Crystal structure of 6-(phenylsulfanyl)-5-propylpyrimidine-2,4(1*H*,3*H*)-dione, $C_{13}H_{14}N_2O_2S$

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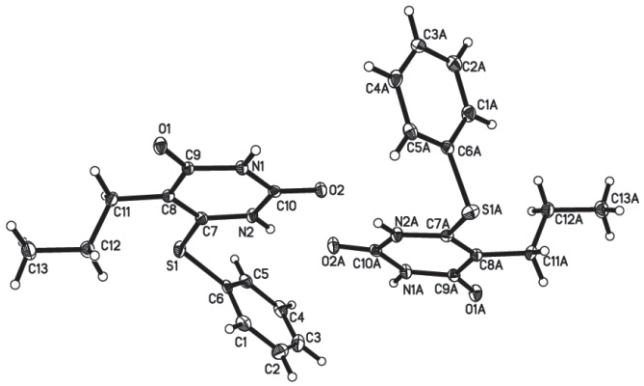

Abstract

$C_{13}H_{14}N_2O_2S$, triclinic, $P\overline{1}$ (no. 2), a = 10.0414(5) Å, b = 11.0866(6) Å, c = 12.6400(7) Å, α = 96.149(2)°, β = 105.602(2)°, γ = 110.432(2)°, V = 1238.2 Å^3, Z = 4, $R_{gt}(F)$ = 0.0553, $wR_{ref}(F^2)$ = 0.1105, T = 150 K.

Table 1. Data collection and handling.

Crystal:	colourless needles, size 0.07×0.15×0.71 mm
Wavelength:	Mo K_α radiation (0.71073 Å)
μ:	2.57 cm^{-1}
Diffractometer, scan mode:	Bruker APEX-II D8 Venture, φ and ω
$2\theta_{max}$:	61.2°
$N(hkl)_{measured}$, $N(hkl)_{unique}$:	63868, 7600
Criterion for I_{obs}, $N(hkl)_{gt}$:	$I_{obs} > 2\ \sigma(I_{obs})$, 4681
$N(param)_{refined}$:	327
Programs:	SHELX [17], SAINT, SADABS [18]

Source of material

A mixture of 6-chloro-5-propyluracil (943 mg, 5 mmol), thiophenol (551 mg, 5 mmol) and potassium hydroxide (281 mg, 5 mmol), in ethanol (10 mL), was heated under reflux for three hours. The solvent was then distilled off *in vaccuo* and the residue was washed with cold water, dried and crystallized from ethanol to yield 892 mg (68%) of the title compound as colourless needle-shaped crystals. **m.p.**: 465-467 K. **^{1}H NMR** (DMSO-d_6, 500.13 MHz): δ 0.84 (t, 3H, CH_2CH_3, J = 7.0 Hz), 1.37-1.40 (m, 2H, CH_2CH_3), 2.43 (t, 2H, $CH_2CH_2CH_3$, J = 7.0 Hz), 7.34-7.41 (m, 5H, Ar-H), 10.91 (s, 1H, NH), 11.24 (s, 1H, NH). **^{13}C NMR** (DMSO-d_6, 125.76 MHz): δ 13.72 (CH_2CH_3), 22.06 (CH_2CH_3), 28.22 ($CH_2CH_2CH_3$), 117.44 (Pyrimidine C-5), 127.58, 129.55, 129.63, 131.71 (Ar-C), 143.02 (Pyrimidine C-6), 150.53 (C=O), 163.23 (C=O).

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Discussion

Pyrimidine-2,4(1*H*,3*H*)-dione (uracil) is an important pharmacophore found in many chemotherapeutic agents. The chemotherapeutic efficacy of uracil and pyrimidine derivatives is related to their ability to inhibit vital enzymes responsible for DNA biosynthesis such as dihydrofolate reductase (DHFR), thymidylate synthetase (TSase), thymidine phosphorylase (TPase) and reverse transcriptase (RTase). Pyrimidine-2,4-diones and their related derivatives have long been known for their diverse chemotherapeutic activities including antiviral activity against HIV [1–5] and HSV viruses [6]. In addition, potent anticancer [7–10] and antimicrobial activities [11, 12] was observed for several pyrimidine-2,4-diones. In continuation to our interest in the chemical and pharmacological properties of pyrimidine and uracil derivatives [13–16] we synthesized the title compound as potential chemotherapeutic agent. X-ray crystallography is a decisive analytical tool which can confirm the configuration of compounds. Fortunately, we have succeeded to get single crystals of the title compound which were suitable for X-ray crystallography. The crystal structure of title compound contains two crystallographic independant molecules in the asymmetric unit. The two six-membered rings in both molecules are nearly planar. The dihedral angles between the six-membered rings are 67.36(10)° and 83.57(11)° for the second molecule in the unit cell. The molecules are twisted about the C pyrimidine–S bond, with a C6–S1–C7–N2 torsion angle of 22.23(16)° and C6A–S1A–C7A–N2A torsion angle of –59.23(15)° in the second molecule. The molecules packing in the crystal structure is stabilized by three intermolecular hydrogen bonds, of which O1A, O1 and O2 work as hydrogen bond acceptors and N1A, N1 and C5 work as hydrogen bond donors. The distance of the interactions between N1A–H1AB···O1A is 2.11(1) Å, N1–H1B···O1 is 2.00(1) Å and C5–H5A···O2 is 2.49(1) Å and the angles are 164°, 172°, 140°, respectively.

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

Atom	Site	x	y	z	U_{iso}
H(1B)	2*i*	0.9277	0.8758	0.4866	0.019
H(2B)	2*i*	0.6952	0.5987	0.5956	0.018
H(1A)	2*i*	0.8503	0.6189	0.8353	0.025
H(2A)	2*i*	0.8526	0.4117	0.8397	0.032
H(3A)	2*i*	0.6301	0.2265	0.7748	0.033
H(4A)	2*i*	0.4034	0.2477	0.7100	0.029
H(5A)	2*i*	0.3985	0.4543	0.7035	0.023
H(11A)	2*i*	0.6690	0.9730	0.7621	0.022
H(11B)	2*i*	0.7864	1.0855	0.7298	0.022
H(12A)	2*i*	0.8622	0.9611	0.9076	0.025
H(12B)	2*i*	0.9831	1.0679	0.8731	0.025
H(13D)	2*i*	0.9375	1.1593	1.0312	0.046

Table 2. continued.

Atom	Site	x	y	z	U_{iso}
H(13E)	2*i*	0.7713	1.1242	0.9556	0.046
H(13F)	2*i*	0.9052	1.2294	0.9317	0.046
H(1AB)	2*i*	0.5499	0.1504	0.5144	0.020
H(2AB)	2*i*	0.8016	0.4501	0.4393	0.020
H(1AA)	2*i*	0.6897	0.3021	0.1036	0.026
H(2AA)	2*i*	0.5934	0.4214	–0.0115	0.031
H(3AA)	2*i*	0.6987	0.6494	0.0370	0.029
H(4AA)	2*i*	0.8933	0.7587	0.2039	0.028
H(5AA)	2*i*	0.9911	0.6403	0.3199	0.023
H(11C)	2*i*	0.7780	–0.0134	0.3083	0.021
H(11D)	2*i*	0.8657	0.1042	0.2618	0.021
H(12C)	2*i*	0.5484	–0.0302	0.1751	0.026
H(12D)	2*i*	0.6435	0.0783	0.1246	0.026
H(13A)	2*i*	0.5799	–0.1242	0.0116	0.040
H(13B)	2*i*	0.6454	–0.1763	0.1156	0.040
H(13C)	2*i*	0.7540	–0.0670	0.0740	0.040

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*	0.61730(5)	0.71357(5)	0.76109(4)	0.0276(3)	0.0157(2)	0.0241(3)	0.0081(2)	0.0175(2)	0.0055(2)
O(1)	2*i*	0.9334(1)	1.0652(1)	0.6018(1)	0.0249(7)	0.0122(7)	0.0217(7)	0.0041(5)	0.0116(6)	0.0024(5)
O(2)	2*i*	0.8370(1)	0.6393(1)	0.4625(1)	0.0238(7)	0.0133(6)	0.0165(7)	0.0060(5)	0.0102(5)	0.0023(5)
N(1)	2*i*	0.8783(2)	0.8507(1)	0.5317(1)	0.0199(8)	0.0127(8)	0.0152(8)	0.0048(6)	0.0095(6)	0.0040(6)
N(2)	2*i*	0.7375(2)	0.6813(1)	0.5973(1)	0.0202(8)	0.0088(7)	0.0173(8)	0.0034(6)	0.0096(6)	0.0029(6)
C(1)	2*i*	0.7606(2)	0.5443(2)	0.8089(2)	0.0190(9)	0.022(1)	0.021(1)	0.0043(8)	0.0098(8)	0.0050(8)
C(2)	2*i*	0.7617(2)	0.4206(2)	0.8118(2)	0.029(1)	0.033(1)	0.030(1)	0.018(1)	0.0168(9)	0.014(1)
C(3)	2*i*	0.6284(2)	0.3097(2)	0.7737(2)	0.047(1)	0.020(1)	0.029(1)	0.016(1)	0.025(1)	0.0106(9)
C(4)	2*i*	0.4929(2)	0.3223(2)	0.7341(2)	0.029(1)	0.016(1)	0.022(1)	–0.0003(8)	0.0123(9)	0.0011(8)
C(5)	2*i*	0.4899(2)	0.4457(2)	0.7300(2)	0.0200(9)	0.019(1)	0.0161(9)	0.0047(8)	0.0082(8)	0.0032(8)
C(6)	2*i*	0.6240(2)	0.5562(2)	0.7658(1)	0.0231(9)	0.0133(9)	0.0124(9)	0.0056(7)	0.0100(7)	0.0021(7)
C(7)	2*i*	0.7216(2)	0.7718(2)	0.6717(1)	0.0149(8)	0.0154(9)	0.0139(9)	0.0051(7)	0.0063(7)	0.0036(7)
C(8)	2*i*	0.7822(2)	0.9038(2)	0.6764(1)	0.0147(8)	0.0144(9)	0.0144(9)	0.0060(7)	0.0043(7)	0.0026(7)
C(9)	2*i*	0.8679(2)	0.9486(2)	0.6029(1)	0.0157(9)	0.0128(9)	0.0135(9)	0.0058(7)	0.0026(7)	0.0008(7)
C(10)	2*i*	0.8178(2)	0.7183(2)	0.5263(1)	0.0130(8)	0.0142(9)	0.0119(9)	0.0045(7)	0.0015(7)	0.0019(7)
C(11)	2*i*	0.7703(2)	1.0056(2)	0.7583(2)	0.0227(9)	0.0146(9)	0.020(1)	0.0095(8)	0.0091(8)	0.0043(8)
C(12)	2*i*	0.8819(2)	1.0397(2)	0.8770(2)	0.024(1)	0.017(1)	0.020(1)	0.0064(8)	0.0071(8)	0.0022(8)
C(13)	2*i*	0.8732(2)	1.1482(2)	0.9562(2)	0.046(1)	0.022(1)	0.022(1)	0.011(1)	0.011(1)	0.0008(9)
S(1A)	2*i*	0.93757(5)	0.37071(5)	0.30601(4)	0.0170(2)	0.0256(3)	0.0281(3)	0.0099(2)	0.0127(2)	0.0145(2)
O(1A)	2*i*	0.5917(1)	–0.0225(1)	0.4131(1)	0.0269(7)	0.0117(7)	0.0272(8)	0.0035(6)	0.0142(6)	0.0033(6)
O(2A)	2*i*	0.6127(1)	0.3878(1)	0.5341(1)	0.0324(8)	0.0159(7)	0.0229(7)	0.0088(6)	0.0163(6)	0.0032(6)
N(1A)	2*i*	0.6087(2)	0.1831(1)	0.4770(1)	0.0216(8)	0.0125(8)	0.0187(8)	0.0041(6)	0.0124(7)	0.0044(6)
N(2A)	2*i*	0.7603(2)	0.3659(1)	0.4314(1)	0.0198(8)	0.0101(7)	0.0199(8)	0.0038(6)	0.0089(7)	0.0027(6)
C(1A)	2*i*	0.7309(2)	0.3939(2)	0.1236(2)	0.027(1)	0.015(1)	0.022(1)	0.0061(8)	0.0083(8)	0.0010(8)
C(2A)	2*i*	0.6738(2)	0.4652(2)	0.0548(2)	0.029(1)	0.028(1)	0.018(1)	0.0130(9)	0.0031(8)	–0.0001(9)
C(3A)	2*i*	0.7360(2)	0.6016(2)	0.0843(2)	0.036(1)	0.027(1)	0.020(1)	0.019(1)	0.0146(9)	0.0108(9)
C(4A)	2*i*	0.8532(2)	0.6670(2)	0.1836(2)	0.032(1)	0.015(1)	0.029(1)	0.0092(8)	0.0171(9)	0.0063(8)
C(5A)	2*i*	0.9114(2)	0.5963(2)	0.2533(2)	0.0187(9)	0.019(1)	0.018(1)	0.0032(8)	0.0095(8)	0.0021(8)
C(6A)	2*i*	0.8501(2)	0.4600(2)	0.2230(2)	0.0194(9)	0.018(1)	0.0153(9)	0.0077(8)	0.0100(8)	0.0060(8)
C(7A)	2*i*	0.8010(2)	0.2867(2)	0.3661(1)	0.0124(8)	0.0161(9)	0.0150(9)	0.0055(7)	0.0046(7)	0.0048(7)
C(8A)	2*i*	0.7464(2)	0.1544(2)	0.3539(2)	0.0156(9)	0.0151(9)	0.0149(9)	0.0063(7)	0.0049(7)	0.0027(7)
C(9A)	2*i*	0.6455(2)	0.0961(2)	0.4156(2)	0.0170(9)	0.0144(9)	0.0151(9)	0.0047(7)	0.0034(7)	0.0012(7)
C(10A)	2*i*	0.6573(2)	0.3171(2)	0.4841(1)	0.0189(9)	0.0133(9)	0.0124(9)	0.0042(7)	0.0036(7)	0.0015(7)
C(11A)	2*i*	0.7712(2)	0.0595(2)	0.2744(2)	0.0197(9)	0.0146(9)	0.022(1)	0.0085(8)	0.0093(8)	0.0036(8)
C(12A)	2*i*	0.6437(2)	0.0060(2)	0.1615(2)	0.023(1)	0.020(1)	0.022(1)	0.0099(8)	0.0062(8)	0.0008(8)
C(13A)	2*i*	0.6570(2)	–0.1001(2)	0.0835(2)	0.033(1)	0.022(1)	0.024(1)	0.0107(9)	0.0109(9)	0.0012(9)

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