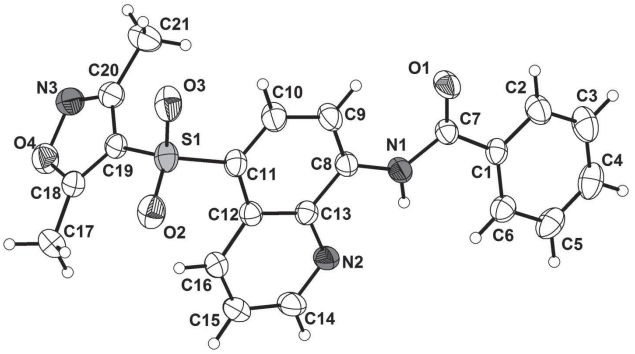
Open Access

Wen-Bo Yu, Jun Xu and Peng-fei Zhang*

Crystal structure of *N*-(5-((3,5-dimethylisoxazol-4-yl)sulfonyl)quinolin-8-yl)benzamide, $C_{21}H_{17}N_3O_4S$



DOI 10.1515/ncrs-2016-0127
Received April 19, 2016; accepted August 2, 2016; available online August 18, 2016

Abstract

$C_{21}H_{17}N_3O_4S$, triclinic, $P\bar{1}$ (no. 2), $a = 10.0424(5)$ Å, $b = 10.4142(4)$ Å, $c = 18.7420(10)$ Å, $\alpha = 91.746(4)°$, $\beta = 90.169(4)°$, $\gamma = 100.878(4)$, $V = 1923.92(16)$ Å^3, $Z = 4$, $R_{gt}(F) = 0.0487$, $wR_{ref}(F^2) = 0.1036$, $T = 293(2)$ K.

CCDC no.: 1041994

One of two crystallographically independent molecules of the title crystal structure is shown in the figure. Tables 1 and 2 contain details of the measurement method and a list of the atoms including atomic coordinates and displacement parameters.

Table 1: Data collection and handling.

Crystal:	Colourless blocks Size 0.27 × 0.24 × 0.22 mm
Wavelength:	Mo $K\alpha$ radiation (0.71073 Å)
μ:	2.0 cm^{-1}
Diffractometer, scan mode:	Bruker SMART, φ and ω
$2\theta_{max}$, completeness:	50°, >99%
$N(hkl)_{measured}$, $N(hkl)_{unique}$, R_{int}:	11709, 6767, 0.032
Criterion for I_{obs}, $N(hkl)_{gt}$:	$I_{obs} > 2\ \sigma(I_{obs})$, 4900
$N(param)_{refined}$:	528
Programs:	Bruker programs [9], SHELX [10], WinGX [11]

Source of material

To a 25 mL schlenk tube charged with CuI and Na_2CO_3 in 1,4-dioxane was added a mixture of *N*-(5-((3,5-dimethylisoxazol-4-yl)sulfonyl)quinolin-8-yl)benzamide and 3,5-dimethylisoxazole-4-sulfonyl chloride. The mixture was stirred at 70 °C under a nitrogen atmosphere for 12 h. After cooling to room temperature, the mixture was poured into water (10 mL). Then the mixture was extracted with ethyl acetate for three times, and the combined organic layers were gradually washed with brine (10 mL), dried with Na_2SO_4, and filtered through a pad of Celite. The solvent was removed under reduced pressure. The residue was then purified by silica-gel column chromatography using petrolether/EtOAc as the eluent to afford a white solid in 82% yield. The solid was recrystallized from CH_2Cl_2 and Et_2O. The resulting solid was filtered off and recrystallized from ethanol to give the pure title compound.

Experimental details

All H atoms were positioned geometrically (C—H = 0.93 or 0.96 Å) and refined using a riding model, with $U_{iso}(H) = 1.2U_{eq}(C, N)$ and $1.5U_{eq}(C_{methyl})$.

Discussion

Heteroaromatic sulfones are important organic intermediates and play a vital role in many fields such as pharmacy, and biology [1, 2]. Antimicrobial activity and antioxidant activity of arylsulfonyl isoxazoles have been reported [3, 4]. The traditional synthesis route of heteroaromatic sulfones is the oxidation of the organic sulfides formed *via* nucleophilic substitution reactions between heteroaryl halides with thiols, which are often not environmentally

***Corresponding author: Peng-fei Zhang,** College of Material, Chemistry and Chemical Engineering, Hangzhou Normal University, Hangzhou 310036, People's Republic of China, e-mail: 76191720@qq.com
Wen-Bo Yu: College of Chemical Engineering and Materials Science, Zhejiang University of Technology, Hangzhou 310014, People's Republic of China; and Linjiang College, Hangzhou Vocational and Technical College, Hangzhou 310018, People's Republic of China
Jun Xu: College of Material, Chemistry and Chemical Engineering, Hangzhou Normal University, Hangzhou 310036, People's Republic of China

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

Atom	x	y	z	U_{iso}*/U_{eq}
S1	0.66013(6)	0.31117(7)	0.19793(4)	0.0544(2)
S2	0.20429(8)	0.43571(7)	0.33721(4)	0.0639(2)
C12	0.7002(2)	0.1265(2)	0.09191(12)	0.0426(6)
N2	0.7400(2)	−0.02481(19)	−0.00423(11)	0.0517(5)
N1	0.94117(19)	0.13877(19)	−0.05679(11)	0.0532(6)
H1	0.9075	0.0597	−0.0705	0.064*
N4	−0.0778(2)	0.7903(2)	0.51076(11)	0.0539(6)
H4	−0.0308	0.8249	0.5472	0.065*
C33	0.1870(3)	0.6078(2)	0.45395(14)	0.0498(6)
O1	1.10377(18)	0.31174(17)	−0.08315(10)	0.0643(5)
O4	0.28534(18)	0.30289(19)	0.14072(11)	0.0661(5)
O2	0.63560(19)	0.2121(2)	0.24991(10)	0.0687(5)
O8	0.4769(2)	0.6768(2)	0.23621(12)	0.0753(6)
C11	0.7420(2)	0.2549(2)	0.12300(13)	0.0484(6)
C1	1.0813(2)	0.1225(2)	−0.15968(13)	0.0437(6)
C7	1.0462(2)	0.2004(2)	−0.09669(13)	0.0452(6)
C8	0.8808(2)	0.1853(2)	0.00276(13)	0.0466(6)
O3	0.73535(18)	0.43833(19)	0.21847(10)	0.0724(6)
C29	−0.0189(2)	0.7031(2)	0.46975(13)	0.0488(6)
C22	−0.2283(2)	0.9286(2)	0.55588(13)	0.0496(6)
C34	0.1141(2)	0.6911(2)	0.49211(13)	0.0470(6)
C19	0.5034(2)	0.3301(2)	0.16489(13)	0.0451(6)
C40	0.3035(2)	0.5449(2)	0.28174(13)	0.0452(6)
C6	1.0361(2)	−0.0114(2)	−0.16950(14)	0.0526(7)
H6	0.9816	−0.0578	−0.1353	0.063*
C32	0.1226(3)	0.5363(2)	0.39316(14)	0.0529(7)
C20	0.4798(3)	0.4251(2)	0.11688(14)	0.0523(7)
C13	0.7700(2)	0.0938(2)	0.03066(13)	0.0429(6)
N5	0.1648(2)	0.7635(2)	0.55103(11)	0.0566(6)
C30	−0.0781(3)	0.6301(3)	0.41218(14)	0.0571(7)
H30	−0.1659	0.6352	0.3982	0.069*
O5	−0.2767(2)	0.7866(2)	0.45369(11)	0.0851(7)
C41	0.4403(3)	0.5925(3)	0.28755(14)	0.0529(7)
C18	0.3783(3)	0.2572(3)	0.17838(15)	0.0528(7)
C16	0.5974(2)	0.0276(2)	0.11694(14)	0.0530(7)
H16	0.5491	0.0430	0.1576	0.064*
C27	−0.1364(3)	0.9934(3)	0.60588(15)	0.0596(7)
H27	−0.0487	0.9765	0.6070	0.071*
C31	−0.0060(3)	0.5474(3)	0.37427(15)	0.0618(8)
H31	−0.0472	0.4986	0.3351	0.074*
N3	0.3511(2)	0.4104(2)	0.10112(12)	0.0599(6)
C28	−0.1982(3)	0.8294(3)	0.50217(14)	0.0547(7)
C9	0.9181(3)	0.3065(3)	0.03500(15)	0.0600(8)
H9	0.9909	0.3659	0.0176	0.072*
C10	0.8461(2)	0.3405(3)	0.09439(15)	0.0598(8)
H10	0.8701	0.4242	0.1149	0.072*
O7	0.2943(2)	0.37312(19)	0.37874(13)	0.0887(7)
C2	1.1625(3)	0.1883(3)	−0.21138(15)	0.0623(8)
H2	1.1939	0.2779	−0.2057	0.075*
C15	0.5687(3)	−0.0903(3)	0.08175(16)	0.0630(8)
H15	0.5006	−0.1559	0.0980	0.076*
O6	0.1022(2)	0.3571(2)	0.29334(13)	0.0963(8)
C39	0.2612(3)	0.6063(3)	0.22230(15)	0.0604(7)
N6	0.3611(3)	0.6853(2)	0.19421(13)	0.0681(7)
C17	0.3261(3)	0.1462(3)	0.22421(18)	0.0755(9)

Table 2 (continued)

Atom	x	y	z	U_{iso}*/U_{eq}
H17A	0.2446	0.1608	0.2471	0.113*
H17B	0.3930	0.1389	0.2598	0.113*
H17C	0.3068	0.0669	0.1955	0.113*
C25	−0.3010(4)	1.1083(3)	0.65313(18)	0.0744(9)
H25	−0.3259	1.1677	0.6862	0.089*
C35	0.3174(3)	0.6028(3)	0.48095(16)	0.0638(8)
H35	0.3692	0.5485	0.4585	0.077*
C14	0.6419(3)	−0.1120(3)	0.02122(15)	0.0626(8)
H14	0.6201	−0.1930	−0.0025	0.075*
C4	1.1525(3)	−0.0089(3)	−0.28030(16)	0.0693(9)
H4A	1.1766	−0.0528	−0.3208	0.083*
C37	0.2869(3)	0.7549(3)	0.57283(16)	0.0696(8)
H37	0.3220	0.8041	0.6132	0.084*
C36	0.3673(3)	0.6762(3)	0.53897(17)	0.0727(9)
H36	0.4539	0.6744	0.5561	0.087*
C24	−0.3927(3)	1.0465(3)	0.60329(19)	0.0836(10)
H24	−0.4798	1.0648	0.6021	0.100*
C23	−0.3570(3)	0.9575(3)	0.55495(17)	0.0726(9)
H23	−0.4202	0.9162	0.5212	0.087*
C5	1.0719(3)	−0.0763(3)	−0.22995(17)	0.0654(8)
H5	1.0410	−0.1659	−0.2363	0.078*
C26	−0.1730(3)	1.0825(3)	0.65408(17)	0.0696(8)
H26	−0.1100	1.1253	0.6875	0.084*
C21	0.5767(3)	0.5339(3)	0.08490(16)	0.0733(9)
H21A	0.5272	0.5882	0.0591	0.110*
H21B	0.6359	0.4984	0.0529	0.110*
H21C	0.6295	0.5852	0.1221	0.110*
C3	1.1976(3)	0.1228(3)	−0.27126(16)	0.0743(9)
H3	1.2521	0.1684	−0.3057	0.089*
C42	0.5502(3)	0.5697(4)	0.33553(17)	0.0815(10)
H42A	0.6316	0.5711	0.3086	0.122*
H42B	0.5242	0.4860	0.3568	0.122*
H42C	0.5661	0.6370	0.3723	0.122*
C38	0.1249(3)	0.5902(4)	0.1879(2)	0.1038(13)
H38A	0.0660	0.6301	0.2180	0.156*
H38B	0.0877	0.4987	0.1809	0.156*
H38C	0.1331	0.6313	0.1426	0.156*

friendly [5, 6]. Our group has a longstanding interest in C—S cross-coupling reactions [7], and we have developed a copper-based catalytic approach for highly regioselective C—H sulfonylation of 8-aminoquinolines at the C5 position [8]. As a continuation of this work, a arylsulfonyl isoxazole, N-(5-((3,5-dimethylisoxazol-4-yl)sulfonyl)quinolin-8-yl)benzamide was synthesized from N-(quinolin-8-yl)benzamide and 3,5-dimethylisoxazole-4-sulfonyl chloride in the presence of CuI and Na_2CO_3. To verify the active position of 8-aminoquinoline for this reaction, the structure of title compound was determined. The title structure crystallizes with two molecules in the asymmetric unit. In the structure, the plane C18/C19/C20/N3/O4 and plane C39/C40/C41/N6/O8 make dideral angles of 86.63(7)° and 82.60(6)° with the plane C8/C9/C10/C11/C12 C13/C14/C15/C16 and plane

C29/C30/C31/C32/C33/C34/C35/C36/C37 respectively, which both indicate chair conformation. The angle of C11—S1—C19 and angle C 32—S2—C40 are similar within 104.01(1) Å and 104.17(11) Å respectively. In the crystal, two organic molecules are linked at least by a weak C42—H42A···O3 hydrogen bond, and are further stablized by other weak N—H···N, C—H···O hydrogen bonds.

Acknowledgements: The authors gratefully acknowledge the support from Zhejiang Provincial Natural Science Foundation of China (No. LZ13B020001).

The authors thank the responsible editor for providing the figure.

References

1. Ivachtchenko, A. V.; Golovina, E. S.; Kadieva, M. G.; Kysil, V. M.; Mitkin, O. D.; Tkachenko, S. E.; Okun, I. M.: Synthesis and structure–activity relationship (SAR) of (5,7-disubstituted 3-phenylsulfonyl-pyrazolo[1,5-a]pyrimidin-2-yl)-methylamines as potent serotonin 5-HT6 receptor (5-HT6 R) antagonists. J. Med. Chem. **54** (2011) 8161–8173.
2. Lu, Q.; Zhang, J.; Wei, F.; Qi, Y.; Wang, H.; Liu, Z.; Lei, A.: Aerobic oxysulfonylation of Alkenes Leading to Secondary and Tertiary β-Hydroxysulfones. Angew. Chem. Int. Ed. **52** (2013) 7156–7159.
3. Lavanya, G.; Mallikarjuna, R. L.; Padmavathi, V.; Padmaja, A.: Synthesis and antimicrobial activity of (1,4-phenylene)bis(arylsulfonylpyrazoles and isoxazoles). Eur. J. Med. Chem. **73** (2014) 187–194.
4. Padmaja, A.; Rajasekhar, C.; Durgamma, S.; Venkatesh, B. C.; Padmavathi, V.: Synthesis and antioxidant activity of pyrazolyl-oxazolines/thiazolines and isoxazolyl-oxazolines/thiazolines. Med. Chem. Res. **23** (2014) 1084–1098.
5. Trankle, W. G.; Kopach, M. E.: Green chemical synthesis of 2-benzenesulfonyl-pyridine and related derivatives. Org. Process Res. Dev. **11** (2007) 913–917.
6. Lee, B. S.; Chiou, C. B.: The use of CFC-12, CFC-11 and CH_3CCl_3 to trace terrestrial airborne pollutant transport by land-sea breezes. Atmos. Environ. **41** (2007) 3360–3372.
7. Shen, C.; Zhang, P.; Sun, Q.; Bai, S.; Hor, T. S.; Liu, X.: Recent advances in C-S bond formation via C-H bond functionalization and decarboxylation. Chem. Soc. Rev. **44** (2015) 291–314.
8. Xu, J.; Shen, C.; Zhu, X.; Zhang, P.; Ajitha, M. J.; Huang, K. W.; An, Z.; Liu, X.: Remote C-H activation of quinolines through copper-catalyzed radical cross-coupling. Chem. Asian J. **11** (2016) 882–892.
9. Bruker SADABS, SMART and SAINT, Bruker AXS Inc., Madison, WI, USA, 2002.
10. Sheldrick, G. M.: A short history of SHELX. Acta Crystallogr. **A64** (2008) 112–122.
11. Farrugia, L. J.: WinGX and ORTEP for Windows: an update. J. App. Crystallogr. **45** (2012) 849–854.