Na1^{vi}	−89.89 (18)
O4^{i}—Na1—Mn1—O1	−22.03 (6)	O7—Mn1—O1—Na1^{vi}	106.15 (6)
C3^{iii}—Na1—Mn1—O1	157.62 (5)	O6^{v}—Mn1—O1—Na1^{vi}	−69.69 (6)
Mn1^{ii}—Na1—Mn1—O1	6.34 (4)	O4^{iv}—Mn1—O1—Na1^{vi}	19.23 (6)
Na1^{ii}—Na1—Mn1—O1	38.17 (7)	O3—Mn1—O1—Na1^{vi}	−170.21 (7)
Na1^{vi}—Na1—Mn1—O1	−35.49 (4)	Na1—Mn1—O1—Na1^{vi}	65.25 (5)
O2^{i}—Na1—Mn1—O5	63.21 (6)	O1—Mn1—O3—C2	−9.55 (11)
O1^{ii}—Na1—Mn1—O5	−152.38 (5)	O5—Mn1—O3—C2	−173.45 (12)
O6^{iii}—Na1—Mn1—O5	−52.33 (6)	O7—Mn1—O3—C2	94.20 (12)
O7—Na1—Mn1—O5	−73.92 (6)	O6^{v}—Mn1—O3—C2	−94.91 (12)
O4^{iv}—Na1—Mn1—O5	89.12 (6)	O4^{iv}—Mn1—O3—C2	14.2 (2)
O5^{iii}—Na1—Mn1—O5	−9.17 (7)	Na1—Mn1—O3—C2	65.79 (12)
O4^{i}—Na1—Mn1—O5	150.93 (6)	Na1^{vi}—Mn1—O3—C2	−15.96 (12)
C3^{iii}—Na1—Mn1—O5	−29.42 (6)	O1—Mn1—O5—C3	26.3 (3)
Mn1^{ii}—Na1—Mn1—O5	179.31 (4)	O7—Mn1—O5—C3	−169.35 (12)
Na1^{ii}—Na1—Mn1—O5	−148.87 (7)	O6^{v}—Mn1—O5—C3	5.57 (12)
Na1^{vi}—Na1—Mn1—O5	137.47 (4)	O4^{iv}—Mn1—O5—C3	−80.12 (13)
O2^{i}—Na1—Mn1—O7	137.13 (7)	O3—Mn1—O5—C3	103.03 (13)
O1^{ii}—Na1—Mn1—O7	−78.46 (6)	Na1—Mn1—O5—C3	−127.40 (12)
O6^{iii}—Na1—Mn1—O7	21.58 (6)	Na1^{vi}—Mn1—O5—C3	−43.73 (15)
O4^{iv}—Na1—Mn1—O7	163.03 (7)	O1—Mn1—O5—Na1^{iii}	−178.56 (14)
O5^{iii}—Na1—Mn1—O7	64.74 (6)	O7—Mn1—O5—Na1^{iii}	−14.22 (19)
O4^{i}—Na1—Mn1—O7	−135.15 (8)	O6^{v}—Mn1—O5—Na1^{iii}	160.70 (19)
C3^{iii}—Na1—Mn1—O7	44.50 (6)	O4^{iv}—Mn1—O5—Na1^{iii}	75.01 (19)
Mn1^{ii}—Na1—Mn1—O7	−106.78 (6)	O3—Mn1—O5—Na1^{iii}	−101.84 (18)
Na1^{ii}—Na1—Mn1—O7	−74.95 (8)	Na1—Mn1—O5—Na1^{iii}	27.73 (19)
Na1^{vi}—Na1—Mn1—O7	−148.61 (5)	Na1^{vi}—Mn1—O5—Na1^{iii}	111.40 (17)
O2^{i}—Na1—Mn1—O6^{v}	−26.93 (7)	O1—Mn1—O7—Na1	−69.96 (6)
O1^{ii}—Na1—Mn1—O6^{v}	117.49 (6)	O5—Mn1—O7—Na1	114.42 (6)
O6^{iii}—Na1—Mn1—O6^{v}	−142.47 (8)	O6^{v}—Mn1—O7—Na1	88.3 (3)
O7—Na1—Mn1—O6^{v}	−164.05 (7)	O4^{iv}—Mn1—O7—Na1	12.09 (5)
O4^{iv}—Na1—Mn1—O6^{v}	−1.02 (7)	O3—Mn1—O7—Na1	−144.46 (5)
O5^{iii}—Na1—Mn1—O6^{v}	−99.31 (6)	Na1^{vi}—Mn1—O7—Na1	−31.69 (5)
O4^{i}—Na1—Mn1—O6^{v}	60.79 (7)	O2^{i}—Na1—O7—Mn1	−73.35 (10)
C3^{iii}—Na1—Mn1—O6^{v}	−119.56 (6)	O1^{ii}—Na1—O7—Mn1	99.18 (5)
Mn1^{ii}—Na1—Mn1—O6^{v}	89.17 (6)	O6^{iii}—Na1—O7—Mn1	−161.78 (5)
Na1^{ii}—Na1—Mn1—O6^{v}	121.00 (7)	O4^{iv}—Na1—O7—Mn1	−10.70 (4)
Na1^{vi}—Na1—Mn1—O6^{v}	47.34 (5)	O5^{iii}—Na1—O7—Mn1	−110.03 (5)

O2^{i}—Na1—Mn1—O4^{iv}	−25.91 (6)	O4^{i}—Na1—O7—Mn1	98.19 (10)
O1^{ii}—Na1—Mn1—O4^{iv}	118.50 (6)	C3^{iii}—Na1—O7—Mn1	−136.63 (6)
O6^{iii}—Na1—Mn1—O4^{iv}	−141.45 (7)	Mn1^{ii}—Na1—O7—Mn1	88.85 (5)
O7—Na1—Mn1—O4^{iv}	−163.03 (7)	Na1^{ii}—Na1—O7—Mn1	150.99 (4)
O5^{iii}—Na1—Mn1—O4^{iv}	−98.29 (6)	Na1^{vi}—Na1—O7—Mn1	25.32 (4)
O4^{i}—Na1—Mn1—O4^{iv}	61.81 (6)	Na1^{vii}—O2—C1—O1	−177.19 (13)
C3^{iii}—Na1—Mn1—O4^{iv}	−118.54 (6)	Na1^{vii}—O2—C1—C2	3.4 (2)
Mn1^{ii}—Na1—Mn1—O4^{iv}	90.19 (5)	Mn1—O1—C1—O2	−168.96 (14)
Na1^{ii}—Na1—Mn1—O4^{iv}	122.01 (9)	Na1^{vi}—O1—C1—O2	−3.7 (3)
Na1^{vi}—Na1—Mn1—O4^{iv}	48.36 (5)	Mn1—O1—C1—C2	10.45 (19)
O2^{i}—Na1—Mn1—O3	−179.73 (6)	Na1^{vi}—O1—C1—C2	175.74 (11)
O1^{ii}—Na1—Mn1—O3	−35.32 (5)	Mn1—O3—C2—O4	−162.51 (15)
O6^{iii}—Na1—Mn1—O3	64.72 (6)	Mn1—O3—C2—C1	17.43 (18)
O7—Na1—Mn1—O3	43.14 (6)	Mn1^{viii}—O4—C2—O3	−34.9 (3)
O4^{iv}—Na1—Mn1—O3	−153.83 (6)	Na1^{viii}—O4—C2—O3	87.01 (19)
O5^{iii}—Na1—Mn1—O3	107.88 (5)	Na1^{vii}—O4—C2—O3	−157.33 (15)
O4^{i}—Na1—Mn1—O3	−92.01 (6)	Mn1^{viii}—O4—C2—C1	145.13 (13)
C3^{iii}—Na1—Mn1—O3	87.64 (6)	Na1^{viii}—O4—C2—C1	−92.93 (14)
Mn1^{ii}—Na1—Mn1—O3	−63.64 (4)	Na1^{vii}—O4—C2—C1	22.73 (17)
Na1^{ii}—Na1—Mn1—O3	−31.81 (8)	O2—C1—C2—O3	159.90 (16)
Na1^{vi}—Na1—Mn1—O3	−105.47 (4)	O1—C1—C2—O3	−19.6 (2)
O2^{i}—Na1—Mn1—Na1^{vi}	−74.26 (5)	O2—C1—C2—O4	−20.2 (2)
O1^{ii}—Na1—Mn1—Na1^{vi}	70.15 (4)	O1—C1—C2—O4	160.39 (15)
O6^{iii}—Na1—Mn1—Na1^{vi}	170.19 (4)	Mn1—O5—C3—O6	174.76 (15)
O7—Na1—Mn1—Na1^{vi}	148.61 (5)	Na1^{iii}—O5—C3—O6	3.09 (18)
O4^{iv}—Na1—Mn1—Na1^{vi}	−48.36 (5)	Mn1—O5—C3—C3^{v}	−4.7 (2)
O5^{iii}—Na1—Mn1—Na1^{vi}	−146.65 (3)	Na1^{iii}—O5—C3—C3^{v}	−176.4 (2)
O4^{i}—Na1—Mn1—Na1^{vi}	13.46 (6)	Mn1—O5—C3—Na1^{iii}	171.67 (9)
C3^{iii}—Na1—Mn1—Na1^{vi}	−166.89 (4)	Mn1^{v}—O6—C3—O5	175.21 (15)
Mn1^{ii}—Na1—Mn1—Na1^{vi}	41.83 (3)	Na1^{iii}—O6—C3—O5	−3.5 (2)
Na1^{ii}—Na1—Mn1—Na1^{vi}	73.66 (7)	Mn1^{v}—O6—C3—C3^{v}	−5.3 (2)
O5—Mn1—O1—C1	78.8 (2)	Na1^{iii}—O6—C3—C3^{v}	176.00 (18)
O7—Mn1—O1—C1	−85.19 (13)	Mn1^{v}—O6—C3—Na1^{iii}	178.71 (12)

Symmetry codes: (i) *x*+1, −*y*+1/2, *z*−1/2; (ii) *x*, −*y*+1/2, *z*−1/2; (iii) −*x*+2, −*y*+1, −*z*+1; (iv) *x*+1, *y*, *z*; (v) −*x*+2, −*y*+1, −*z*+2; (vi) *x*, −*y*+1/2, *z*+1/2; (vii) *x*−1, −*y*+1/2, *z*+1/2; (viii) *x*−1, *y*, *z*.

Hydrogen-bond geometry (Å, °)

D—H···*A*	*D*—H	H···*A*	*D*···*A*	*D*—H···*A*
O7—H7A···O2^{ii}	0.887 (10)	1.833 (11)	2.6877 (19)	161 (2)
O7—H7B···O3^{ix}	0.889 (10)	1.947 (11)	2.8237 (19)	168 (2)

Symmetry codes: (ii) *x*, −*y*+1/2, *z*−1/2; (ix) −*x*+1, −*y*+1, −*z*+1.

Fig. 1

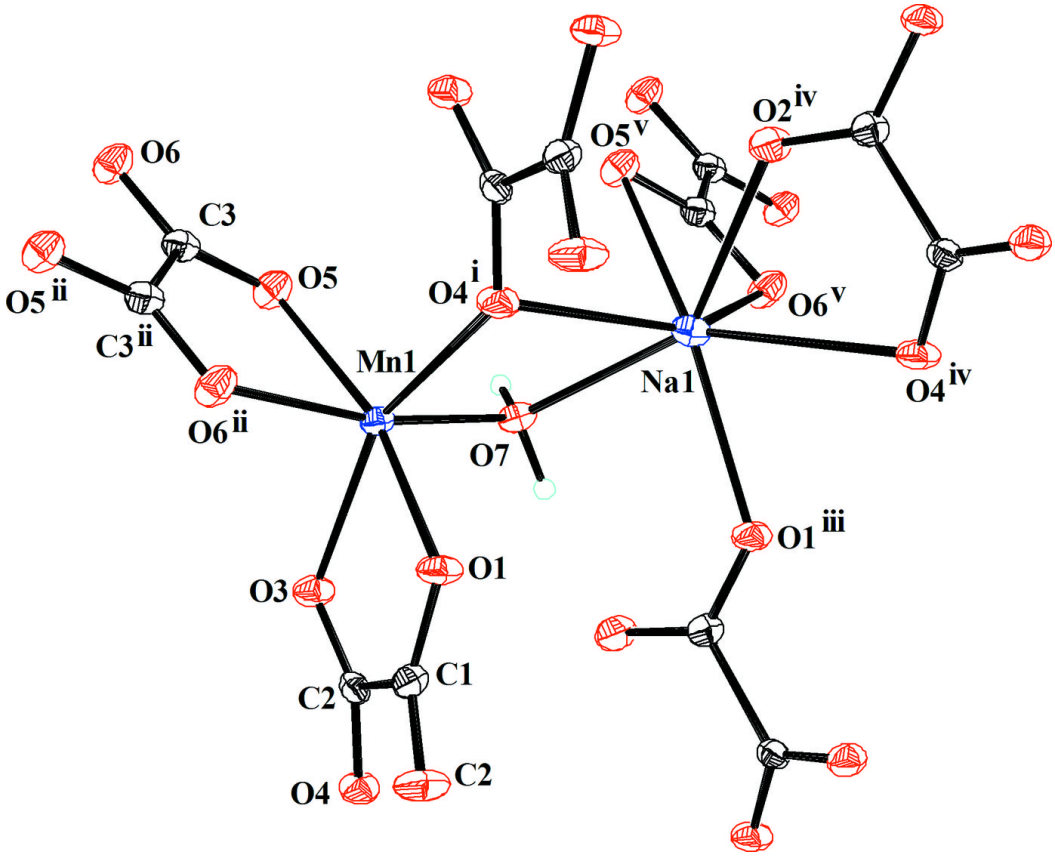
O6
C3
O5
O5 ii
C3 ii
O6 ii
Mn1
O4 i
O5 v
O2 iv
O6 v
Na1
O4 iv
O7
O1 iii
O1
O3
C1
C2
O4
C2

Fig. 2

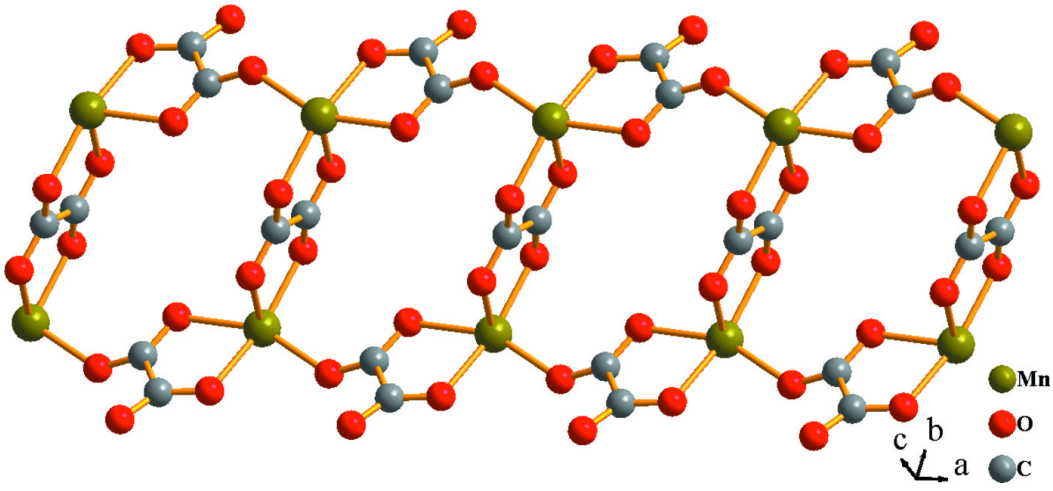

Fig. 3