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# 8-Hydroxy-2-methylquinolinium tetrachlorido(quinolin-2-olato-$\kappa^2N,O$)-stannate(IV) methanol disolvate

**Ezzatollah Najafi,[a] Mostafa M. Amini[a] and Seik Weng Ng[b]***

[a]Department of Chemistry, General Campus, Shahid Beheshti University, Tehran 1983963113, Iran, and [b]Department of Chemistry, University of Malaya, 50603 Kuala Lumpur, Malaysia
Correspondence e-mail: seikweng@um.edu.my

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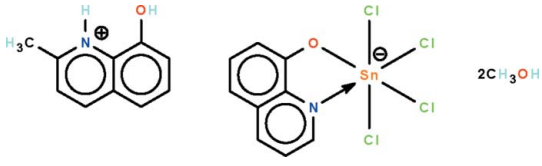
Key indicators: single-crystal X-ray study; $T$ = 100 K; mean $\sigma$(C–C) = 0.007 Å; $R$ factor = 0.049; $wR$ factor = 0.130; data-to-parameter ratio = 18.2.

In the reaction of 8-hydroxyquinoline, 2-methyl-8-hydroxyquinoline and stannic chloride, the 2-methyl-8-hydroxyquinoline is protonated, yielding the disolvated title salt, $(C_{10}H_{10}NO)[SnCl_4(C_9H_6NO)]\cdot 2CH_3OH$. The $Sn^{IV}$ atom in the anion is *N*,*O*-chelated by the hydroxyquinolinate in a *cis*-$SnNOCl_4$ octahedral geometry. In the crystal, the cation, anion and solvent molecules are linked by N—H···O, O—H···O and O—H···Cl hydrogen bonds, generating a three-dimensional network.

## Related literature

For related tin–oxinate structures, see: Archer *et al.* (1987); Fazaeli *et al.* (2009); Lo & Ng (2009).



## Experimental

### Crystal data

$(C_{10}H_{10}NO)[SnCl_4(C_9H_6NO)]\cdot 2CH_4O$
$M_r$ = 628.91
Triclinic, $P\overline{1}$
$a$ = 7.9395 (3) Å
$b$ = 9.9721 (4) Å
$c$ = 16.0531 (8) Å
$\alpha$ = 75.056 (4)°
$\beta$ = 82.529 (4)°
$\gamma$ = 88.529 (3)°
$V$ = 1217.53 (9) Å$^3$
$Z$ = 2
Mo $K\alpha$ radiation
$\mu$ = 1.52 mm$^{-1}$
$T$ = 100 K
0.30 × 0.25 × 0.20 mm

### Data collection

Agilent SuperNova Dual diffractometer with an Atlas detector
Absorption correction: multi-scan (*CrysAlis PRO*; Agilent Technologies, 2010)
$T_{min}$ = 0.659, $T_{max}$ = 0.751
8825 measured reflections
5371 independent reflections
4258 reflections with $I > 2\sigma(I)$
$R_{int}$ = 0.040

### Refinement

$R[F^2 > 2\sigma(F^2)]$ = 0.049
$wR(F^2)$ = 0.130
$S$ = 1.05
5371 reflections
295 parameters
H-atom parameters constrained
$\Delta\rho_{max}$ = 1.76 e Å$^{-3}$
$\Delta\rho_{min}$ = −1.85 e Å$^{-3}$

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

| $D$—H···$A$ | $D$—H | H···$A$ | $D$···$A$ | $D$—H···$A$ |
|---|---|---|---|---|
| O2—H2···O3 | 0.84 | 1.76 | 2.595 (4) | 172 |
| O3—H3···O1 | 0.84 | 1.91 | 2.736 (4) | 168 |
| O4—H4···Cl1$^{i}$ | 0.84 | 2.53 | 3.258 (3) | 146 |
| N2—H2n···O4 | 0.88 | 1.91 | 2.764 (5) | 162 |

Symmetry code: (i) $x+1, y+1, z$.

Data collection: *CrysAlis PRO* (Agilent Technologies, 2010); cell refinement: *CrysAlis PRO*; data reduction: *CrysAlis PRO*; program(s) used to solve structure: *SHELXS97* (Sheldrick, 2008); program(s) used to refine structure: *SHELXL97* (Sheldrick, 2008); molecular graphics: *X-SEED* (Barbour, 2001); software used to prepare material for publication: *publCIF* (Westrip, 2010).

We thank Shahid Beheshti University and the University of Malaya for supporting this study.

Supplementary data and figures for this paper are available from the IUCr electronic archives (Reference: SI2328).

## References

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# supplementary materials

*Acta Cryst.* (2011). E**67**, m241 [ **doi:10.1107/S1600536811001954** ]

# 8-Hydroxy-2-methylquinolinium tetrachlorido(quinolin-2-olato-$\kappa^2N,O$)stannate(IV) methanol disolvate

**E. Najafi, M. M. Amini and S. W. Ng**

## Comment

Only symmetrical dichlorotin bis(oxinates) have been reported; these include the 8-hydroxyquinoline, 2-methyl-8-hydroxyquinoline and 5,7-dichloro-8-hydroxyquinoline derivatives (Archer *et al.*, 1987; Fazaeli *et al.*, 2009; Lo & Ng, 2009). In the reaction of 8-hydroxyquinoline, 2-methyl-8-hydroxyquinoline and stannic chloride, the 2-methyl-8-hydroxyquinoline is protonated to yield the disolvated salt, $[SnCl_4(C_9H_6NO_2)]^-.2CH_3OH$ (Scheme I, Fig. 1). The tin atom in the anion is *N*,*O*-chelated by the hydroxyquinolinate and it exists in a *cis*-$SnNOCl_4$ octahedral geometry. The cation, anion and solvent molecules are linked by N–H···O and O–H···O hydrogen bonds to generate a three-dimensional network (Table 1).

## Experimental

Stannic chloride pentahydrate (0.35 g, 1 mmol), 8-hydroxyquinoline (0.15 g, 1 mmol) and 2-methyl-8-hydroxyquinoline (0.16 g, 1 mmol) were loaded into a convection tube; the tube was filled with dry methanol and kept at 333 K. Yellow crystals were collected from the side arm after several days.

## Refinement

Carbon-bound H-atoms were placed in calculated positions [C—H 0.95 to 0.98 Å, $U_{iso}$(H) 1.2 to 1.5$U_{eq}$(C)] and were included in the refinement in the riding model approximation.

The amino and hydroxy H-atoms were similarly placed (N–H 0.88±0.01, O–H 0.84±0.01 Å) and their temperature factors were also tied. The final difference Fourier map had a peak and a hole in the vicinity of Sn1.

## Figures

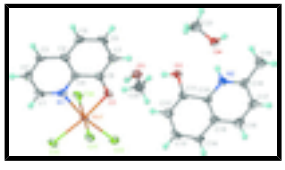


Fig. 1. Thermal ellipsoid plot (Barbour, 2001) of $[C_{10}H_{10}NO]^+$ $[SnCl_4(C_9H_6NO)]^-.$ $2CH_3OH$ at the 70% probability level; hydrogen atoms are drawn as spheres of arbitrary radius.

## 8-Hydroxy-2-methylquinolinium tetrachlorido(quinolin-2-olato-$\kappa^2N,O$)stannate(IV) methanol disolvate

*Crystal data*

| | |
|---|---|
| $(C_{10}H_{10}NO)[SnCl_4(C_9H_6NO)]\cdot 2CH_4O$ | $Z = 2$ |
| $M_r = 628.91$ | $F(000) = 628$ |

| | |
|---|---|
| Triclinic, $P\bar{1}$ | $D_x$ = 1.715 Mg m$^{-3}$ |
| Hall symbol: -P 1 | Mo $K\alpha$ radiation, λ = 0.71073 Å |
| $a$ = 7.9395 (3) Å | Cell parameters from 4114 reflections |
| $b$ = 9.9721 (4) Å | θ = 2.6–29.3° |
| $c$ = 16.0531 (8) Å | μ = 1.52 mm$^{-1}$ |
| α = 75.056 (4)° | $T$ = 100 K |
| β = 82.529 (4)° | Prism, yellow |
| γ = 88.529 (3)° | 0.30 × 0.25 × 0.20 mm |
| $V$ = 1217.53 (9) Å$^3$ | |

*Data collection*

| | |
|---|---|
| Agilent SuperNova Dual diffractometer with an Atlas detector | 5371 independent reflections |
| Radiation source: SuperNova (Mo) X-ray Source | 4258 reflections with $I > 2\sigma(I)$ |
| Mirror | $R_{int}$ = 0.040 |
| Detector resolution: 10.4041 pixels mm$^{-1}$ | $\theta_{max}$ = 27.5°, $\theta_{min}$ = 2.6° |
| ω scans | $h$ = −8→10 |
| Absorption correction: multi-scan (*CrysAlis PRO*; Agilent Technologies, 2010) | $k$ = −11→12 |
| $T_{min}$ = 0.659, $T_{max}$ = 0.751 | $l$ = −16→20 |
| 8825 measured reflections | |

*Refinement*

| | |
|---|---|
| Refinement on $F^2$ | Primary atom site location: structure-invariant direct methods |
| Least-squares matrix: full | Secondary atom site location: difference Fourier map |
| $R[F^2 > 2\sigma(F^2)]$ = 0.049 | Hydrogen site location: inferred from neighbouring sites |
| $wR(F^2)$ = 0.130 | H-atom parameters constrained |
| $S$ = 1.05 | $w = 1/[\sigma^2(F_o^2) + (0.0633P)^2]$ where $P = (F_o^2 + 2F_c^2)/3$ |
| 5371 reflections | $(\Delta/\sigma)_{max}$ = 0.001 |
| 295 parameters | $\Delta\rho_{max}$ = 1.76 e Å$^{-3}$ |
| 0 restraints | $\Delta\rho_{min}$ = −1.85 e Å$^{-3}$ |

*Fractional atomic coordinates and isotropic or equivalent isotropic displacement parameters (Å$^2$)*

| | $x$ | $y$ | $z$ | $U_{iso}$*/$U_{eq}$ |
|---|---|---|---|---|
| Sn1 | 0.51336 (4) | 0.56573 (3) | 0.20809 (2) | 0.01909 (12) |
| Cl1 | 0.24880 (15) | 0.54380 (11) | 0.30721 (8) | 0.0232 (3) |
| Cl2 | 0.47350 (15) | 0.33873 (11) | 0.18991 (8) | 0.0242 (3) |
| Cl3 | 0.67740 (16) | 0.50347 (12) | 0.32577 (8) | 0.0262 (3) |
| Cl4 | 0.75884 (15) | 0.60727 (11) | 0.09839 (8) | 0.0227 (3) |
| O1 | 0.5234 (4) | 0.7725 (3) | 0.2102 (2) | 0.0203 (7) |
| O2 | 0.8013 (5) | 1.0336 (3) | 0.3161 (2) | 0.0280 (8) |

| | | | | |
|---|---|---|---|---|
| H2 | 0.8017 | 0.9885 | 0.2786 | 0.042* |
| O3 | 0.8327 (4) | 0.8959 (3) | 0.1982 (2) | 0.0253 (8) |
| H3 | 0.7453 | 0.8506 | 0.1976 | 0.038* |
| O4 | 1.0402 (4) | 1.2688 (3) | 0.3035 (2) | 0.0262 (8) |
| H4 | 1.1279 | 1.3129 | 0.3052 | 0.039* |
| N1 | 0.3617 (5) | 0.6649 (4) | 0.1035 (2) | 0.0191 (8) |
| N2 | 0.8391 (5) | 1.1312 (4) | 0.4535 (3) | 0.0216 (9) |
| H2N | 0.8831 | 1.1741 | 0.4004 | 0.032* |
| C1 | 0.2875 (6) | 0.6087 (5) | 0.0509 (3) | 0.0235 (10) |
| H1 | 0.2968 | 0.5117 | 0.0565 | 0.028* |
| C2 | 0.1958 (6) | 0.6896 (5) | −0.0127 (3) | 0.0256 (11) |
| H2A | 0.1428 | 0.6470 | −0.0492 | 0.031* |
| C3 | 0.1824 (6) | 0.8287 (5) | −0.0226 (3) | 0.0215 (10) |
| H3A | 0.1215 | 0.8834 | −0.0663 | 0.026* |
| C4 | 0.2598 (6) | 0.8921 (5) | 0.0328 (3) | 0.0211 (10) |
| C5 | 0.2544 (6) | 1.0356 (5) | 0.0277 (3) | 0.0219 (10) |
| H5 | 0.1940 | 1.0964 | −0.0139 | 0.026* |
| C6 | 0.3369 (6) | 1.0866 (5) | 0.0830 (3) | 0.0247 (11) |
| H6 | 0.3334 | 1.1834 | 0.0788 | 0.030* |
| C7 | 0.4256 (6) | 1.0005 (5) | 0.1451 (3) | 0.0228 (10) |
| H7 | 0.4803 | 1.0393 | 0.1828 | 0.027* |
| C8 | 0.4353 (6) | 0.8596 (5) | 0.1527 (3) | 0.0197 (10) |
| C9 | 0.3486 (6) | 0.8058 (4) | 0.0956 (3) | 0.0171 (9) |
| C10 | 0.7577 (6) | 1.0063 (5) | 0.4660 (3) | 0.0208 (10) |
| C11 | 0.7396 (6) | 0.9540 (5) | 0.3939 (3) | 0.0220 (10) |
| C12 | 0.6582 (6) | 0.8283 (5) | 0.4091 (3) | 0.0238 (11) |
| H12 | 0.6452 | 0.7911 | 0.3614 | 0.029* |
| C13 | 0.5940 (6) | 0.7539 (5) | 0.4932 (3) | 0.0254 (11) |
| H13 | 0.5399 | 0.6668 | 0.5013 | 0.030* |
| C14 | 0.6071 (6) | 0.8030 (5) | 0.5637 (3) | 0.0251 (11) |
| H14 | 0.5609 | 0.7521 | 0.6203 | 0.030* |
| C15 | 0.6919 (6) | 0.9330 (5) | 0.5509 (3) | 0.0226 (10) |
| C16 | 0.7117 (7) | 0.9934 (5) | 0.6198 (3) | 0.0283 (11) |
| H16 | 0.6721 | 0.9455 | 0.6781 | 0.034* |
| C17 | 0.7881 (6) | 1.1211 (5) | 0.6025 (3) | 0.0247 (11) |
| H17 | 0.7957 | 1.1629 | 0.6488 | 0.030* |
| C18 | 0.8548 (6) | 1.1910 (5) | 0.5179 (3) | 0.0224 (10) |
| C19 | 0.9411 (6) | 1.3281 (5) | 0.4955 (4) | 0.0278 (11) |
| H19A | 0.9106 | 1.3840 | 0.4399 | 0.042* |
| H19B | 1.0644 | 1.3150 | 0.4908 | 0.042* |
| H19C | 0.9054 | 1.3758 | 0.5410 | 0.042* |
| C20 | 0.9683 (6) | 0.8028 (5) | 0.2200 (4) | 0.0289 (12) |
| H20A | 1.0752 | 0.8552 | 0.2092 | 0.043* |
| H20B | 0.9763 | 0.7361 | 0.1843 | 0.043* |
| H20C | 0.9470 | 0.7529 | 0.2816 | 0.043* |
| C21 | 0.9985 (7) | 1.3030 (6) | 0.2168 (3) | 0.0319 (12) |
| H21A | 0.8821 | 1.2724 | 0.2171 | 0.048* |
| H21B | 1.0773 | 1.2565 | 0.1812 | 0.048* |
| H21C | 1.0075 | 1.4037 | 0.1924 | 0.048* |

*Atomic displacement parameters (Å$^2$)*

| | $U^{11}$ | $U^{22}$ | $U^{33}$ | $U^{12}$ | $U^{13}$ | $U^{23}$ |
|---|---|---|---|---|---|---|
| Sn1 | 0.0224 (2) | 0.01323 (17) | 0.0203 (2) | −0.00323 (12) | −0.00130 (14) | −0.00209 (13) |
| Cl1 | 0.0248 (6) | 0.0189 (5) | 0.0238 (6) | −0.0031 (4) | 0.0030 (5) | −0.0041 (5) |
| Cl2 | 0.0291 (7) | 0.0147 (5) | 0.0277 (7) | −0.0021 (4) | −0.0006 (5) | −0.0045 (5) |
| Cl3 | 0.0291 (7) | 0.0225 (6) | 0.0245 (7) | −0.0029 (5) | −0.0066 (5) | 0.0002 (5) |
| Cl4 | 0.0249 (6) | 0.0167 (5) | 0.0237 (6) | −0.0025 (4) | 0.0021 (5) | −0.0028 (5) |
| O1 | 0.0243 (18) | 0.0132 (15) | 0.0230 (19) | −0.0003 (13) | −0.0024 (15) | −0.0039 (14) |
| O2 | 0.041 (2) | 0.0218 (17) | 0.0186 (19) | −0.0130 (15) | 0.0025 (16) | −0.0020 (14) |
| O3 | 0.0248 (19) | 0.0234 (17) | 0.025 (2) | −0.0081 (14) | −0.0014 (15) | −0.0005 (15) |
| O4 | 0.030 (2) | 0.0241 (18) | 0.024 (2) | −0.0085 (14) | −0.0026 (15) | −0.0041 (15) |
| N1 | 0.018 (2) | 0.0176 (19) | 0.019 (2) | −0.0039 (15) | 0.0008 (16) | −0.0001 (16) |
| N2 | 0.024 (2) | 0.021 (2) | 0.018 (2) | −0.0018 (16) | −0.0012 (17) | −0.0019 (17) |
| C1 | 0.027 (3) | 0.015 (2) | 0.025 (3) | −0.0030 (19) | 0.004 (2) | −0.003 (2) |
| C2 | 0.029 (3) | 0.029 (3) | 0.019 (3) | −0.005 (2) | −0.002 (2) | −0.007 (2) |
| C3 | 0.022 (3) | 0.020 (2) | 0.018 (3) | 0.0015 (18) | −0.002 (2) | 0.0032 (19) |
| C4 | 0.022 (3) | 0.019 (2) | 0.020 (3) | −0.0034 (18) | 0.006 (2) | −0.005 (2) |
| C5 | 0.022 (3) | 0.019 (2) | 0.021 (3) | 0.0026 (19) | −0.002 (2) | 0.000 (2) |
| C6 | 0.026 (3) | 0.014 (2) | 0.030 (3) | −0.0032 (19) | 0.007 (2) | −0.001 (2) |
| C7 | 0.024 (3) | 0.021 (2) | 0.019 (3) | −0.0067 (19) | 0.005 (2) | −0.002 (2) |
| C8 | 0.016 (2) | 0.019 (2) | 0.021 (3) | −0.0012 (18) | 0.0017 (19) | −0.0030 (19) |
| C9 | 0.018 (2) | 0.017 (2) | 0.014 (2) | −0.0023 (17) | 0.0039 (18) | −0.0025 (18) |
| C10 | 0.019 (3) | 0.017 (2) | 0.023 (3) | 0.0003 (18) | 0.000 (2) | −0.002 (2) |
| C11 | 0.023 (3) | 0.020 (2) | 0.022 (3) | −0.0006 (19) | −0.003 (2) | −0.003 (2) |
| C12 | 0.023 (3) | 0.023 (2) | 0.024 (3) | −0.0014 (19) | 0.001 (2) | −0.005 (2) |
| C13 | 0.023 (3) | 0.016 (2) | 0.034 (3) | −0.0063 (19) | 0.004 (2) | −0.002 (2) |
| C14 | 0.030 (3) | 0.016 (2) | 0.024 (3) | 0.0005 (19) | 0.002 (2) | 0.003 (2) |
| C15 | 0.016 (2) | 0.022 (2) | 0.028 (3) | 0.0051 (19) | −0.001 (2) | −0.005 (2) |
| C16 | 0.031 (3) | 0.031 (3) | 0.020 (3) | 0.002 (2) | 0.001 (2) | −0.003 (2) |
| C17 | 0.026 (3) | 0.028 (3) | 0.019 (3) | −0.001 (2) | −0.002 (2) | −0.005 (2) |
| C18 | 0.014 (2) | 0.028 (3) | 0.024 (3) | 0.0036 (19) | −0.002 (2) | −0.004 (2) |
| C19 | 0.023 (3) | 0.030 (3) | 0.032 (3) | −0.002 (2) | −0.006 (2) | −0.011 (2) |
| C20 | 0.025 (3) | 0.031 (3) | 0.029 (3) | −0.002 (2) | −0.004 (2) | −0.005 (2) |
| C21 | 0.032 (3) | 0.034 (3) | 0.027 (3) | −0.004 (2) | −0.004 (2) | −0.002 (2) |

*Geometric parameters (Å, °)*

| | | | |
|---|---|---|---|
| Sn1—O1 | 2.075 (3) | C6—H6 | 0.9500 |
| Sn1—N1 | 2.204 (4) | C7—C8 | 1.379 (6) |
| Sn1—Cl3 | 2.3758 (12) | C7—H7 | 0.9500 |
| Sn1—Cl2 | 2.3898 (11) | C8—C9 | 1.428 (6) |
| Sn1—Cl4 | 2.4174 (12) | C10—C15 | 1.409 (7) |
| Sn1—Cl1 | 2.4427 (12) | C10—C11 | 1.412 (6) |
| O1—C8 | 1.350 (5) | C11—C12 | 1.376 (6) |
| O2—C11 | 1.333 (6) | C12—C13 | 1.399 (7) |
| O2—H2 | 0.8400 | C12—H12 | 0.9500 |
| O3—C20 | 1.423 (6) | C13—C14 | 1.361 (7) |

| | | | |
|---|---|---|---|
| O3—H3 | 0.8400 | C13—H13 | 0.9500 |
| O4—C21 | 1.426 (6) | C14—C15 | 1.431 (7) |
| O4—H4 | 0.8400 | C14—H14 | 0.9500 |
| N1—C1 | 1.328 (6) | C15—C16 | 1.416 (6) |
| N1—C9 | 1.381 (5) | C16—C17 | 1.371 (7) |
| N2—C18 | 1.341 (6) | C16—H16 | 0.9500 |
| N2—C10 | 1.373 (6) | C17—C18 | 1.397 (7) |
| N2—H2N | 0.8800 | C17—H17 | 0.9500 |
| C1—C2 | 1.400 (7) | C18—C19 | 1.483 (7) |
| C1—H1 | 0.9500 | C19—H19A | 0.9800 |
| C2—C3 | 1.358 (6) | C19—H19B | 0.9800 |
| C2—H2A | 0.9500 | C19—H19C | 0.9800 |
| C3—C4 | 1.422 (6) | C20—H20A | 0.9800 |
| C3—H3A | 0.9500 | C20—H20B | 0.9800 |
| C4—C9 | 1.399 (7) | C20—H20C | 0.9800 |
| C4—C5 | 1.411 (6) | C21—H21A | 0.9800 |
| C5—C6 | 1.370 (6) | C21—H21B | 0.9800 |
| C5—H5 | 0.9500 | C21—H21C | 0.9800 |
| C6—C7 | 1.393 (7) | | |
| O1—Sn1—N1 | 78.45 (12) | N1—C9—C4 | 121.7 (4) |
| O1—Sn1—Cl3 | 90.22 (9) | N1—C9—C8 | 116.6 (4) |
| N1—Sn1—Cl3 | 168.60 (9) | C4—C9—C8 | 121.7 (4) |
| O1—Sn1—Cl2 | 171.51 (9) | N2—C10—C15 | 119.3 (4) |
| N1—Sn1—Cl2 | 93.09 (10) | N2—C10—C11 | 119.7 (4) |
| Cl3—Sn1—Cl2 | 98.22 (4) | C15—C10—C11 | 121.0 (4) |
| O1—Sn1—Cl4 | 88.73 (9) | O2—C11—C12 | 125.8 (4) |
| N1—Sn1—Cl4 | 87.00 (10) | O2—C11—C10 | 116.2 (4) |
| Cl3—Sn1—Cl4 | 93.98 (4) | C12—C11—C10 | 118.0 (5) |
| Cl2—Sn1—Cl4 | 91.61 (4) | C11—C12—C13 | 121.5 (4) |
| O1—Sn1—Cl1 | 88.01 (9) | C11—C12—H12 | 119.3 |
| N1—Sn1—Cl1 | 86.76 (10) | C13—C12—H12 | 119.3 |
| Cl3—Sn1—Cl1 | 91.73 (4) | C14—C13—C12 | 121.7 (4) |
| Cl2—Sn1—Cl1 | 90.78 (4) | C14—C13—H13 | 119.1 |
| Cl4—Sn1—Cl1 | 173.44 (4) | C12—C13—H13 | 119.1 |
| C8—O1—Sn1 | 114.7 (2) | C13—C14—C15 | 118.7 (5) |
| C11—O2—H2 | 109.5 | C13—C14—H14 | 120.7 |
| C20—O3—H3 | 109.5 | C15—C14—H14 | 120.7 |
| C21—O4—H4 | 109.5 | C10—C15—C16 | 117.8 (4) |
| C1—N1—C9 | 119.6 (4) | C10—C15—C14 | 119.1 (4) |
| C1—N1—Sn1 | 129.6 (3) | C16—C15—C14 | 123.1 (5) |
| C9—N1—Sn1 | 110.8 (3) | C17—C16—C15 | 120.0 (5) |
| C18—N2—C10 | 123.4 (4) | C17—C16—H16 | 120.0 |
| C18—N2—H2N | 118.3 | C15—C16—H16 | 120.0 |
| C10—N2—H2N | 118.3 | C16—C17—C18 | 121.2 (4) |
| N1—C1—C2 | 121.3 (4) | C16—C17—H17 | 119.4 |
| N1—C1—H1 | 119.3 | C18—C17—H17 | 119.4 |
| C2—C1—H1 | 119.3 | N2—C18—C17 | 118.2 (4) |
| C3—C2—C1 | 120.3 (4) | N2—C18—C19 | 118.2 (4) |
| C3—C2—H2A | 119.8 | C17—C18—C19 | 123.6 (4) |

| | | | |
|---|---|---|---|
| C1—C2—H2A | 119.8 | C18—C19—H19A | 109.5 |
| C2—C3—C4 | 119.8 (4) | C18—C19—H19B | 109.5 |
| C2—C3—H3A | 120.1 | H19A—C19—H19B | 109.5 |
| C4—C3—H3A | 120.1 | C18—C19—H19C | 109.5 |
| C9—C4—C5 | 118.5 (4) | H19A—C19—H19C | 109.5 |
| C9—C4—C3 | 117.2 (4) | H19B—C19—H19C | 109.5 |
| C5—C4—C3 | 124.3 (4) | O3—C20—H20A | 109.5 |
| C6—C5—C4 | 119.6 (4) | O3—C20—H20B | 109.5 |
| C6—C5—H5 | 120.2 | H20A—C20—H20B | 109.5 |
| C4—C5—H5 | 120.2 | O3—C20—H20C | 109.5 |
| C5—C6—C7 | 121.8 (4) | H20A—C20—H20C | 109.5 |
| C5—C6—H6 | 119.1 | H20B—C20—H20C | 109.5 |
| C7—C6—H6 | 119.1 | O4—C21—H21A | 109.5 |
| C8—C7—C6 | 120.9 (4) | O4—C21—H21B | 109.5 |
| C8—C7—H7 | 119.5 | H21A—C21—H21B | 109.5 |
| C6—C7—H7 | 119.5 | O4—C21—H21C | 109.5 |
| O1—C8—C7 | 123.1 (4) | H21A—C21—H21C | 109.5 |
| O1—C8—C9 | 119.4 (4) | H21B—C21—H21C | 109.5 |
| C7—C8—C9 | 117.5 (4) | | |
| N1—Sn1—O1—C8 | 1.6 (3) | C5—C4—C9—N1 | −178.9 (4) |
| Cl3—Sn1—O1—C8 | −177.2 (3) | C3—C4—C9—N1 | 0.3 (7) |
| Cl4—Sn1—O1—C8 | 88.8 (3) | C5—C4—C9—C8 | −1.1 (7) |
| Cl1—Sn1—O1—C8 | −85.5 (3) | C3—C4—C9—C8 | 178.1 (4) |
| O1—Sn1—N1—C1 | 178.1 (4) | O1—C8—C9—N1 | −0.1 (6) |
| Cl3—Sn1—N1—C1 | −175.9 (4) | C7—C8—C9—N1 | 179.2 (4) |
| Cl2—Sn1—N1—C1 | −2.6 (4) | O1—C8—C9—C4 | −178.0 (4) |
| Cl4—Sn1—N1—C1 | 88.8 (4) | C7—C8—C9—C4 | 1.3 (7) |
| Cl1—Sn1—N1—C1 | −93.2 (4) | C18—N2—C10—C15 | −2.4 (7) |
| O1—Sn1—N1—C9 | −1.6 (3) | C18—N2—C10—C11 | 176.9 (4) |
| Cl3—Sn1—N1—C9 | 4.4 (7) | N2—C10—C11—O2 | −1.5 (7) |
| Cl2—Sn1—N1—C9 | 177.6 (3) | C15—C10—C11—O2 | 177.8 (4) |
| Cl4—Sn1—N1—C9 | −90.9 (3) | N2—C10—C11—C12 | 179.7 (4) |
| Cl1—Sn1—N1—C9 | 87.0 (3) | C15—C10—C11—C12 | −1.0 (7) |
| C9—N1—C1—C2 | 0.0 (7) | O2—C11—C12—C13 | −178.4 (5) |
| Sn1—N1—C1—C2 | −179.7 (3) | C10—C11—C12—C13 | 0.3 (7) |
| N1—C1—C2—C3 | 0.7 (8) | C11—C12—C13—C14 | 0.8 (8) |
| C1—C2—C3—C4 | −0.9 (8) | C12—C13—C14—C15 | −1.2 (7) |
| C2—C3—C4—C9 | 0.4 (7) | N2—C10—C15—C16 | 0.7 (7) |
| C2—C3—C4—C5 | 179.5 (5) | C11—C10—C15—C16 | −178.7 (4) |
| C9—C4—C5—C6 | 0.7 (7) | N2—C10—C15—C14 | 179.9 (4) |
| C3—C4—C5—C6 | −178.5 (5) | C11—C10—C15—C14 | 0.6 (7) |
| C4—C5—C6—C7 | −0.5 (8) | C13—C14—C15—C10 | 0.5 (7) |
| C5—C6—C7—C8 | 0.7 (8) | C13—C14—C15—C16 | 179.7 (5) |
| Sn1—O1—C8—C7 | 179.3 (4) | C10—C15—C16—C17 | 2.0 (7) |
| Sn1—O1—C8—C9 | −1.4 (5) | C14—C15—C16—C17 | −177.2 (5) |
| C6—C7—C8—O1 | 178.2 (4) | C15—C16—C17—C18 | −3.1 (7) |
| C6—C7—C8—C9 | −1.1 (7) | C10—N2—C18—C17 | 1.4 (7) |
| C1—N1—C9—C4 | −0.5 (7) | C10—N2—C18—C19 | −178.2 (4) |
| Sn1—N1—C9—C4 | 179.3 (4) | C16—C17—C18—N2 | 1.4 (7) |

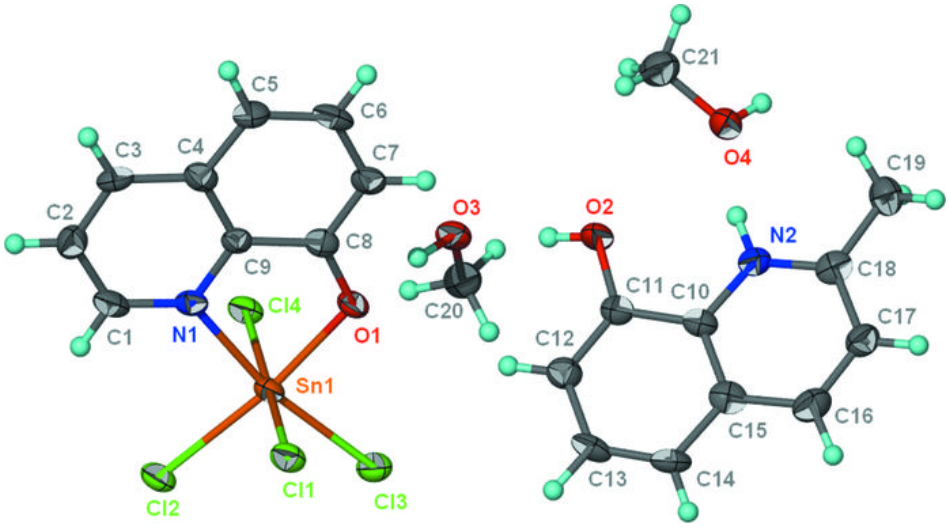
| | | | |
|---|---|---|---|
| C1—N1—C9—C8 | −178.4 (4) | C16—C17—C18—C19 | −179.0 (4) |
| Sn1—N1—C9—C8 | 1.4 (5) | | |

*Hydrogen-bond geometry (Å, °)*

| *D*—H···*A* | *D*—H | H···*A* | *D*···*A* | *D*—H···*A* |
|---|---|---|---|---|
| O2—H2···O3 | 0.84 | 1.76 | 2.595 (4) | 172 |
| O3—H3···O1 | 0.84 | 1.91 | 2.736 (4) | 168 |
| O4—H4···Cl1$^{i}$ | 0.84 | 2.53 | 3.258 (3) | 146 |
| N2—H2n···O4 | 0.88 | 1.91 | 2.764 (5) | 162 |

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

**Fig. 1**


C21
O4
C19
C5
C6
C3
C4
C7
O3
O2
N2
C2
C8
C18
C9
C11
C10
C17
C20
Cl4
C1
N1
O1
C12
Sn1
C16
C15
C13
C14
Cl2
Cl1
Cl3