Crystal structure of 2,6-dimethoxy-4-((4-(*N*-(6-methoxypyrimidin-4-yl)-sulfamoyl)phenyl)carbamoyl)phenyl acetate, $C_{22}H_{22}N_4O_8S$

Wei-Gao Pan[I, III], Jian-Hua Miao[II], Jun Xiong[I], Peng Luo[III] and Cui-Wu Lin[*, I]

[I] Guangxi University, College of Chemistry and Chemical Engineering, Nanning 530004, Guangxi Province, P. R. China
[II] Guangxi Botanical Garden of Medicinal Plants, Nanning 530023, Guangxi Province, P. R. China
[III] Guangxi University of Chinese Medicine, Nanning 530001, Guangxi Province, P. R. China

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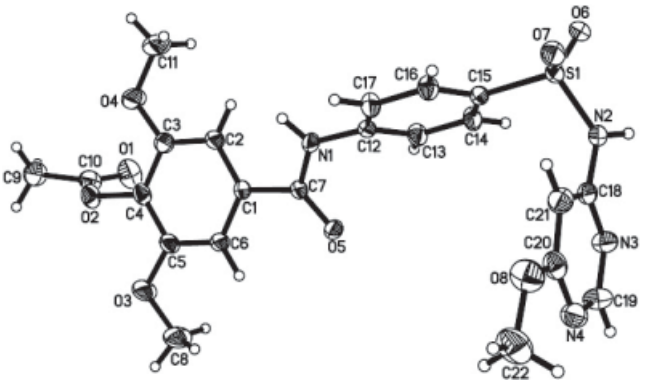

Abstract

$C_{22}H_{22}N_4O_8S$, triclinic, $P\bar{1}$ (no. 2), a = 8.730(1) Å, b = 9.730(1) Å, c = 14.220(2) Å, α = 97.970(2)°, β = 92.606(2)°, γ = 100.195(2)°, V = 1174.3 Å^3, Z = 2, $R_{gt}(F)$ = 0.0477, $wR_{ref}(F^2)$ = 0.1357, T = 296 K.

Table 1. Data collection and handling.

Crystal:	colourless prisms, size 0.0×80.30×0.47 mm
Wavelength:	Mo K_α radiation (0.71073 Å)
μ:	1.94 cm^{-1}
Diffractometer, scan mode:	CCD area detector, φ and ω
$2\theta_{max}$:	56.62°
$N(hkl)_{measured}$, $N(hkl)_{unique}$:	11975, 5777
Criterion for I_{obs}, $N(hkl)_{gt}$:	$I_{obs} > 2\ \sigma(I_{obs})$, 3886
$N(param)_{refined}$:	316
Programs:	SHELX [3]

Source of material

6 g (about 30 mmol) of syringic acid (4-hydroxy-3,5-dimethoxybenzoic acid) in 50 mL of acetic anhydride was stirred and refluxed at 120 °C for 2h. 900 mL of water was added to the above solution to get precipitates (5300mg) by method of pumping filtration. 5 g (about 20 mmol) of above dry precipitates in 40mL of thionyl chloride was stirred and refluxed at 80 °C for 6h under anhydrous conditions, the solvent was removed under reduced pressure to get the raw product (5500 mg). 5173 mg (20 mmol) of the raw product, 5606 mg (20 mmol) of sulfamonomethoxine (4-amino-*N*-(6-methoxy-4-pyrimidinyl)-benzenesulfonamide) and 10 mL of pyridine in 400 mL of THF were stirred at 0 °C for 2h and then at room temperature for 24h. 8 L of water was added to the above reaction solution to get 7220 mg of precipitates after pumping filtration. This product was redissolved in mixed solution of THF and methanol and then left for evaporating at room temperature. After crystallization and recrystallization from the mixed solution, colourless crystals suitable for X-ray analysis were obtained This crystal was detected by electrospray ionization mass spectroscopy (ESI) to give a molecular ion at *m/z* value of 502.2 ([M]$^-$). The melting point was determined as 532-533K using a XT-4 melting point instrument (Beijing Taike Instrument Co., Ltd, Beijing, China). NMR spectra were obtained on a AVANCE III 300 NMR instrument (Bruker, Germany). **^{1}H-NMR** (300 MHz, DMSO-d_6) δ: 8.43 (1H, s, H-19), 7.94(4H, m, H-13, 14, 16, 17), 7.29(2H, s, H-2, 6), 6.35 (1H, s, H-21), 3.85 (9H, s, H-8, 11, 22), 2.30 (3H, s, H-9), 10.58 (1H, s, N1-H), 12.05 (1H, s, N2-H); **^{13}C-NMR** (75 MHz, DMSO-d_6) δ: 133.1 (C-1), 105.3 (C-2), 152.1 (C-3), 131.2 (C-4), 152.1 (C-5), 105.3 (C-6), 165.9 (C-7), 56.7 (C-8), 20.6 (C-9), 168.3 (C-10), 56.7 (C-11), 143.5 (C-12), 120.6 (C-13), 128.5 (C-14), 135.2 (C-15), 128.5 (C-16), 120.6 (C-17), 152.1 (C-18), 159.0 (C-19), 170.4 (C-20), 91.4(C-21), 54.7 (C-22). **IR** spectra (potassium bromide) were recorded on a NEXUS 470 Fourier Transform IR spectrophotometer (Thermo Nicolet Corporation, USA). IR (ν_{max}, cm^{-1}): 3511, 3548 (νN-H); 3075, 3007 ($\nu_{=C-H}$); 1772 ($\nu_{C=O}$); 1670, 1604, 1594, 1522, 1505, 1497, 1484 ($\nu_{C=C}$); 1416, 1391, 1339, 1198, 1177, 1155, 1135, 1092, 1042, 1010, 910, 835, 776, 755, 747, 694, 674, 646, 586, 482, 469.

Experimental details

H atoms were positioned geometrically with d(N–H) = 0.86 Å, d(C–H) = 0.93 (aromatic CH) or 0.96 Å (methyl CH_3), and treated as riding atoms. For all H atoms, isotropic displacement parameters were calculated as U_{iso}(H) = 1.2 U_{eq}(N, C).

Discussion

The title compound was synthesized from two bioactive substances, syringic acid and sulfamonomethoxine. Syringic acid showed antifungal activity [1], anti-endotoxic effects [2], *et al.* Sulfamonomethoxine was usually used as an antibiotic. Whether the title hybrid compound, which includes two types of antibiotic groups (benzoyl and sulfanilamide), has some novel antibiotic properties should be investigated in future. The title crystal structure is only built up by $C_{22}H_{22}N_4O_8S$ molecules, in which all values of the geometric parameters are normal. The benzene rings make a dihedral angle of 73.6 (1)°, and the pyrimidine ring is twisted by 78.2 (1)° from the central benzene ring. Only intermolecular N–H···O hydrogen bonds occur: N2-H2A···O5 (d(N2–H2A···O5) = 2.853 Å; N2–H2A···O5 = 117.54°; i: -x, -y, -z+1), N1–H1A···O6 (d(N1–H1A···O6) = 3.019Å; N1–H1A···O6 = 147.95°; ii: -x+1, -y, -z+1).

* Correspondence author (e-mail: lincuiwugxdx@yahoo.cn)

Table 2. Atomic coordinates and displacement parameters (in Å^2).

Atom	Site	*x*	*y*	*z*	U_{iso}
H(2A)	2*i*	0.0945	–0.2933	0.6877	0.046
H(1A)	2*i*	0.4270	0.3346	0.4323	0.044
H(14A)	2*i*	0.1371	–0.1305	0.5109	0.051
H(2B)	2*i*	0.4272	0.3874	0.2911	0.047
H(16A)	2*i*	0.5184	0.0819	0.6709	0.048
H(17A)	2*i*	0.5203	0.2688	0.5854	0.049
H(13A)	2*i*	0.1386	0.0563	0.4267	0.048
H(6B)	2*i*	0.0665	0.5549	0.3923	0.046
H(21A)	2*i*	0.2993	–0.0011	0.8379	0.057
H(8A)	2*i*	–0.1145	0.8149	0.3078	0.108
H(8B)	2*i*	–0.0626	0.7230	0.3813	0.108
H(8C)	2*i*	–0.1264	0.6519	0.2780	0.108
H(9A)	2*i*	0.3434	0.8175	–0.0363	0.098
H(9B)	2*i*	0.4800	0.8643	0.0434	0.098
H(9C)	2*i*	0.3286	0.9299	0.0515	0.098
H(19A)	2*i*	–0.2240	–0.0425	0.8138	0.066
H(11A)	2*i*	0.6705	0.4818	0.1129	0.123
H(11B)	2*i*	0.5272	0.3722	0.1350	0.123
H(11C)	2*i*	0.6464	0.4555	0.2180	0.123
H(22A)	2*i*	0.2019	0.3412	1.0549	0.124
H(22B)	2*i*	0.0488	0.2272	1.0473	0.124
H(22C)	2*i*	0.0763	0.3279	0.9702	0.124

Table 3. Atomic coordinates and displacement parameters (in Å^2).

Atom	Site	*x*	*y*	*z*	U_{11}	U_{22}	U_{33}	U_{12}	U_{13}	U_{23}
S(1)	2*i*	0.32558(5)	–0.18568(5)	0.66168(3)	0.0316(2)	0.0371(3)	0.0502(3)	0.0134(2)	0.0073(2)	0.0206(2)
O(5)	2*i*	0.0818(1)	0.3171(1)	0.44620(9)	0.0333(7)	0.0420(7)	0.0473(7)	0.0105(6)	0.0103(6)	0.0195(6)
O(7)	2*i*	0.4438(2)	–0.1460(2)	0.7382(1)	0.0377(8)	0.0563(9)	0.0588(9)	0.0131(7)	–0.0037(6)	0.0264(7)
O(6)	2*i*	0.3261(2)	–0.3110(1)	0.5959(1)	0.0432(8)	0.0360(7)	0.0673(9)	0.0172(6)	0.0160(7)	0.0152(6)
C(7)	2*i*	0.2128(2)	0.3511(2)	0.4184(1)	0.0348(9)	0.0288(8)	0.0340(9)	0.0086(7)	0.0054(7)	0.0099(7)
N(2)	2*i*	0.1542(2)	–0.2125(2)	0.7048(1)	0.0350(8)	0.0337(8)	0.0499(9)	0.0077(7)	0.0100(7)	0.0154(7)
N(1)	2*i*	0.3364(2)	0.2965(2)	0.4470(1)	0.0305(8)	0.0373(8)	0.0487(9)	0.0088(6)	0.0093(7)	0.0215(7)
O(2)	2*i*	0.3306(2)	0.7660(1)	0.1778(1)	0.068(1)	0.0395(7)	0.0398(7)	0.0099(7)	0.0080(7)	0.0174(6)
C(15)	2*i*	0.3272(2)	–0.0418(2)	0.5990(1)	0.0314(9)	0.0347(9)	0.0397(9)	0.0113(7)	0.0073(7)	0.0152(7)
O(4)	2*i*	0.5045(2)	0.5689(2)	0.1701(1)	0.076(1)	0.072(1)	0.071(1)	0.0351(9)	0.0463(9)	0.0401(8)
C(12)	2*i*	0.3284(2)	0.1819(2)	0.4990(1)	0.0308(9)	0.0314(8)	0.0366(9)	0.0114(7)	0.0086(7)	0.0121(7)
C(14)	2*i*	0.2137(2)	–0.0498(2)	0.5260(2)	0.036(1)	0.034(1)	0.059(1)	0.0019(8)	–0.0033(9)	0.0175(9)
C(2)	2*i*	0.3647(2)	0.4555(2)	0.2914(1)	0.044(1)	0.036(1)	0.043(1)	0.0151(8)	0.0116(8)	0.0141(8)
C(1)	2*i*	0.2448(2)	0.4573(2)	0.3519(1)	0.0356(9)	0.0298(8)	0.0350(9)	0.0070(7)	0.0059(7)	0.0113(7)
C(18)	2*i*	0.0982(2)	–0.1120(2)	0.7681(1)	0.041(1)	0.040(1)	0.039(1)	0.0129(8)	0.0087(8)	0.0182(8)
C(16)	2*i*	0.4423(2)	0.0769(2)	0.6220(1)	0.039(1)	0.040(1)	0.042(1)	0.0052(8)	–0.0044(8)	0.0146(8)
C(17)	2*i*	0.4426(2)	0.1887(2)	0.5710(1)	0.041(1)	0.035(1)	0.045(1)	0.0014(8)	–0.0025(8)	0.0127(8)
C(4)	2*i*	0.2950(2)	0.6572(2)	0.2323(1)	0.055(1)	0.0322(9)	0.0353(9)	0.0093(9)	0.0061(8)	0.0127(7)
N(3)	2*i*	–0.0576(2)	–0.1243(2)	0.7590(1)	0.0393(9)	0.051(1)	0.052(1)	0.0130(8)	0.0071(7)	0.0048(8)
O(3)	2*i*	0.0864(2)	0.7590(2)	0.2853(1)	0.079(1)	0.060(1)	0.080(1)	0.0433(9)	0.0312(9)	0.0406(8)
C(13)	2*i*	0.2144(2)	0.0617(2)	0.4758(1)	0.035(1)	0.039(1)	0.048(1)	0.0073(8)	–0.0046(8)	0.0156(8)
C(5)	2*i*	0.1727(2)	0.6564(2)	0.2912(1)	0.051(1)	0.037(1)	0.043(1)	0.0179(9)	0.0088(8)	0.0142(8)
C(6)	2*i*	0.1475(2)	0.5561(2)	0.3520(1)	0.040(1)	0.039(1)	0.042(1)	0.0148(8)	0.0110(8)	0.0146(8)
N(4)	2*i*	–0.0399(2)	0.0668(2)	0.8863(1)	0.057(1)	0.051(1)	0.051(1)	0.0173(9)	0.0075(8)	0.0076(8)
C(10)	2*i*	0.2980(3)	0.7315(2)	0.0828(2)	0.061(1)	0.051(1)	0.041(1)	0.022(1)	0.011(1)	0.0145(9)
O(8)	2*i*	0.2019(2)	0.1763(2)	0.9560(1)	0.072(1)	0.064(1)	0.066(1)	0.0101(9)	–0.0055(9)	–0.0062(9)
C(3)	2*i*	0.3903(2)	0.5569(2)	0.2313(1)	0.050(1)	0.043(1)	0.040(1)	0.0129(9)	0.0147(9)	0.0140(8)
C(21)	2*i*	0.1912(2)	–0.0106(2)	0.8332(2)	0.042(1)	0.055(1)	0.049(1)	0.010(1)	0.0017(9)	0.014(1)
O(1)	2*i*	0.2216(2)	0.6202(2)	0.0477(1)	0.104(2)	0.059(1)	0.053(1)	0.009(1)	–0.001(1)	0.0084(8)
C(8)	2*i*	–0.0665(3)	0.7353(3)	0.3155(2)	0.070(2)	0.083(2)	0.083(2)	0.048(2)	0.022(1)	0.038(2)
C(9)	2*i*	0.3687(3)	0.8459(3)	0.0308(2)	0.083(2)	0.069(2)	0.058(1)	0.026(1)	0.027(1)	0.036(1)
C(19)	2*i*	–0.1161(3)	–0.0342(3)	0.8191(2)	0.043(1)	0.066(2)	0.060(1)	0.021(1)	0.010(1)	0.004(1)
C(20)	2*i*	0.1132(3)	0.0774(2)	0.8916(2)	0.061(1)	0.043(1)	0.042(1)	0.010(1)	0.001(1)	0.0121(9)
C(11)	2*i*	0.5944(3)	0.4609(3)	0.1580(2)	0.083(2)	0.088(2)	0.093(2)	0.038(2)	0.053(2)	0.028(2)
C(22)	2*i*	0.1259(4)	0.2765(3)	1.0118(2)	0.109(2)	0.061(2)	0.074(2)	0.019(2)	–0.001(2)	–0.009(1)

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