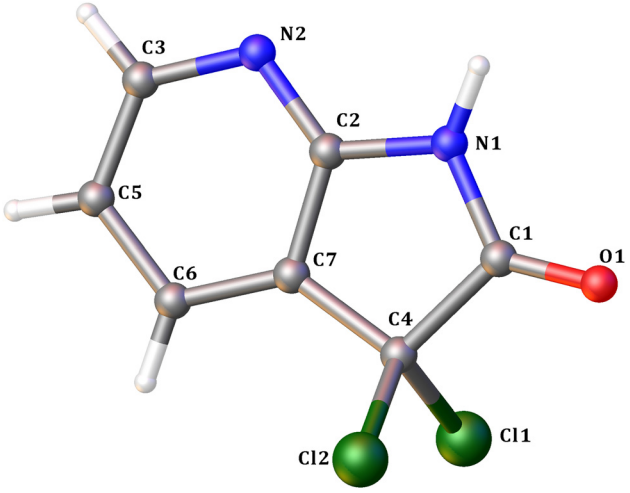
Su-Fen Bai, Shan-Shan Li, Jia-Xuan Liu, Chun-Yu Tian, Xiao-Long Li and Xiao-Jin La*

Crystal structure of phenyl(3,3-dichloro-1,3-dihydro-2*H*-pyrrolo[2,3-*b*]pyridin-2-one) methanone, $C_7H_4Cl_2N_2O$



https://doi.org/10.1515/ncrs-2022-0021
Received January 16, 2022; accepted February 21, 2022;
published online March 29, 2023

Abstract

$C_7H_4Cl_2N_2O$, monoclinic, $P2_1/c$ (no. 14), a = 6.215(2) Å, b = 16.544(5) Å, c = 8.561(3) Å, β = 108.707(4)°, V = 833.8(5) Å^3, Z = 4, $R_{gt}(F)$ = 0.0339, $wR_{ref}(F^2)$ = 0.1265, T = 296 K.

CCDC no.: 2133257

The molecular structure is shown in the figure (atoms are shown with arbitrary radii). Table 1 contains crystallographic data and Table 2 contains the list of the atoms including atomic coordinates and displacement parameters.

Table 1: Data collection and handling.

Crystal:	Colorless block
Size:	0.18 × 0.16 × 0.14 mm
Wavelength:	Mo *K*α radiation (0.71073 Å)
μ:	0.73 mm^{-1}
Diffractometer, scan mode:	Bruker APEX-II, φ and ω
θ_{max}, completeness:	27.4°, >99%
$N(hkl)_{measured}$, $N(hkl)_{unique}$, R_{int}:	4900, 1887, 0.020
Criterion for I_{obs}, $N(hkl)_{gt}$:	I_{obs} > 2 σ(I_{obs}), 1645
$N(param)_{refined}$:	113
Programs:	Bruker [1], SHELX [2, 32,3]

Source of material

To sodium hydride (0.44 g of 60 wt% NaH in oil, 0.011 mol) suspended in dry tetrahydrofuran (40 mL) at 0 °C under a nitrogen atmosphere was added 1,3-dihydro-2*H*-pyrrolo [2,3-*b*]pyridin-2-one (1.34 g, 0.010 mol). The reaction mixture was stirred at room temperature for 30 min and then recooled to 0 °C. Then an excess of thionylchloride was added (2.91 mL, 0.040 mol). The resulting solution was warmed slowly to room temperature and stirred for 16 h. The solvent was removed with a rotary evaporator at 80 °C. The residue was extracted with ethyl acetate and saturated $NaHCO_3$ solution. The organic layers were combined, and the solution was removed. The product was separated by column chromatography (petroleum ether: ethyl acetate = 7:2, *v*/*v*). Finally, the obtained solution was evaporated to dryness *in vacuo* and recrystallized from methanol and dichloromethane (2:1, *v*/*v*) to obtain the title compound as colorless block crystals.

Experimental details

All hydrogen atoms were placed in the calculated positions and constrained to ride on their parent atoms.

Su-Fen Bai and Shan-Shan Li contributed equally.

***Corresponding author: Xiao-Jin La**, College of Traditional Chinese Medicine, North China University of Science and Technology, Caofeidian District, 063210 Tangshan, P. R. China,
E-mail: laxiaojin@ncst.edu.cn
Su-Fen Bai, College of Traditional Chinese Medicine, North China University of Science and Technology, Caofeidian District, 063210 Tangshan, P. R. China; and Department of Basic Medicine, Hebei University of Chinese Medicine, Qiaoxi District, 050091 Shijiazhuang, P. R. China
Shan-Shan Li, Jia-Xuan Liu, Chun-Yu Tian and Xiao-Long Li, College of Traditional Chinese Medicine, North China University of Science and Technology, Caofeidian District, 063210 Tangshan, P. R. China

Table 2: Fractional atomic coordinates and isotropic or equivalent isotropic displacement parameters (Å^2).

Atom	*x*	*y*	*z*	U_{iso}*/U_{eq}
Cl1	0.37048 (8)	0.24819 (2)	0.82864 (6)	0.0503 (2)
Cl2	0.11395 (9)	0.37372 (3)	0.92705 (6)	0.0503 (2)
O1	0.6308 (2)	0.41342 (10)	0.96278 (14)	0.0528 (4)
N1	0.4736 (2)	0.44149 (9)	0.68521 (15)	0.0357 (3)
N2	0.2169 (2)	0.45036 (8)	0.40938 (15)	0.0319 (3)
C1	0.4863 (3)	0.40571 (10)	0.83112 (18)	0.0342 (4)
C2	0.2742 (3)	0.42094 (9)	0.56104 (17)	0.0280 (3)
C3	0.0139 (3)	0.42439 (10)	0.30775 (19)	0.0357 (4)
H1	−0.034451	0.443803	0.200121	0.043*
C4	0.2725 (3)	0.35021 (9)	0.79524 (18)	0.0309 (3)
C5	−0.1254 (3)	0.37144 (10)	0.3525 (2)	0.0408 (4)
H3	−0.263322	0.356152	0.276506	0.049*
C6	−0.0595 (3)	0.34049 (11)	0.5127 (2)	0.0382 (4)
H2	−0.149852	0.304094	0.546406	0.046*
C7	0.1461 (3)	0.36664 (8)	0.61830 (18)	0.0288 (3)
H1A	0.561 (5)	0.4834 (13)	0.666 (3)	0.078 (7)*

Comment

Azaindole is an important nitrogen-containing fused heterocycle in pharmaceutical chemistry [4–6]. Azaindoles exist as the basic structures of many natural botanicals and bioactive compounds [7–9], and are widely found in herbal medicines with therapeutic effects on diabetes.

In the molecules forming the title crystal structure, charasteristic bonds are C1–C4, C2–C7, and C5–C6. Their lengths are 1.562 (2) Å, 1.389 (2) Å, and 1.397 (2) Å respectively. The four C-N bond lengths range from 1.3240(19) Å for N2-C2 to 1.3919(19) Å for N1-C2. The bond lengths and angles are in the expected ranges [5, 6].

Author contributions: All the authors have accepted responsibility for the entire content of this submitted manuscript and approved submission.

Research funding: This work was supported by Hebei Key Laboratory of Integrated Traditional Chinese and Western Medicine for Diabetes and its Complications, College of Traditional Chinese Medicine, North China University of Science and Technology, 21 Bohai Road, Tangshan 063210, China. This work was supported by Science and Technology Partnership Program, Ministry of Science and Technology of China (KY201904005), Tangshan Science and Technology Innovation Team Training Program (19130205C) to Ji-an Li, Science and Technology Planning Project of Hebei Province, China (No. 14397705D).

Conflict of interest statement: The authors declare no conflicts of interest regarding this article.

References

1. Bruker. SAINT (version 8.23B); Bruker AXS Inc.: Madison, Wisconsin, USA, 2013.
2. Sheldrick G. M. Crystal structure refinement with SHELXL. *Acta Crystallogr.* 2015, *C71*, 3–8.
3. Sheldrick G. M. A short history of *SHELX*. *Acta Crystallogr.* 2008, *A64*, 112–122.
4. Somei M., Yamada F. Simple indole alkaloids and those with a non-rearranged monoterpenoid unit. *Nat. Prod. Rep.* 2005, *22*, 73–103.
5. Zirimwabagabo J.-O., Jailani A. B. A., Avgoustou P., Tozer M. J., Gibson K. R., Glossop P. A., Mills J. E. J., Porter R. A., Blaney P., Wang N., Skerry T. M., Richards G. O., Harrity J. P. A. Discovery of a first-in-class small molecule antagonist against the Adrenomedullin-2 receptor: structure-activity relationships and optimization. *J. Med. Chem.* 2021, *64*, 3299–3319.
6. El-Hiti G. A., Smith K., Hegazy A. S., Masmali A. M., Kariuki B. M. Crystal structure of 3-*tert*-butyl-7-azadioxindole, $C_{11}H_{14}N_2O_2$. *Z. Kristallogr. N. Cryst. Struct.* 2016, *231*, 1069–1070.
7. Zaimoku H., Taniguchi T., Ishibashi H. Synthesis of the core of actinophyllic acid using a transannular acyl radical cyclization. *Org. Lett.* 2012, *14*, 1656–1658.
8. Routier S., Peixoto P., Mérour J. Y., Coudert G., Dias N., Bailly C., Pierré A., Léonce S., Caignard D. H. Synthesis and biological evaluation of novel naphthocarbazoles as potential anticancer agents. *J. Med. Chem.* 2005, *48*, 1401–1413.
9. Lancianesi S., Palmieri A., Petrini M. Synthetic approaches to 3-(2-nitroalkyl) indoles and their use to access tryptamines and related bioactive compounds. *Chem. Rev.* 2015, *45*, 7108–7149.