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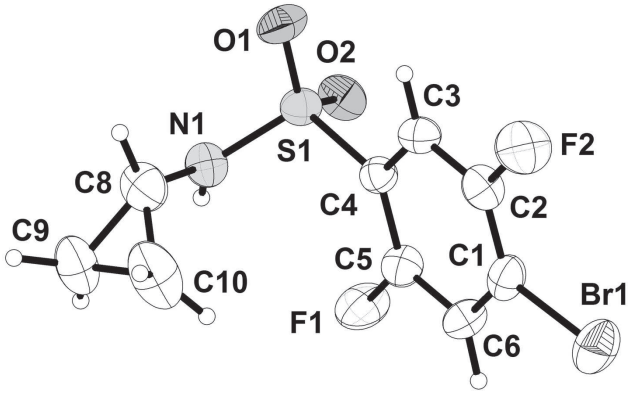
Li Liu, Ming-Yuan Wu, Chao Huang, Ming-Gang Teng and Jian-Xin Cao*

The crystal structure of 4-bromo-*N*-cyclopropyl-2,5-difluorobenzenesulfonamide, $C_9H_8BrF_2NO_2S$



DOI 10.1515/ncrs-2016-0352
Received December 18, 2016; accepted April 26, 2017; available online May 10, 2017

Abstract

$C_9H_8BrF_2NO_2S$, triclinic, $P\bar{1}$ (no. 2), $a = 7.5277(6)$ Å, $b = 8.3730(7)$ Å, $c = 9.8785(9)$ Å, $\alpha = 92.637(3)°$, $\beta = 111.201°$, $\gamma = 105.856(2)°$, $V = 551.08(8)$ Å^3, $Z = 2$, $R_{gt}(F) = 0.0330$, $wR_{ref}(F^2) = 0.0787$, $T = 273$ K.

CCDC no.: 1515172

The asymmetric unit of the title crystal structure is shown in the figure. Tables 1 and 2 contain details on crystal structure and measurement conditions and a list of the atoms including atomic coordinates and displacement parameters.

***Corresponding author: Jian-Xin Cao,** Key Laboratory for Green Chemical and Clean Energy Technology of Guizhou Province, Guiyang 550025, P. R. China, e-mail: jxcao@gzu.edu.cn; and School of Chemistry and Chemical Engineering, Guizhou University, Guiyang 550025, P. R. China
Li Liu: School of Chemistry and Chemical Engineering, Guizhou University, Guiyang 550025, P. R. China; and School of Pharmaceutical Sciences, Guizhou University, Guiyang 550025, P. R. China
Ming-Yuan Wu and Chao Huang: School of Pharmaceutical Sciences, Guizhou University, Guiyang 550025, P. R. China
Ming-Gang Teng: School of Chemistry and Chemical Engineering, Guizhou University, Guiyang 550025, P. R. China

Table 1: Data collection and handling.

Crystal:	Colourless block
Size:	0.22 × 0.20 × 0.15 mm
Wavelength:	Mo $K\alpha$ radiation (0.71073 Å)
μ:	39.3 cm^{-1}
Diffractometer, scan mode:	Bruker CCD, φ and ω
$2\theta_{max}$, completeness:	50.2°, >99%
$N(hkl)_{measured}$, $N(hkl)_{unique}$, R_{int}:	3574, 1940, 0.020
Criterion for I_{obs}, $N(hkl)_{gt}$:	$I_{obs} > 2\,\sigma(I_{obs})$, 1580
$N(param)_{refined}$:	149
Programs:	Bruker [1], SHELX [2]

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

Atom	*x*	*y*	*z*	U_{iso}*/U_{eq}
H1N	0.657(5)	0.053(4)	0.430(3)	0.030(9)*
Br1	0.05704(5)	0.39942(5)	−0.18303(4)	0.05545(17)
C1	0.2215(4)	0.3637(4)	0.0009(4)	0.0380(8)
C2	0.3573(5)	0.4963(4)	0.1075(4)	0.0383(8)
C3	0.4746(5)	0.4730(4)	0.2439(3)	0.0348(7)
H3	0.5662	0.5647	0.3145	0.042*
C4	0.4544(4)	0.3107(4)	0.2745(3)	0.0298(7)
C5	0.3187(4)	0.1787(4)	0.1658(4)	0.0351(7)
C6	0.2025(4)	0.2011(4)	0.0290(4)	0.0391(8)
H6	0.1136	0.1095	−0.0428	0.047*
N1	0.7084(4)	0.1475(4)	0.4356(3)	0.0372(7)
C8	0.8632(5)	0.1845(4)	0.3784(4)	0.0478(9)
H8	0.9786	0.2844	0.4309	0.057*
C9	0.9092(6)	0.0406(5)	0.3220(4)	0.0568(10)
H9A	0.8276	−0.0718	0.3207	0.068*
H9B	1.0486	0.0525	0.3421	0.068*
C10	0.8129(7)	0.1440(6)	0.2191(5)	0.0738(14)
H10A	0.8935	0.2190	0.1765	0.089*
H10B	0.6726	0.0946	0.1550	0.089*
O1	0.7408(3)	0.4390(3)	0.5240(2)	0.0443(6)
O2	0.4574(3)	0.1985(3)	0.5154(3)	0.0425(5)
F1	0.2979(3)	0.0193(2)	0.1936(2)	0.0539(5)
F2	0.3769(3)	0.6550(2)	0.0794(2)	0.0594(6)
S1	0.59626(11)	0.27917(9)	0.45233(8)	0.0328(2)

Source of material

All chemicals, reagents and solvents are of analytical grade and are commercially available. Preparation of

4-bromo-2,5-difluorobenzenesulfonyl chloride: 2-bromo-1,4-difluorobenzene (10.00 g, 52 mmol) was dissolved in 100 mL CH_2Cl_2. To this solution, chlorosulfonic acid (30.18 g, 260 mmol) was added over a period of 20 min at 0 °C. After the addition was complete, the mixture was stirred at room temperature for 5 h. The reaction mixture was poured into 60 g ice water, and then extracted with dichloromethane. The organic phase was dehydrated with anhydrous sodium sulfate and concentrated at reduced pressure to afford a light yellow powder (14.05 g, 93%). Preparation of 4-bromo-*N*-cyclopropyl-2,5-difluorobenzenesulfonamide: A mixture of 4-bromo-2,5-difluorobenzenesulfonyl chloride (12.00 g, 41 mmol), cyclopropylamine (2.80 g, 49 mmol), and triethylamine (8.30 g, 82 mmol) in 100 mL dichloromethane was stirred at room temperature for 3 h. The mixture was concentrated at reduced pressure, and the residue was washed with 60 mL water and crystallized from *n*-hexane to afford pure product (11.60 g, 91%).

Experimental details

All hydrogen atoms were placed in geometrically calculated positions. The U_{iso} values of the hydrogen atoms of methyl groups were set to $1.5U_{eq}(C_{methyl})$ and the U_{iso} values of all other hydrogen atoms were set to $1.2U_{eq}(C)$.

Discussion

The hepatitis C virus is a leading cause of liver disease and represents a serious health concern [3]. The treatment with non-nucleoside thumb pocket 2 HCV NS5B polymerase inhibitors has made a great progress [4]. Phenyl sulfonamide and its derivatives can be used as an important intermediate in the synthesis of non-nucleoside thumb pocket 2 HCV NS5B polymerase inhibitors. In addition, it has been reported that phenyl sulfonamides can also be used to synthesize the tyrosine kinase inhibitor, which shows anti-cancer effect [5].

All bond lengths and angles are in the expected ranges. Particularly, the bond length of C—Br bond is 1.884 Å. In addition, the bond length of C2–F5 and C5–F1 are 1.349 Å and 1.353 Å, respectively. The angle of C4S1N1 is 108.55° due to the steric stabilization. Title molecules are pairwise connected by classical N—H···O hydrogen bonds. The molecules packing in the crystal structure is additionally stabilized by weak intermolecular C—H···O hydrogen bonds.

Acknowledgements: This work was supported by the Science and Technology Cooperation Program of Guizhou Province (LH20157647).

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