Acta Crystallographica Section E
Structure Reports Online
ISSN 1600-5368

N-Benzylindole-2,3-dione (*N*-benzylisatin)

Mehmet Akkurt,[a]* Sevim Türktekin,[a] Ali Asghar Jarrahpour,[b] Dariush Khalili[b] and Orhan Büyükgüngör[c]

[a]Department of Physics, Faculty of Arts and Sciences, Erciyes University, 38039 Kayseri, Turkey, [b]Department of Chemistry, College of Sciences, Shiraz University, 71454 Shiraz, Iran, and [c]Department of Physics, Faculty of Arts and Sciences, Ondokuz Mayıs University, 55139 Samsun, Turkey

Correspondence e-mail: akkurt@erciyes.edu.tr

Key indicators

Single-crystal X-ray study
T = 296 K
Mean σ(C–C) = 0.002 Å
R factor = 0.039
wR factor = 0.099
Data-to-parameter ratio = 13.9

For details of how these key indicators were automatically derived from the article, see http://journals.iucr.org/e.

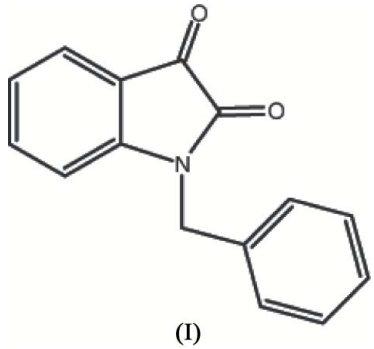
© 2006 International Union of Crystallography
All rights reserved

Received 20 March 2006
Accepted 21 March 2006.

The title molecule, $C_{15}H_{11}NO_2$, is non-planar, the dihedral angle between the isatin group and the phenyl ring being 87.08 (5)°. The crystal structure is stabilized by C–H···O hydrogen bonding interactions.

Comment

Isatin is an endogenous indole present in mammalian tissues and fluids (Igosheva *et al.*, 2004). It has a distinct and discontinuous distribution in rat brain and other tissues; highest concentrations in the brain have been found in the hippocampus (about 0.1 μg/ml) and cerebellum (Watkins *et al.*, 1990). Isatin has shown a wide variety of biological activity on the central nervous system (Glover *et al.*, 1988), such as anticonvulsant (Bhattacharya & Chakraborti, 1998; Bhattacharya, 1988), anxiogenic (Palit *et al.*, 1997; Medvedev *et al.*, 1992) and antiviral activity (Webber *et al.*, 1996; Chen *et al.*, 2005). Thus, isatin is a biologically validated starting point for the design and synthesis of chemical libraries directed at these targets. *N*-Alkylated isatins have interesting pharmacological activities such as antibacterial, antiviral (Garden *et al.*, 1998; Bauer & Sadler, 1960; Skiles & McNeil, 1990) and anticancer (Chazeau *et al.*, 1992) and are reversible and competitive inhibitors of monoamine oxidase A and B (Medvedev *et al.*, 1995). Mach and his coworkers (Chu *et al.*, 2005) have reported that *N*-benzylisatin sulfonamide analogues have potent caspase-3 inhibitor activity. Recently, it has been found that certain isatin compounds are potent inhibitors against rhinovirus 3C protease (Webber *et al.*, 1996). The isatin scaffold with derivatization may provide a good candidate for the SARS CoV 3CLpro inhibitor because both of the proteases (human SARS CoV and rhinovirus) are cysteine protease and structurally similar at the active site (Chen *et al.*, 2005).



(I)

The molecular structure of (I) is shown in Fig. 1. The values of the geometric parameters of (I) are within normal ranges, within experimental error. The isatin group in (I) is almost

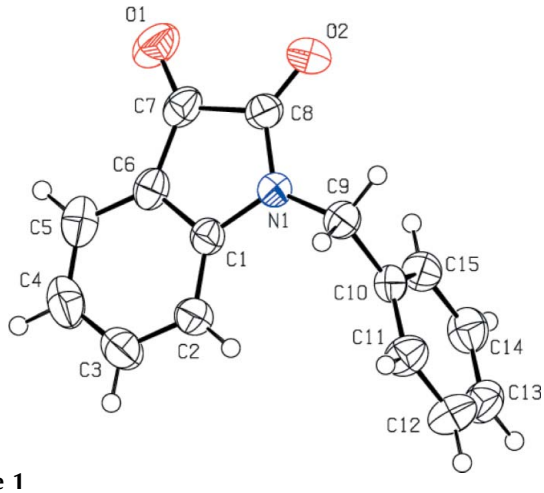


Figure 1
An *ORTEP-3* drawing of (I), with the atom-numbering scheme and 50% probability displacement ellipsoids.

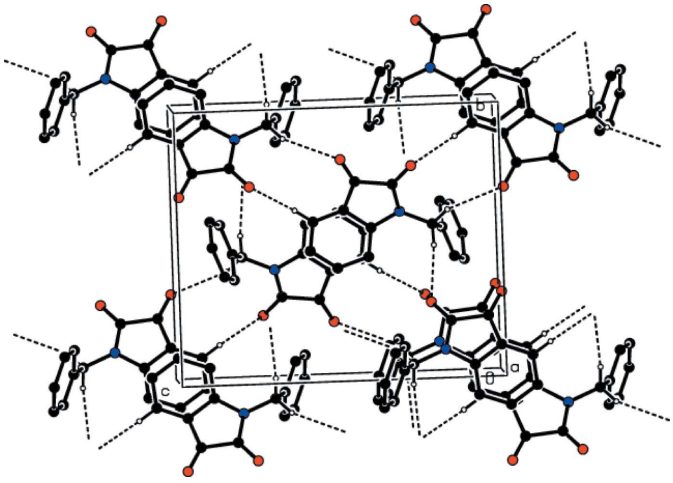


Figure 2
Packing of (I), projected on to the *bc* plane. H atoms have been omitted for clarity, except for those involved in hydrogen-bonding (dashed lines) interactions.

planar, with a maximum deviation of 0.058 (1) for atom O2. The planes of the isatin group and the phenyl ring make a dihedral angle of 87.08 (5)°.

The crystal structure of (I) is stabilized by inter- and intramolecular C—H···O hydrogen-bonding interactions (Table 1 and Fig. 2).

Experimental

Isatin (2.0 g, 13.6 mmol) and powdered calcium hydride (1.91 g, 45.3 mmol) were combined in DMF (23 ml) and the solution/suspension stirred with gentle warming (313–323 K). After approximately 30 min., benzyl bromide (2.43 ml, 20.4 mmol) was added and the reaction either allowed to proceed at room temperature or gently warmed until TLC indicated complete consumption of the starting material. The reaction mixture was poured into an aqueous solution, acidified with 0.2*M* HCl, 10% sodium chloride solution (226 ml) and extracted with ethyl acetate (3 × 110 ml). The combined ethyl acetate solution was then dried over anhydrous Na_2SO_4, filtered and evaporated. The crude benzylisatin was purified by column chromatography and recrystallized from ethyl acetate (3.16 g, 98%) m.p. 399 K (Lit: 404 K). The infrared spectrum of benzylisatin in KBr pellets showed the expected characteristic bands of ketone and amide groups at 1614 and 1732 respectively. The ^{1}H NMR spectrum of this compound showed a singlet at 4.98 for the methylene group. The aromatic protons appeared as a multiplet at 6.76–7.62. The ^{13}C NMR spectrum showed a peak at 44.40 for the methylene group. The carbonyl groups of this compound appeared at 158.66 and 183.63 p.p.m. for the amide and the ketone groups, respectively.

Crystal data

$C_{15}H_{11}NO_2$
M_r = 237.25
Monoclinic, $P2_1/c$
a = 7.610 (3) Å
b = 11.311 (2) Å
c = 13.422 (4) Å
β = 90.16 (3)°
V = 1155.3 (6) Å^3
Z = 4
D_x = 1.364 Mg m^{-3}
Mo $K\alpha$ radiation
Cell parameters from 20339 reflections
θ = 2.4–28.0°
μ = 0.09 mm^{-1}
T = 296 K
Prism, red
0.62 × 0.56 × 0.49 mm

Data collection

STOE IPDS 2 diffractometer
ω scans
Absorption correction: integration (*X-RED32*; Stoe & Cie, 2002)
T_{min} = 0.946, T_{max} = 0.957
7903 measured reflections
2266 independent reflections
1948 reflections with $I > 2\sigma(I)$
R_{int} = 0.025
θ_{max} = 26.0°
$h = -9 \rightarrow 9$
$k = -13 \rightarrow 13$
$l = -16 \rightarrow 16$

Refinement

Refinement on F^2
$R[F^2 > 2\sigma(F^2)]$ = 0.039
$wR(F^2)$ = 0.099
S = 1.07
2266 reflections
163 parameters
H-atom parameters constrained
$w = 1/[\sigma^2(F_o^2) + (0.0485P)^2 + 0.2006P]$ where $P = (F_o^2 + 2F_c^2)/3$
$(\Delta/\sigma)_{max} < 0.001$
$\Delta\rho_{max}$ = 0.12 e Å^{-3}
$\Delta\rho_{min}$ = −0.20 e Å^{-3}

Table 1
Selected geometric parameters (Å, °).

O1—C7	1.2061 (18)	N1—C8	1.3595 (17)
O2—C8	1.2091 (17)	N1—C9	1.4599 (17)
N1—C1	1.4128 (17)		
C1—N1—C8	110.82 (11)	O1—C7—C8	123.22 (13)
C1—N1—C9	124.76 (11)	O2—C8—N1	127.27 (13)
C8—N1—C9	124.10 (11)	O2—C8—C7	126.59 (12)
N1—C1—C2	127.79 (12)	N1—C8—C7	106.15 (11)
N1—C1—C6	110.68 (11)	N1—C9—C10	113.06 (11)
O1—C7—C6	131.71 (14)		
C1—N1—C9—C10	65.02 (16)	N1—C9—C10—C11	−128.34 (13)
C8—N1—C9—C10	−122.13 (13)	N1—C9—C10—C15	53.41 (16)

Table 2
Hydrogen-bond geometry (Å, °).

D—H···*A*	*D*—H	H···*A*	*D*···*A*	*D*—H···*A*
C5—H5···O2^{i}	0.93	2.56	3.457 (2)	162
C9—H9*A*···O2^{ii}	0.97	2.43	3.379 (2)	167
C9—H9*B*···O2	0.97	2.54	2.921 (2)	103
C9—H9*B*···O1^{iii}	0.97	2.60	3.508 (2)	157

Symmetry codes: (i) $x, -y+\frac{3}{2}, z+\frac{1}{2}$; (ii) $-x+2, y-\frac{1}{2}, -z+\frac{1}{2}$; (iii) $x, -y+\frac{3}{2}, z-\frac{1}{2}$.

All H atoms were positioned geometrically and refined with a riding model, with C–H = 0.93–0.97 Å, and with $U_{iso} = 1.2U_{eq}$(C).

Data collection: *X-AREA* (Stoe & Cie, 2002); cell refinement: *X-AREA*; data reduction: *X-RED32* (Stoe & Cie, 2002); program(s) used to solve structure: *SHELXS97* (Sheldrick, 1997); program(s) used to refine structure: *SHELXL97* (Sheldrick, 1997); molecular graphics: *ORTEP-3 for Windows* (Farrugia, 1997); software used to prepare material for publication: *WinGX* (Farrugia, 1999).

The authors acknowledge the Faculty of Arts and Sciences, Ondokuz Mayıs University, Turkey, for the use of the Stoe IPDS 2 diffractometer (purchased under grant F.279 of the University Research Fund). AAJ and DK acknowledge the Shiraz University Research Council (Grant No. 84-GR-SC-23).

References

Bauer, D. J. & Sadler, P. W. (1960). *Brit. J. Pharmacol.* **15**, 101–110.
Bhattacharya, S. K. (1988). *Biog. Amines*, **14**, 131–141.
Bhattacharya, S. K. & Chakraborti, A. (1998). *Indian. J. Exp. Biol.* **36**, 118–121.
Chazeau, V., Gussac, M. & Boucherle, A. (1992). *Eur. J. Med. Chem.* **27**, 615–625.
Chen, L. R., Wang, Y. C., Lin, Y. W., Chou, S. Y., Chen, S. F., Liu, L. T., Wu, Y. T., Kuo, C. J., Chen, T. S. S. & Juang, S. H. (2005). *Bioorg. Med. Chem. Lett.* **15**, 3058–3062.
Chu, W., Zhang, J., Zeng, C., Rothfuss, J., Tu, Z., Chu, Y., Reichert, D. E., Welch, M. J. & Mach, R. H. (2005). *J. Med. Chem.* **48**, 7637–7647.
Farrugia, L. J. (1997). *J. Appl. Cryst.* **30**, 565.
Farrugia, L. J. (1999). *J. Appl. Cryst.* **32**, 837–838.
Garden, S. J., Torres, J. C., Silva, L. E. & Pinto, A. C. (1998). *Synth. Commun.* **28**, 1679–1689.
Glover, V., Halket, J. M., Watkins, P. J., Clow, A., Goddwin, B. L. & Sandler, M. J. (1988). *Neurochemistry*, **51**, 656–659.
Igosheva, N., Matta, S. & Glover, V. (2004). *Physiology & Behavior*, **80**, 665–668.
Medvedev, A. E., Goodwin, A., Clow, A., Halket, J., Glover, V. & Sandler, M. (1992). *Biochem. Pharmacol.* **44**, 590–592.
Medvedev, A. E., Ivanov, A. S., Camyshanskaya, N. S., Kirkel, A. Z., Moskvitina, T. A., Gorkin, V. Z., Li, N. Y. & Marshakov, V. Y. (1995). *Biochem. Mol. Biol. Int.* **36**, 113–122.
Palit, G., Kumar, R., Patnaik, G. K. & Bhattacharya, S. K. (1997). *Biogenic Amines*, **13**, 131–142.
Sheldrick, G. M. (1997). *SHELXS97* and *SHELXL97*. University of Göttingen, Germany.
Skiles, J. W. & McNeil, D. (1990). *Tetrahedron Lett.* **31**, 7277–7280.
Stoe & Cie (2002). *X-AREA* (Version 1.18) and *X-RED32* (Version 1.04). Stoe & Cie, Darmstadt, Germany.
Watkins, P., Clow, A., Glover, V., Halket, J. & Zyborowska, A. (1990). *M. Neurochem. Int.* **17**, 321–323.
Webber, S. E., Tikhe, J., Worland, S. T., Fuhrman, S. A., Hendrickson, T. F., Matthews, D. A., Love, R. A., Patick, A. K., Weador, J. W., Ferre, R. A., Brown, E. L., Delisle, D. M., Ford, C. E. & Binford, S. L. (1996). *J. Med. Chem.* **39**, 5072–5082.