

## (2-Amino-3-oxidopyridinium- $\kappa^2$ N,O)-dibenzylchloridotin(IV)

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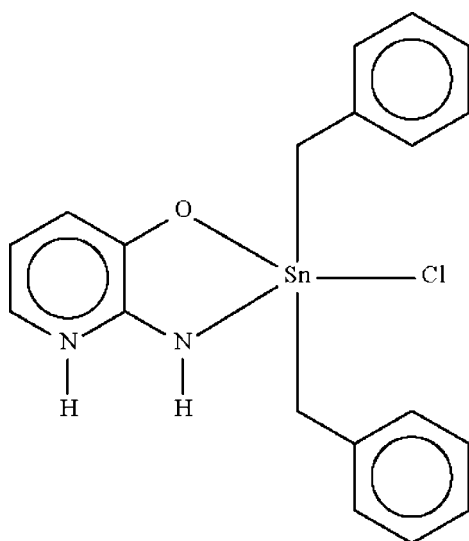
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 Key indicators: single-crystal X-ray study;  $T = 133$  K; mean  $\sigma(\text{C}-\text{C}) = 0.003$  Å;  $R$  factor = 0.021;  $wR$  factor = 0.054; data-to-parameter ratio = 18.2.

The Sn atom in the title compound,  $[\text{Sn}(\text{C}_7\text{H}_7)_2(\text{C}_5\text{H}_5\text{N}_2\text{O})\text{Cl}]$ , shows a distorted  $\text{C}_2\text{ClNOSn}$  trigonal-bipyramidal coordination, with a  $\text{Cl}-\text{Sn}-\text{O}$  axial angle of  $163.77(3)^\circ$ , but the  $\text{C}-\text{Sn}-\text{C}$  angle [ $141.43(7)^\circ$ ] deviates from  $120^\circ$ . The chelating ligand exists in a zwitterionic form. Adjacent molecules are linked by an  $\text{N}-\text{H}_{\text{pyridinium}} \cdots \text{O}$  hydrogen bond, forming a chain running along the  $c$  axis of the orthorhombic unit cell.

### Related literature

2-Amino-3-hydroxypyridine behaves as a mono-anion chelating to a metal atom; see: Gerber *et al.* (2004). The ligand also chelates in the neutral form; see: Palkina *et al.* (2000). The ligand exists as an isolated mono-cation in other metal salts; see: Halvorson *et al.* (1990); Place *et al.* (1998).



### Experimental

#### Crystal data

$[\text{Sn}(\text{C}_7\text{H}_7)_2(\text{C}_5\text{H}_5\text{N}_2\text{O})\text{Cl}]$   
 $M_r = 445.50$   
 Orthorhombic,  $Pbca$   
 $a = 11.0457(1)$  Å  
 $b = 16.8447(2)$  Å  
 $c = 19.1227(2)$  Å

$V = 3558.00(6)$  Å<sup>3</sup>  
 $Z = 8$   
 Mo  $K\alpha$  radiation  
 $\mu = 1.59$  mm<sup>-1</sup>  
 $T = 133$  K  
 $0.20 \times 0.05 \times 0.05$  mm

#### Data collection

Bruker SMART APEX  
 diffractometer  
 Absorption correction: multi-scan  
 (*SADABS*; Sheldrick, 1996)  
 $T_{\text{min}} = 0.640$ ,  $T_{\text{max}} = 0.746$   
 (expected range = 0.792–0.923)

32398 measured reflections  
 4086 independent reflections  
 3434 reflections with  $I > 2\sigma(I)$   
 $R_{\text{int}} = 0.025$

#### Refinement

$R[F^2 > 2\sigma(F^2)] = 0.021$   
 $wR(F^2) = 0.054$   
 $S = 1.01$   
 4086 reflections  
 225 parameters  
 2 restraints

H atoms treated by a mixture of  
 independent and constrained  
 refinement  
 $\Delta\rho_{\text{max}} = 0.58$  e Å<sup>-3</sup>  
 $\Delta\rho_{\text{min}} = -0.38$  e Å<sup>-3</sup>

**Table 1**

Hydrogen-bond geometry (Å, °).

$D-H \cdots A$	$D-H$	$H \cdots A$	$D \cdots A$	$D-H \cdots A$
$\text{N1}-\text{H1} \cdots \text{O1}^i$	0.88 (1)	1.87 (1)	2.726 (2)	165 (2)

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

Data collection: *APEX2* (Bruker, 2007); cell refinement: *SAINT* (Bruker, 2007); data reduction: *SAINT*; 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, 2009).

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Supplementary data and figures for this paper are available from the IUCr electronic archives (Reference: TK2469).

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**supplementary materials**

*Acta Cryst.* (2009). E65, m721 [ doi:10.1107/S1600536809020339 ]

**(2-Amido-3-oxidopyridinium- $\kappa^2N,O$ )dibenzylchloridotin(IV)**

**C. L. Tan, K. M. Lo and S. W. Ng**

**Experimental**

Dibenzyltin dichloride (0.37 g, 1 mmol) and 2-amino-3-hydroxypyridine (0.11 g, 1 mmol) were dissolved in chloroform (100 ml); the solution was heated for 1 hour. Slow evaporation of the filtrate afforded pale-yellow crystals.

**Refinement**

Hydrogen atoms were placed at calculated positions (C–H 0.95–0.99 Å) and were treated as riding on their parent atoms, with  $U(H)$  set to  $1.2U_{eq}(C)$ . The nitrogen-bound H atoms were located in a difference Fourier map, and were refined with a distance restraint of N–H  $0.88 \pm 0.01$  Å and individual isotropic temperature factors.

**Figures**

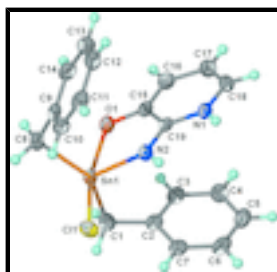


Fig. 1. Thermal ellipsoid plot (Barbour, 2001) of  $\text{SnCl}(\text{C}_7\text{H}_7)(\text{C}_5\text{H}_5\text{N}_2\text{O})$  at the 70% probability level. Hydrogen atoms are drawn as spheres of arbitrary radius.

**(2-Amido-3-oxidopyridinium- $\kappa^2N,O$ )dibenzylchloridotin(IV)**

*Crystal data*

$[\text{Sn}(\text{C}_7\text{H}_7)_2(\text{C}_5\text{H}_5\text{N}_2\text{O})\text{Cl}]$

$M_r = 445.50$

Orthorhombic, *Pbca*

Hall symbol: -P 2ac 2ab

$a = 11.0457$  (1) Å

$b = 16.8447$  (2) Å

$c = 19.1227$  (2) Å

$V = 3558.00$  (6) Å<sup>3</sup>

$Z = 8$

$F_{000} = 1776$

$D_x = 1.663$  Mg m<sup>-3</sup>

Mo  $K\alpha$  radiation

$\lambda = 0.71073$  Å

Cell parameters from 9941 reflections

$\theta = 2.4$ – $28.2^\circ$

$\mu = 1.59$  mm<sup>-1</sup>

$T = 133$  K

Prism, pale-yellow

$0.20 \times 0.05 \times 0.05$  mm

## Data collection

Bruker SMART APEX diffractometer	4086 independent reflections
Radiation source: fine-focus sealed tube	3434 reflections with $I > 2\sigma(I)$
Monochromator: graphite	$R_{\text{int}} = 0.025$
$T = 133$ K	$\theta_{\text{max}} = 27.5^\circ$
$\omega$ scans	$\theta_{\text{min}} = 2.1^\circ$
Absorption correction: Multi-scan (SADABS; Sheldrick, 1996)	$h = -14 \rightarrow 14$
$T_{\text{min}} = 0.640$ , $T_{\text{max}} = 0.746$	$k = -21 \rightarrow 21$
32398 measured reflections	$l = -24 \rightarrow 24$

## Refinement

Refinement on $F^2$	Secondary atom site location: difference Fourier map
Least-squares matrix: full	Hydrogen site location: inferred from neighbouring sites
$R[F^2 > 2\sigma(F^2)] = 0.021$	H atoms treated by a mixture of independent and constrained refinement
$wR(F^2) = 0.054$	$w = 1/[\sigma^2(F_o^2) + (0.0279P)^2 + 2.1692P]$
$S = 1.01$	where $P = (F_o^2 + 2F_c^2)/3$
4086 reflections	$(\Delta/\sigma)_{\text{max}} = 0.004$
225 parameters	$\Delta\rho_{\text{max}} = 0.58 \text{ e } \text{\AA}^{-3}$
2 restraints	$\Delta\rho_{\text{min}} = -0.38 \text{ e } \text{\AA}^{-3}$
Primary atom site location: structure-invariant direct methods	Extinction correction: none

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

	x	y	z	$U_{\text{iso}}^*/U_{\text{eq}}$
Sn1	0.497920 (10)	0.547145 (7)	0.324875 (6)	0.01725 (5)
Cl1	0.65272 (4)	0.45738 (3)	0.37607 (3)	0.02492 (10)
O1	0.40585 (10)	0.64531 (8)	0.26870 (6)	0.0207 (3)
N1	0.68659 (13)	0.70633 (9)	0.19394 (8)	0.0185 (3)
H1	0.7626 (10)	0.6937 (12)	0.2015 (11)	0.024 (5)*
N2	0.63839 (13)	0.61218 (9)	0.28027 (8)	0.0183 (3)
H2	0.7151 (10)	0.6008 (13)	0.2832 (12)	0.033 (6)*
C1	0.43387 (17)	0.46293 (11)	0.24812 (10)	0.0224 (4)
H1A	0.4448	0.4079	0.2653	0.027*
H1B	0.3469	0.4716	0.2383	0.027*
C2	0.50788 (15)	0.47652 (12)	0.18346 (10)	0.0212 (4)
C3	0.46973 (18)	0.53013 (12)	0.13232 (10)	0.0230 (4)
H3	0.3931	0.5552	0.1369	0.028*
C4	0.54191 (19)	0.54737 (12)	0.07487 (11)	0.0261 (4)
H4	0.5147	0.5844	0.0408	0.031*

C5	0.65348 (18)	0.51080 (12)	0.06696 (10)	0.0277 (4)
H5	0.7032	0.5228	0.0278	0.033*
C6	0.69168 (18)	0.45658 (12)	0.11679 (11)	0.0274 (4)
H6	0.7676	0.4308	0.1114	0.033*
C7	0.62000 (17)	0.43961 (12)	0.17456 (10)	0.0238 (4)
H7	0.6476	0.4025	0.2084	0.029*
C8	0.44732 (17)	0.60092 (12)	0.42300 (10)	0.0229 (4)
H8A	0.3655	0.6246	0.4198	0.027*
H8B	0.4474	0.5609	0.4609	0.027*
C9	0.54035 (17)	0.66398 (11)	0.43697 (9)	0.0216 (4)
C10	0.65205 (17)	0.64382 (11)	0.46612 (9)	0.0234 (4)
H10	0.6665	0.5907	0.4805	0.028*
C11	0.74193 (18)	0.70028 (12)	0.47429 (10)	0.0271 (4)
H11	0.8177	0.6854	0.4938	0.033*
C12	0.72242 (19)	0.77828 (12)	0.45420 (11)	0.0286 (4)
H12	0.7841	0.8170	0.4602	0.034*
C13	0.6121 (2)	0.79920 (12)	0.42533 (11)	0.0301 (4)
H13	0.5978	0.8526	0.4116	0.036*
C14	0.52218 (18)	0.74232 (12)	0.41639 (11)	0.0265 (4)
H14	0.4472	0.7572	0.3959	0.032*
C15	0.48011 (15)	0.68662 (11)	0.22755 (10)	0.0179 (4)
C16	0.44615 (17)	0.74253 (11)	0.17952 (10)	0.0225 (4)
H16	0.3632	0.7565	0.1748	0.027*
C17	0.53422 (18)	0.77968 (12)	0.13674 (10)	0.0246 (4)
H17	0.5103	0.8175	0.1026	0.030*
C18	0.65246 (17)	0.76107 (11)	0.14473 (10)	0.0232 (4)
H18	0.7119	0.7859	0.1162	0.028*
C19	0.60653 (15)	0.66784 (10)	0.23445 (9)	0.0158 (3)

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

	$U^{11}$	$U^{22}$	$U^{33}$	$U^{12}$	$U^{13}$	$U^{23}$
Sn1	0.01411 (7)	0.02073 (8)	0.01692 (8)	-0.00099 (5)	-0.00013 (4)	0.00119 (4)
Cl1	0.0225 (2)	0.0226 (2)	0.0297 (2)	0.00080 (18)	-0.00556 (19)	0.00552 (18)
O1	0.0125 (6)	0.0273 (7)	0.0223 (7)	0.0028 (5)	0.0014 (5)	0.0027 (5)
N1	0.0132 (7)	0.0216 (8)	0.0209 (8)	0.0025 (6)	0.0013 (6)	0.0014 (6)
N2	0.0111 (6)	0.0226 (8)	0.0212 (8)	0.0013 (6)	-0.0007 (6)	0.0016 (6)
C1	0.0192 (9)	0.0256 (9)	0.0224 (9)	-0.0051 (7)	-0.0019 (7)	-0.0006 (7)
C2	0.0197 (9)	0.0216 (9)	0.0223 (10)	-0.0034 (7)	-0.0026 (7)	-0.0057 (7)
C3	0.0206 (8)	0.0270 (10)	0.0215 (10)	0.0010 (8)	-0.0028 (8)	-0.0045 (7)
C4	0.0281 (10)	0.0289 (10)	0.0211 (10)	-0.0017 (8)	-0.0031 (8)	-0.0012 (8)
C5	0.0261 (9)	0.0334 (11)	0.0237 (10)	-0.0050 (9)	0.0040 (8)	-0.0080 (8)
C6	0.0210 (9)	0.0320 (11)	0.0292 (11)	0.0026 (8)	-0.0008 (8)	-0.0098 (8)
C7	0.0235 (9)	0.0232 (9)	0.0247 (10)	0.0001 (8)	-0.0039 (7)	-0.0043 (7)
C8	0.0196 (9)	0.0300 (10)	0.0191 (9)	-0.0004 (8)	0.0027 (7)	0.0010 (8)
C9	0.0224 (9)	0.0274 (10)	0.0150 (9)	0.0004 (8)	0.0039 (7)	-0.0015 (7)
C10	0.0290 (10)	0.0244 (9)	0.0168 (9)	0.0025 (8)	-0.0019 (7)	-0.0013 (7)
C11	0.0231 (9)	0.0374 (12)	0.0208 (10)	0.0008 (8)	-0.0020 (8)	-0.0052 (8)

## supplementary materials

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C12	0.0324 (10)	0.0301 (11)	0.0235 (10)	-0.0094 (9)	0.0042 (8)	-0.0053 (8)
C13	0.0405 (12)	0.0246 (10)	0.0253 (10)	0.0011 (9)	0.0036 (9)	-0.0002 (8)
C14	0.0267 (10)	0.0296 (11)	0.0233 (10)	0.0061 (8)	0.0003 (8)	-0.0016 (8)
C15	0.0131 (8)	0.0219 (9)	0.0186 (9)	0.0011 (7)	0.0000 (7)	-0.0031 (7)
C16	0.0180 (9)	0.0261 (10)	0.0234 (10)	0.0062 (8)	-0.0020 (7)	0.0011 (7)
C17	0.0248 (9)	0.0265 (10)	0.0226 (10)	0.0055 (8)	-0.0006 (8)	0.0059 (8)
C18	0.0241 (9)	0.0233 (9)	0.0223 (10)	0.0014 (8)	0.0031 (8)	0.0050 (7)
C19	0.0139 (7)	0.0185 (8)	0.0151 (9)	0.0014 (6)	-0.0007 (6)	-0.0034 (6)

### *Geometric parameters (Å, °)*

Sn1—N2	2.0821 (15)	C6—H6	0.9500
Sn1—C8	2.1573 (19)	C7—H7	0.9500
Sn1—C1	2.1604 (18)	C8—C9	1.502 (3)
Sn1—O1	2.2187 (12)	C8—H8A	0.9900
Sn1—C11	2.4836 (4)	C8—H8B	0.9900
O1—C15	1.333 (2)	C9—C14	1.392 (3)
N1—C19	1.343 (2)	C9—C10	1.396 (3)
N1—C18	1.370 (2)	C10—C11	1.384 (3)
N1—H1	0.878 (9)	C10—H10	0.9500
N2—C19	1.331 (2)	C11—C12	1.386 (3)
N2—H2	0.871 (9)	C11—H11	0.9500
C1—C2	1.500 (3)	C12—C13	1.383 (3)
C1—H1A	0.9900	C12—H12	0.9500
C1—H1B	0.9900	C13—C14	1.391 (3)
C2—C7	1.396 (3)	C13—H13	0.9500
C2—C3	1.396 (3)	C14—H14	0.9500
C3—C4	1.388 (3)	C15—C16	1.368 (3)
C3—H3	0.9500	C15—C19	1.438 (2)
C4—C5	1.386 (3)	C16—C17	1.417 (3)
C4—H4	0.9500	C16—H16	0.9500
C5—C6	1.386 (3)	C17—C18	1.352 (3)
C5—H5	0.9500	C17—H17	0.9500
C6—C7	1.389 (3)	C18—H18	0.9500
N2—Sn1—C8	109.18 (7)	C2—C7—H7	119.6
N2—Sn1—C1	108.13 (7)	C9—C8—Sn1	105.93 (12)
C8—Sn1—C1	141.43 (7)	C9—C8—H8A	110.6
N2—Sn1—O1	75.58 (5)	Sn1—C8—H8A	110.6
C8—Sn1—O1	89.40 (6)	C9—C8—H8B	110.6
C1—Sn1—O1	90.59 (6)	Sn1—C8—H8B	110.6
N2—Sn1—C11	88.21 (4)	H8A—C8—H8B	108.7
C8—Sn1—C11	95.23 (5)	C14—C9—C10	118.10 (18)
C1—Sn1—C11	95.36 (5)	C14—C9—C8	121.45 (17)
O1—Sn1—C11	163.77 (3)	C10—C9—C8	120.25 (17)
C15—O1—Sn1	113.14 (10)	C11—C10—C9	120.81 (18)
C19—N1—C18	122.68 (15)	C11—C10—H10	119.6
C19—N1—H1	114.7 (14)	C9—C10—H10	119.6
C18—N1—H1	122.6 (14)	C10—C11—C12	120.59 (19)
C19—N2—Sn1	116.32 (11)	C10—C11—H11	119.7

C19—N2—H2	117.0 (15)	C12—C11—H11	119.7
Sn1—N2—H2	125.7 (15)	C13—C12—C11	119.29 (19)
C2—C1—Sn1	106.34 (12)	C13—C12—H12	120.4
C2—C1—H1A	110.5	C11—C12—H12	120.4
Sn1—C1—H1A	110.5	C12—C13—C14	120.17 (19)
C2—C1—H1B	110.5	C12—C13—H13	119.9
Sn1—C1—H1B	110.5	C14—C13—H13	119.9
H1A—C1—H1B	108.7	C13—C14—C9	121.04 (19)
C7—C2—C3	118.06 (18)	C13—C14—H14	119.5
C7—C2—C1	121.07 (18)	C9—C14—H14	119.5
C3—C2—C1	120.77 (17)	O1—C15—C16	125.95 (16)
C4—C3—C2	121.08 (18)	O1—C15—C19	115.38 (15)
C4—C3—H3	119.5	C16—C15—C19	118.65 (16)
C2—C3—H3	119.5	C15—C16—C17	120.23 (17)
C5—C4—C3	120.27 (19)	C15—C16—H16	119.9
C5—C4—H4	119.9	C17—C16—H16	119.9
C3—C4—H4	119.9	C18—C17—C16	119.72 (18)
C6—C5—C4	119.25 (19)	C18—C17—H17	120.1
C6—C5—H5	120.4	C16—C17—H17	120.1
C4—C5—H5	120.4	C17—C18—N1	119.96 (17)
C5—C6—C7	120.60 (18)	C17—C18—H18	120.0
C5—C6—H6	119.7	N1—C18—H18	120.0
C7—C6—H6	119.7	N2—C19—N1	123.10 (15)
C6—C7—C2	120.73 (19)	N2—C19—C15	118.18 (15)
C6—C7—H7	119.6	N1—C19—C15	118.71 (16)
N2—Sn1—O1—C15	9.88 (12)	Sn1—C8—C9—C14	93.23 (18)
C8—Sn1—O1—C15	119.87 (12)	Sn1—C8—C9—C10	-81.55 (18)
C1—Sn1—O1—C15	-98.71 (12)	C14—C9—C10—C11	0.1 (3)
Cl1—Sn1—O1—C15	13.0 (2)	C8—C9—C10—C11	175.01 (17)
C8—Sn1—N2—C19	-94.25 (14)	C9—C10—C11—C12	0.6 (3)
C1—Sn1—N2—C19	75.77 (14)	C10—C11—C12—C13	-0.4 (3)
O1—Sn1—N2—C19	-10.04 (12)	C11—C12—C13—C14	-0.3 (3)
Cl1—Sn1—N2—C19	170.83 (13)	C12—C13—C14—C9	0.9 (3)
N2—Sn1—C1—C2	-1.11 (14)	C10—C9—C14—C13	-0.8 (3)
C8—Sn1—C1—C2	163.69 (12)	C8—C9—C14—C13	-175.65 (18)
O1—Sn1—C1—C2	73.91 (13)	Sn1—O1—C15—C16	170.06 (16)
Cl1—Sn1—C1—C2	-90.98 (12)	Sn1—O1—C15—C19	-8.36 (19)
Sn1—C1—C2—C7	85.78 (19)	O1—C15—C16—C17	-177.14 (17)
Sn1—C1—C2—C3	-90.42 (18)	C19—C15—C16—C17	1.2 (3)
C7—C2—C3—C4	-1.1 (3)	C15—C16—C17—C18	-1.6 (3)
C1—C2—C3—C4	175.23 (18)	C16—C17—C18—N1	0.2 (3)
C2—C3—C4—C5	0.6 (3)	C19—N1—C18—C17	1.7 (3)
C3—C4—C5—C6	0.4 (3)	Sn1—N2—C19—N1	-169.87 (13)
C4—C5—C6—C7	-0.8 (3)	Sn1—N2—C19—C15	9.3 (2)
C5—C6—C7—C2	0.3 (3)	C18—N1—C19—N2	177.05 (17)
C3—C2—C7—C6	0.7 (3)	C18—N1—C19—C15	-2.1 (3)
C1—C2—C7—C6	-175.64 (17)	O1—C15—C19—N2	-0.1 (2)
N2—Sn1—C8—C9	-8.06 (14)	C16—C15—C19—N2	-178.61 (17)
C1—Sn1—C8—C9	-172.75 (12)	O1—C15—C19—N1	179.10 (15)

## supplementary materials

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O1—Sn1—C8—C9	-82.56 (12)	C16—C15—C19—N1	0.6 (3)
Cl1—Sn1—C8—C9	81.86 (12)		

### *Hydrogen-bond geometry (Å, °)*

<i>D—H···A</i>	<i>D—H</i>	<i>H···A</i>	<i>D···A</i>	<i>D—H···A</i>
N1—H1···O1 <sup>i</sup>	0.88 (1)	1.87 (1)	2.726 (2)	165 (2)

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

Fig. 1

