

## 2-(4-Hydroxybiphenyl-3-yl)isoindolin-1-one

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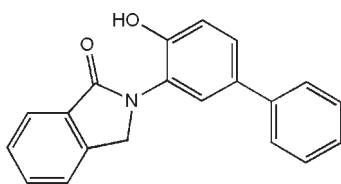
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Key indicators: single-crystal X-ray study;  $T = 294$  K; mean  $\sigma(\text{C}-\text{C}) = 0.003$  Å;  $R$  factor = 0.031;  $wR$  factor = 0.077; data-to-parameter ratio = 8.0.

In the molecular structure of the title compound,  $\text{C}_{20}\text{H}_{15}\text{NO}_2$ , the isoindolin-1-one unit is planar, the maximum atomic deviation being 0.048 (2) Å. The two biphenyl rings are twisted with respect to the isoindolin-1-one plane, making dihedral angles of 33.21 (9) and 33.34 (9)°. The two benzene rings of the biphenyl substituent are oriented at a dihedral angle of 35.43 (11)° to each other. An intramolecular O—H···O interaction occurs and intermolecular C—H···O hydrogen bonding is present in the crystal structure.

### Related literature

For the biological activity of isoindolin-1-ones, see: Nozawa *et al.* (1997); Atack *et al.* (2006); Lunn *et al.* (2004). For the reaction conditions for the synthesis of the title compound, see: Wu *et al.* (2007). For the palladium-catalysed intramolecular decarbonylative coupling mechanism, see: Baudoin (2007).



### Experimental

#### Crystal data

$\text{C}_{20}\text{H}_{15}\text{NO}_2$   
 $M_r = 301.33$   
Tetragonal,  $P4_32_12$   
 $a = 7.5123$  (2) Å  
 $c = 52.3543$  (17) Å  
 $V = 2954.60$  (15) Å<sup>3</sup>

$Z = 8$   
Cu  $K\alpha$  radiation  
 $\mu = 0.70$  mm<sup>-1</sup>  
 $T = 294$  K  
0.32 × 0.22 × 0.20 mm

#### Data collection

Rigaku R-Axis RAPID IP diffractometer  
Absorption correction: multi-scan (ABSCOR; Higashi, 1995)  
 $T_{\min} = 0.822$ ,  $T_{\max} = 0.900$   
10482 measured reflections  
1676 independent reflections  
1556 reflections with  $I > 2\sigma(I)$   
 $R_{\text{int}} = 0.041$

#### Refinement

$R[F^2 > 2\sigma(F^2)] = 0.031$   
 $wR(F^2) = 0.077$   
 $S = 1.08$   
1676 reflections  
210 parameters  
H-atom parameters constrained  
 $\Delta\rho_{\max} = 0.16$  e Å<sup>-3</sup>  
 $\Delta\rho_{\min} = -0.15$  e Å<sup>-3</sup>

**Table 1**

Hydrogen-bond geometry (Å, °).

D—H···A	D—H	H···A	D···A	D—H···A
O2—H2···O1	0.82	1.79	2.575 (2)	162
C20—H20···O1 <sup>1</sup>	0.93	2.37	3.283 (3)	168

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

Data collection: *PROCESS-AUTO* (Rigaku, 1998); cell refinement: *PROCESS-AUTO*; data reduction: *CrystalStructure* (Rigaku/MSK, 2002); program(s) used to solve structure: *SIR92* (Altomare *et al.*, 1993); program(s) used to refine structure: *SHELXL97* (Sheldrick, 2008); molecular graphics: *ORTEP-3 for Windows* (Farrugia, 1997); software used to prepare material for publication: *WinGX* (Farrugia, 1999).

This work was supported by a research grant from the Natural Science Foundation of China (grant No. 20672092). Professor Wei-Min Dai is thanked for his valuable suggestions. Mr Ji-Yong Liu of the X-ray crystallography facility of Zhejiang University is acknowledged for his assistance with the crystal structural analysis.

Supplementary data and figures for this paper are available from the IUCr electronic archives (Reference: XU2719).

### References

- Altomare, A., Cascarano, G., Giacovazzo, C. & Guagliardi, A. (1993). *J. Appl. Cryst.* **26**, 343–350.
- Atack, J. R., Pike, A., Marshall, G., Stanley, J., Lincoln, R., Cook, S. M., Lewis, R. T., Blackaby, W. P., Goodacre, S. C., McKernan, R. M., Dawson, G. R., Wafford, K. A. & Reynolds, D. S. (2006). *Neuropharmacology*, **50**, 677–689.
- Baudoin, O. (2007). *Angew. Chem. Int. Ed.* **46**, 1373–1375.
- Farrugia, L. J. (1997). *J. Appl. Cryst.* **30**, 565.
- Farrugia, L. J. (1999). *J. Appl. Cryst.* **32**, 837–838.
- Higashi, T. (1995). *ABSCOR*. Rigaku Corporation, Tokyo, Japan.
- Lunn, M. R., Root, D. E., Martino, A. M., Flaherty, S. P., Kelley, B. P., Coovert, D. D., Burghes, A. H., Man, N., Morris, G. E., Zhou, J., Androphy, E. J., Sumner, C. J. & Stockwell, B. R. (2004). *Chem. Biol.* **11**, 1489–1493.
- Nozawa, Y., Yamamoto, K., Ito, M., Sakai, N., Mizoue, K., Mizobe, F. & Hanada, K. (1997). *J. Antibiot.* **50**, 635–640.
- Rigaku (1998). *PROCESS-AUTO*. Rigaku Corporation, Tokyo, Japan.
- Rigaku/MSK (2002). *CrystalStructure*. Rigaku/MSK, The Woodlands, Texas, USA.
- Sheldrick, G. M. (2008). *Acta Cryst.* **A64**, 112–122.
- Wu, J., Nie, L. & Dai, W.-M. (2007). *Synlett*, pp. 2728–2732.

**supplementary materials**

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## 2-(4-Hydroxybiphenyl-3-yl)isoindolin-1-one

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### Comment

The title compound is a derivative of isoindolin-1-ones, which has been reported to deliver various biological activities such as neuritogenic activity (Nozawa *et al.*, 1997); anxiolytic activity (Atack *et al.*, 2006), survival motor neuron (SMN)-reporter upregulation activity (Lunn *et al.*, 2004). In our laboratory the crystals of title compound was obtained unexpectedly when 4-(2'-bromobenzyl)-6-phenylbenz[1,4]oxazine-2,3-dione was subjected to the palladium-catalyzed intramolecular direct arylation (Wu *et al.*, 2007). It seems that the substrate underwent an intramolecular decarbonylative coupling under the palladium-catalyzed conditions (Baudoin, 2007). The structure of the title compound has been characterized by spectroscopic methods with further confirmation by X-ray analysis. We report here its crystal structure.

In the molecular structure of the title compound, there are one biphenyl moiety and one isoindolin-1-one linked through C11—N1 single bond (Fig. 1). The isoindolin-1-one moiety has a coplanar structure, the maximum atomic deviation being 0.048 (2) Å. Two phenyl rings are twisted with respect to the isoindolin-1-one plane with dihedral angles of 33.21 (9) and 33.34 (9)°, respectively. The two phenyl rings are oriented at 35.43 (11)°. The O—H···O and C—H···O hydrogen bonding is present in the crystal structure (Table 1).

### Experimental

A 10 mL flask was charged with Pd(OAc)<sub>2</sub> (6.7 mg, 0.03 mmol), 1,1'-bis(diphenylphosphino)ferrocene (dppf) (16.6 mg, 0.03 mmol), and K<sub>2</sub>CO<sub>3</sub> (83.0 mg, 0.6 mmol). The loaded flask was evacuated and backfilled with N<sub>2</sub> (repeated for three times). To the degassed flask was added a solution of 4-(2'-bromobenzyl)-6-phenylbenz[1,4]oxazine-2,3-dione (122.4 mg, 0.3 mmol) in degassed DMA (3 mL). The resultant mixture was heated at 393 K for 2 h under a nitrogen atmosphere. After cooling to room temperature, the reaction was quenched by adding CH<sub>2</sub>Cl<sub>2</sub> (20 mL), and the resultant mixture was washing with H<sub>2</sub>O (3 × 10 mL) to remove DMA. The organic layer was washed with brine, dried over anhydrous Na<sub>2</sub>SO<sub>4</sub>, filtrated, and concentrated under reduced pressure. The residue was purified by column chromatography over silica gel with elution by 20% EtOAc in petroleum ether (333–363 K) to give 2-(4'-hydroxybiphenyl-3'-yl)isoindolin-1-one (70.0 mg, 78%), m.p. 453–454 K (CH<sub>2</sub>Cl<sub>2</sub>-hexane). Single crystals suitable for X-ray diffraction of the title compound were grown in the mixed solvent of CH<sub>2</sub>Cl<sub>2</sub> and hexane.

### Refinement

H atoms were placed in calculated positions with C—H = 0.93–0.97 and O—H = 0.82 Å, and included in the refinement in riding model with  $U_{\text{iso}}(\text{H}) = 1.2U_{\text{eq}}(\text{C})$  and  $1.5U_{\text{eq}}(\text{O})$ . As no significant anomalous scattering effects were observed, Friedel pairs were merged.

## Figures

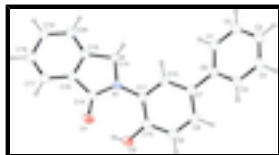


Fig. 1. The molecular structure of (I). Displacement ellipsoids are drawn at 40% probability level and H atoms are shown as small circles of arbitrary radii.

## 2-(4-Hydroxybiphenyl-3-yl)isoindolin-1-one

### Crystal data

$C_{20}H_{15}NO_2$

$M_r = 301.33$

Tetragonal,  $P4_32_12$

Hall symbol: P 4nw 2abw

$a = 7.5123 (2) \text{ \AA}$

$c = 52.3543 (17) \text{ \AA}$

$V = 2954.60 (15) \text{ \AA}^3$

$Z = 8$

$F(000) = 1264$

$D_x = 1.355 \text{ Mg m}^{-3}$

Cu  $K\alpha$  radiation,  $\lambda = 1.54184 \text{ \AA}$

Cell parameters from 3246 reflections

$\theta = 3.5\text{--}65.0^\circ$

$\mu = 0.70 \text{ mm}^{-1}$

$T = 294 \text{ K}$

Prism, colorless

$0.32 \times 0.22 \times 0.20 \text{ mm}$

### Data collection

Rigaku R-Axis RAPID IP  
diffractometer

Radiation source: fine-focus sealed tube  
graphite

Detector resolution:  $10.0 \text{ pixels mm}^{-1}$

$\omega$  scans

Absorption correction: multi-scan  
(ABSCOR; Higashi, 1995)

$T_{\min} = 0.822$ ,  $T_{\max} = 0.900$

10482 measured reflections

1676 independent reflections

1556 reflections with  $I > 2\sigma(I)$

$R_{\text{int}} = 0.041$

$\theta_{\max} = 67.1^\circ$ ,  $\theta_{\min} = 3.4^\circ$

$h = -8 \rightarrow 8$

$k = -8 \rightarrow 8$

$l = -56 \rightarrow 61$

### Refinement

Refinement on  $F^2$

Least-squares matrix: full

$R[F^2 > 2\sigma(F^2)] = 0.031$

$wR(F^2) = 0.077$

$S = 1.08$

1676 reflections

210 parameters

Secondary atom site location: difference Fourier map

Hydrogen site location: inferred from neighbouring sites

H-atom parameters constrained

$w = 1/[\sigma^2(F_o^2) + (0.0383P)^2 + 0.7354P]$

where  $P = (F_o^2 + 2F_c^2)/3$

$(\Delta/\sigma)_{\max} = 0.001$

$\Delta\rho_{\max} = 0.16 \text{ e \AA}^{-3}$

$\Delta\rho_{\min} = -0.15 \text{ e \AA}^{-3}$

0 restraints

Extinction correction: SHELXL97 (Sheldrick, 2008),

$$F_c^* = kFc[1+0.001xFc^2\lambda^3/\sin(2\theta)]^{-1/4}$$

Primary atom site location: structure-invariant direct methods

Extinction coefficient: 0.00108 (16)

### 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  $F^2 > \sigma(F^2)$  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>	$U_{\text{iso}}^*/U_{\text{eq}}$
O1	1.19213 (19)	0.1923 (2)	0.94864 (3)	0.0332 (4)
O2	1.2708 (2)	-0.0751 (2)	0.92001 (2)	0.0343 (4)
H2	1.2642	0.0021	0.9310	0.052*
N1	0.9322 (2)	0.1133 (2)	0.92751 (3)	0.0227 (4)
C1	0.6483 (3)	0.0856 (3)	0.83609 (4)	0.0298 (5)
H1	0.5924	0.0596	0.8515	0.036*
C2	0.5463 (3)	0.1296 (3)	0.81496 (4)	0.0349 (5)
H2A	0.4229	0.1325	0.8163	0.042*
C3	0.6272 (3)	0.1694 (3)	0.79190 (4)	0.0348 (5)
H3	0.5589	0.2004	0.7778	0.042*
C4	0.8105 (3)	0.1625 (3)	0.79011 (3)	0.0326 (5)
H4	0.8655	0.1875	0.7746	0.039*
C5	0.9131 (3)	0.1186 (3)	0.81118 (3)	0.0282 (5)
H5	1.0364	0.1150	0.8097	0.034*
C6	0.8337 (3)	0.0797 (3)	0.83461 (3)	0.0239 (4)
C7	0.9453 (3)	0.0361 (3)	0.85723 (3)	0.0242 (4)
C8	1.1044 (3)	-0.0590 (3)	0.85490 (3)	0.0282 (5)
H8	1.1399	-0.1008	0.8390	0.034*
C9	1.2093 (3)	-0.0914 (3)	0.87605 (4)	0.0297 (5)
H9	1.3153	-0.1539	0.8741	0.036*
C10	1.1605 (3)	-0.0328 (3)	0.90024 (3)	0.0266 (5)
C11	0.9992 (3)	0.0590 (3)	0.90309 (3)	0.0232 (4)
C12	0.8957 (3)	0.0937 (3)	0.88161 (3)	0.0231 (4)
H12	0.7902	0.1572	0.8835	0.028*
C13	1.0282 (3)	0.1716 (3)	0.94795 (3)	0.0252 (4)
C14	0.7394 (3)	0.1129 (3)	0.93267 (3)	0.0232 (4)
H14A	0.6893	-0.0053	0.9306	0.028*
H14B	0.6770	0.1950	0.9215	0.028*
C15	0.7311 (3)	0.1730 (3)	0.96011 (3)	0.0224 (4)

## supplementary materials

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C16	0.9020 (3)	0.2040 (3)	0.96878 (3)	0.0236 (4)
C17	0.9354 (3)	0.2596 (3)	0.99368 (3)	0.0282 (5)
H17	1.0510	0.2791	0.9994	0.034*
C18	0.7913 (3)	0.2848 (3)	1.00959 (3)	0.0295 (5)
H18	0.8097	0.3196	1.0264	0.035*
C19	0.6183 (3)	0.2586 (3)	1.00072 (4)	0.0289 (5)
H19	0.5228	0.2788	1.0116	0.035*
C20	0.5861 (3)	0.2026 (3)	0.97573 (3)	0.0272 (4)
H20	0.4706	0.1857	0.9698	0.033*

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

	$U^{11}$	$U^{22}$	$U^{33}$	$U^{12}$	$U^{13}$	$U^{23}$
O1	0.0203 (8)	0.0453 (10)	0.0340 (7)	-0.0038 (7)	-0.0027 (6)	-0.0023 (7)
O2	0.0300 (8)	0.0425 (10)	0.0305 (7)	0.0109 (7)	-0.0058 (6)	0.0042 (6)
N1	0.0195 (8)	0.0270 (9)	0.0216 (7)	-0.0004 (7)	-0.0002 (6)	0.0013 (6)
C1	0.0282 (11)	0.0328 (12)	0.0283 (9)	-0.0004 (9)	0.0017 (8)	-0.0037 (9)
C2	0.0233 (11)	0.0391 (13)	0.0423 (11)	0.0032 (9)	-0.0050 (9)	-0.0101 (10)
C3	0.0365 (13)	0.0347 (13)	0.0332 (10)	0.0021 (10)	-0.0129 (9)	-0.0059 (9)
C4	0.0382 (13)	0.0369 (13)	0.0226 (9)	-0.0042 (10)	-0.0041 (9)	-0.0032 (9)
C5	0.0257 (11)	0.0323 (12)	0.0265 (9)	-0.0009 (9)	-0.0011 (8)	-0.0033 (8)
C6	0.0245 (10)	0.0211 (10)	0.0260 (9)	0.0004 (8)	-0.0004 (8)	-0.0057 (8)
C7	0.0247 (11)	0.0224 (10)	0.0255 (9)	-0.0019 (8)	0.0021 (8)	-0.0001 (8)
C8	0.0296 (11)	0.0277 (11)	0.0274 (9)	0.0031 (10)	0.0052 (8)	-0.0017 (8)
C9	0.0265 (12)	0.0291 (11)	0.0336 (9)	0.0065 (9)	0.0043 (9)	0.0014 (9)
C10	0.0226 (11)	0.0268 (11)	0.0302 (9)	0.0014 (8)	0.0004 (8)	0.0042 (8)
C11	0.0246 (10)	0.0218 (10)	0.0232 (9)	-0.0019 (8)	0.0031 (7)	0.0013 (8)
C12	0.0204 (10)	0.0231 (10)	0.0259 (9)	0.0004 (8)	0.0005 (7)	0.0000 (8)
C13	0.0233 (11)	0.0255 (11)	0.0268 (9)	-0.0021 (8)	-0.0037 (8)	0.0032 (8)
C14	0.0208 (10)	0.0281 (10)	0.0206 (8)	-0.0015 (8)	-0.0006 (7)	0.0010 (7)
C15	0.0265 (11)	0.0205 (10)	0.0202 (8)	-0.0014 (8)	-0.0026 (7)	0.0035 (7)
C16	0.0244 (10)	0.0220 (10)	0.0245 (8)	-0.0004 (8)	-0.0009 (8)	0.0014 (8)
C17	0.0292 (11)	0.0268 (11)	0.0286 (9)	-0.0015 (9)	-0.0072 (8)	-0.0027 (8)
C18	0.0388 (12)	0.0278 (11)	0.0218 (8)	0.0020 (9)	-0.0041 (8)	-0.0015 (8)
C19	0.0303 (11)	0.0313 (12)	0.0253 (8)	0.0021 (9)	0.0029 (8)	0.0000 (9)
C20	0.0234 (11)	0.0319 (12)	0.0263 (8)	-0.0008 (9)	-0.0012 (8)	0.0032 (8)

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

O1—C13	1.242 (3)	C8—H8	0.9300
O2—C10	1.363 (2)	C9—C10	1.390 (3)
O2—H2	0.8200	C9—H9	0.9300
N1—C13	1.363 (2)	C10—C11	1.402 (3)
N1—C11	1.433 (2)	C11—C12	1.393 (3)
N1—C14	1.474 (3)	C12—H12	0.9300
C1—C2	1.386 (3)	C13—C16	1.466 (3)
C1—C6	1.396 (3)	C14—C15	1.507 (2)
C1—H1	0.9300	C14—H14A	0.9700
C2—C3	1.384 (3)	C14—H14B	0.9700

C2—H2A	0.9300	C15—C20	1.380 (3)
C3—C4	1.381 (3)	C15—C16	1.382 (3)
C3—H3	0.9300	C16—C17	1.392 (3)
C4—C5	1.386 (3)	C17—C18	1.379 (3)
C4—H4	0.9300	C17—H17	0.9300
C5—C6	1.395 (3)	C18—C19	1.394 (3)
C5—H5	0.9300	C18—H18	0.9300
C6—C7	1.487 (3)	C19—C20	1.396 (3)
C7—C8	1.398 (3)	C19—H19	0.9300
C7—C12	1.398 (3)	C20—H20	0.9300
C8—C9	1.381 (3)		
C10—O2—H2	109.5	C12—C11—C10	119.27 (17)
C13—N1—C11	127.30 (17)	C12—C11—N1	118.10 (17)
C13—N1—C14	112.13 (15)	C10—C11—N1	122.59 (16)
C11—N1—C14	120.56 (15)	C11—C12—C7	122.03 (18)
C2—C1—C6	121.00 (19)	C11—C12—H12	119.0
C2—C1—H1	119.5	C7—C12—H12	119.0
C6—C1—H1	119.5	O1—C13—N1	126.02 (18)
C3—C2—C1	120.3 (2)	O1—C13—C16	126.79 (18)
C3—C2—H2A	119.8	N1—C13—C16	107.19 (17)
C1—C2—H2A	119.8	N1—C14—C15	102.41 (15)
C4—C3—C2	119.3 (2)	N1—C14—H14A	111.3
C4—C3—H3	120.4	C15—C14—H14A	111.3
C2—C3—H3	120.4	N1—C14—H14B	111.3
C3—C4—C5	120.6 (2)	C15—C14—H14B	111.3
C3—C4—H4	119.7	H14A—C14—H14B	109.2
C5—C4—H4	119.7	C20—C15—C16	120.77 (16)
C4—C5—C6	120.8 (2)	C20—C15—C14	130.21 (18)
C4—C5—H5	119.6	C16—C15—C14	108.99 (16)
C6—C5—H5	119.6	C15—C16—C17	121.75 (18)
C5—C6—C1	117.99 (18)	C15—C16—C13	109.17 (15)
C5—C6—C7	120.34 (18)	C17—C16—C13	129.07 (19)
C1—C6—C7	121.66 (18)	C18—C17—C16	117.72 (19)
C8—C7—C12	117.76 (17)	C18—C17—H17	121.1
C8—C7—C6	121.68 (16)	C16—C17—H17	121.1
C12—C7—C6	120.54 (18)	C17—C18—C19	120.76 (17)
C9—C8—C7	120.55 (17)	C17—C18—H18	119.6
C9—C8—H8	119.7	C19—C18—H18	119.6
C7—C8—H8	119.7	C18—C19—C20	121.11 (19)
C8—C9—C10	121.62 (19)	C18—C19—H19	119.4
C8—C9—H9	119.2	C20—C19—H19	119.4
C10—C9—H9	119.2	C15—C20—C19	117.84 (19)
O2—C10—C9	117.24 (18)	C15—C20—H20	121.1
O2—C10—C11	123.97 (17)	C19—C20—H20	121.1
C9—C10—C11	118.74 (18)		

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

$D-H\cdots A$	$D-H$	$H\cdots A$	$D\cdots A$	$D-H\cdots A$
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## supplementary materials

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O2—H2…O1	0.82	1.79	2.575 (2)	162
C20—H20…O1 <sup>i</sup>	0.93	2.37	3.283 (3)	168

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



Fig. 1

