

Jing Xiang,\* Qin Li and Ping Mei

College of Chemistry and Environmental  
Engineering, Yangtze University, Jingzhou  
434020, Hubei, People's Republic of China

Correspondence e-mail: g\_jingx@stu.edu.cn

## Key indicators

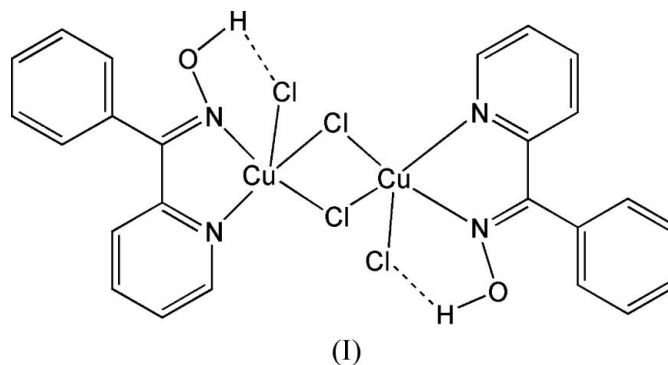
Single-crystal X-ray study  
 $T = 295$  K  
Mean  $\sigma(\text{C}-\text{C}) = 0.005$  Å  
 $R$  factor = 0.043  
 $wR$  factor = 0.113  
Data-to-parameter ratio = 18.5For details of how these key indicators were  
automatically derived from the article, see  
<http://journals.iucr.org/e>.Di- $\mu$ -chloro-bis[chloro(phenyl 2-pyridyl  
ketone oxime- $\kappa^2\text{N},\text{N}'$ )copper(II)]

The title complex,  $[\text{Cu}_2\text{Cl}_4(\text{C}_{12}\text{H}_{10}\text{N}_2\text{O})_2]$ , was synthesized by reacting phenyl 2-pyridyl ketone oxime with  $\text{CuCl}_2 \cdot 2\text{H}_2\text{O}$  in a basic medium. The organic ligand coordinates to the  $\text{Cu}^{\text{II}}$  ions through its N atoms, while the oxime O atom remains uncoordinated. The  $\text{Cl}^-$  ions play two roles: one is a terminal ligand and the other is a bridging ligand, the bridge being formed through a crystallographic inversion centre.

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## Comment

The ligand phenyl 2-pyridyl ketone oxime ( $L1$ ; Taga *et al.*, 1990) is of particular interest for the synthesis of metal-organic complexes, as the hydroxyl group may be deprotonated (Milios *et al.*, 2003). The title compound, (I), is a dinuclear  $\text{Cu}^{\text{II}}$  complex, formulated as  $\text{Cu}_2(\text{L}1)_2\text{Cl}_4$ . It was synthesized in a basic NaOH medium (see *Experimental*) and its X-ray crystal structure determined.



In compound (I),  $L1$  acts as a bidentate chelating ligand. The asymmetric unit contains a monomeric  $\text{CuLCl}_2$  moiety with an inversion centre at the mid-point of the  $\text{Cu}\cdots\text{Cu}$  vector. Monomeric units are linked through a long  $\text{Cu}-\text{Cl}1$  bond (Fig. 1 and Table 1). The resulting coordination geometry for the metallic centre is a distorted square pyramid, with atoms N1, N2, Cl2 and Cl1<sup>i</sup> forming the base of the pyramid and atom Cl1 occupying the apical position [symmetry code: (i)  $-x, 1-y, -z$ ]. The  $L1$  ligand is bidentate through its pyridine and imine N atoms, while atom O1 does not participate in the coordination. The  $\text{Cu}1-\text{N}1$  bond is slightly shorter than  $\text{Cu}1-\text{N}2$  (Table 1). The  $\text{C}1-\text{C}6$  phenyl ring forms a dihedral angle of  $51.9(1)^\circ$  with the non-H atoms of the pyridyl/oxime/ $\text{CuCl}_2$  group ( $\text{O}1/\text{N}1/\text{N}2/\text{C}7-\text{C}12/\text{Cu}1/\text{Cl}1^i/\text{Cl}2$ ).

The central  $(\mu_2-\text{Cl})_2\text{Cu}_2$  four-membered ring is planar by symmetry and the metal $\cdots$ metal separation is  $3.442(1)$  Å. The OH group forms a short intramolecular hydrogen bond

with atom Cl2 (Table 2), giving a five-membered ring, Cu1/N1/O1/H1/Cl2 (Fig. 1).

## Experimental

The ligand *L1* was synthesized according to a reported procedure, as yellow block crystals (Taga *et al.*, 1990). Treatment of a methanolic solution (30 ml) of copper chloride dihydrate (2 mmol, 0.34 g) and *L1* (2 mmol, 0.39 g) in the presence of NaOH (4 mmol) led to dark-green block crystals of (I) suitable for X-ray crystal structure analysis. Analysis, found: C 43.26, H 3.10, N 8.50%; calculated for C<sub>24</sub>H<sub>20</sub>Cl<sub>4</sub>Cu<sub>2</sub>N<sub>4</sub>O<sub>2</sub>: C 43.32, H 3.03, N 8.42%.

### Crystal data

[Cu <sub>2</sub> Cl <sub>4</sub> (C <sub>12</sub> H <sub>10</sub> N <sub>2</sub> O) <sub>2</sub> ]	<i>Z</i> = 2
<i>M<sub>r</sub></i> = 665.34	<i>D<sub>x</sub></i> = 1.676 Mg m <sup>-3</sup>
Monoclinic, <i>P</i> 2 <sub>1</sub> / <i>c</i>	Mo <i>K</i> α radiation
<i>a</i> = 10.3137 (14) Å	<i>μ</i> = 2.05 mm <sup>-1</sup>
<i>b</i> = 13.8137 (18) Å	<i>T</i> = 295 (2) K
<i>c</i> = 9.4334 (13) Å	Block, dark green
<i>β</i> = 101.218 (2)°	0.32 × 0.26 × 0.20 mm
<i>V</i> = 1318.3 (3) Å <sup>3</sup>	

### Data collection

Bruker APEX area-detector diffractometer	8038 measured reflections
<i>φ</i> and <i>ω</i> scans	3010 independent reflections
Absorption correction: multi-scan ( <i>SADABS</i> ; Bruker, 2002)	2569 reflections with <i>I</i> > 2σ( <i>I</i> )
<i>T<sub>min</sub></i> = 0.533, <i>T<sub>max</sub></i> = 0.664	<i>R<sub>int</sub></i> = 0.022
	<i>θ<sub>max</sub></i> = 27.9°

### Refinement

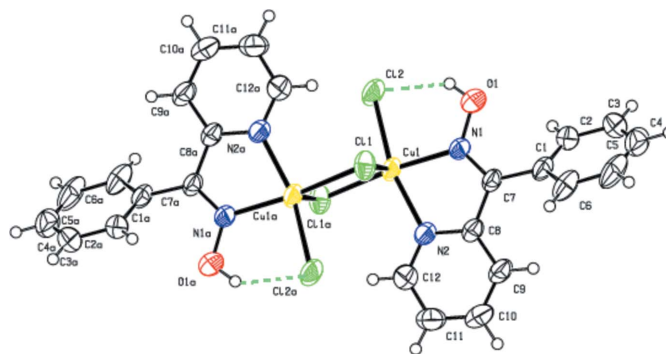
Refinement on <i>F</i> <sup>2</sup>	$w = 1/[\sigma^2(F_o^2) + (0.0569P)^2 + 0.7387P]$
$R[F^2 > 2\sigma(F^2)] = 0.043$	where $P = (F_o^2 + 2F_c^2)/3$
$wR(F^2) = 0.113$	( $\Delta/\sigma$ ) <sub>max</sub> < 0.001
<i>S</i> = 1.08	$\Delta\rho_{max} = 0.65 \text{ e } \text{Å}^{-3}$
3010 reflections	$\Delta\rho_{min} = -0.31 \text{ e } \text{Å}^{-3}$
163 parameters	
H-atom parameters constrained	

**Table 1**

Selected geometric parameters (Å, °).

Cu1—N1	2.001 (2)	Cu1—Cl2	2.2620 (9)
Cu1—N2	2.027 (2)	Cu1—Cl1	2.6977 (9)
Cu1—Cl1 <sup>i</sup>	2.2513 (8)		
N1—Cu1—N2	78.15 (10)	Cl1 <sup>i</sup> —Cu1—Cl2	94.76 (3)
N1—Cu1—Cl1 <sup>i</sup>	171.11 (8)	N1—Cu1—Cl1	94.91 (8)
N2—Cu1—Cl1 <sup>i</sup>	96.46 (8)	N2—Cu1—Cl1	92.62 (7)
N1—Cu1—Cl2	89.25 (7)	Cl1 <sup>i</sup> —Cu1—Cl1	92.37 (3)
N2—Cu1—Cl2	164.09 (7)	Cl2—Cu1—Cl1	98.16 (3)

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



**Figure 1**

A plot of (I). Displacement ellipsoids are drawn at the 30% probability level and H atoms are shown as spheres of arbitrary radii. Dashed lines indicate hydrogen bonds. Atoms labelled with the suffix a are at the symmetry position ( $-x, 1 - y, -z$ ).

**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>
O1—H1···Cl2	0.82	2.32	2.954 (3)	135

H atoms were placed in calculated positions and included in the refinement using a riding-model approximation, with C—H = 0.93 Å and O—H = 0.82 Å, and with  $U_{iso}(H) = 1.2U_{eq}(C)$  or  $1.5U_{eq}(O)$ .

Data collection: *SMART* (Bruker, 2002); cell refinement: *SMART*; data reduction: *SAINT* (Bruker, 2002); program(s) used to solve structure: *SHELXS97* (Sheldrick, 1997); program(s) used to refine structure: *SHELXL97* (Sheldrick, 1997); molecular graphics: *ORTEPII* (Johnson, 1976); software used to prepare material for publication: *SHELXL97*.

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