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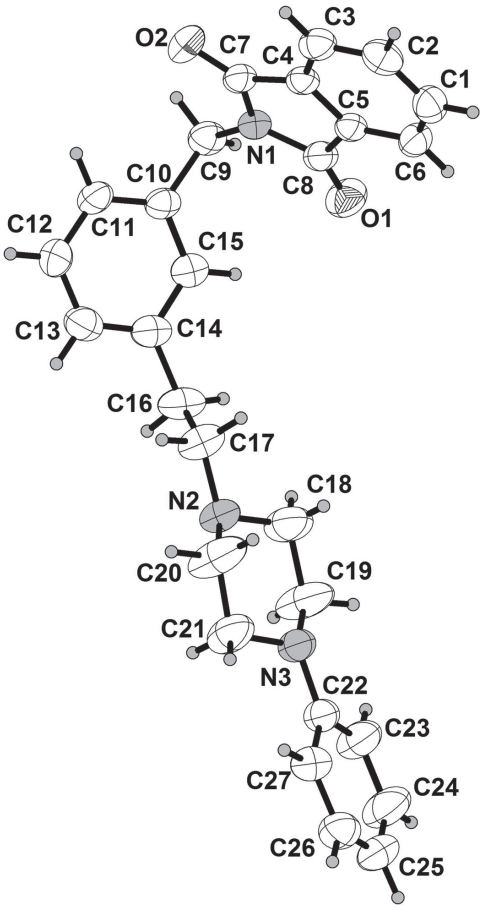
Crystal structure of 2-(3-(2-(4-phenylpiperazin-1-yl)ethyl)benzyl)isoindoline-1,3-dione, $C_{27}H_{27}N_3O_2$



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Abstract

$C_{27}H_{27}N_3O_2$, triclinic, $P\bar{1}$ (no. 2), $a = 6.9263(4)$ Å, $b = 10.0832(7)$ Å, $c = 17.3531(10)$ Å, $\alpha = 75.708(5)°$, $\beta = 87.142(5)°$, $\gamma = 74.935(6)°$, $V = 1133.92(13)$ Å^3, $Z = 2$, $R_{gt}(F) = 0.0605$, $wR_{ref}(F^2) = 0.1661$, $T = 290(1)$ K.

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Table 1: Data collection and handling.

Crystal:	Light yellow block
Size:	0.16 × 0.13 × 0.12 mm
Wavelength:	Mo $K\alpha$ radiation (0.71073 Å)
μ:	0.08 mm^{-1}
Diffractometer, scan mode:	SuperNova, ω-scans
θ_{max}, completeness:	25°, >99%
$N(hkl)_{measured}$, $N(hkl)_{unique}$, R_{int}:	7776, 3957, 0.023
Criterion for I_{obs}, $N(hkl)_{gt}$:	$I_{obs} > 2\ \sigma(I_{obs})$, 2968
$N(param)_{refined}$:	289
Programs:	CrysAlis^{PRO} [1], SHELX [2]

The crystal structure is shown in the figure. Table 1 contains crystallographic data and Table 2 contains the list of the atoms including atomic coordinates and displacement parameters.

Source of material

The title compound was synthesized from 3-((1,3-dioxoisoindolin-2-yl)methyl)phenethyl 4-methylbenzenesulfonate in form of white crystals. To a solution of 3-((1,3-dioxoisoindolin-2-yl)methyl)phenethyl 4-methylbenzenesulfonate (100 mg, 0.29 mmol) in acetonitrile (CH_3CN, 20 mL) was added 1-phenylpiperazine (56 mg, 0.34 mmol) and potassium carbonate (240 mg, 1.74 mmol). The reaction mixture was stirred at reflux for 24 h. After cooling to ambient temperature, the reaction mixture was filtered. After filtration the filtrate was concentrated in vacuo and the residue was purified by silica gel column chromatography using ethyl acetate/petroleum ether (1/15, v/v) as eluent to obtain the target product as a light yellow solid. Yield: 75%; Mp. 402–403 K; **^{1}H NMR** (400 MHz, $CDCl_3$): 7.83 (dd, J = 5.3 Hz, J = 3.1 Hz, 2H), 7.68 (dd, J = 5.4 Hz, J = 3.0 Hz, 2H), 7.28 (d, J = 8.7 Hz, 4H), 7.23 (d, J = 9.3 Hz, 1H), 7.13 (d, J = 7.2 Hz, 1H), 6.93 (d, J = 8.1 Hz, 2H), 6.86 (t, J = 7.2 Hz, 1H), 4.82 (s, 2H), 3.21 (t, J = 4.6 Hz, 4H), 2.84–2.80 (m, 2H), 2.69–2.62 (m, 6H). **^{13}C NMR** (100 MHz, $CDCl_3$): 168.1, 151.3, 140.8, 136.5, 134.0, 132.1, 129.1, 129.0, 128.8, 128.2, 126.4, 123.4, 119.7, 116.1, 60.2, 53.2, 49.1, 41.6, 33.4. **HRMS** (ESI) m/z [M + H]+: calcd for $C_{27}H_{28}N_3O_2$: 426.2176, found: 426.2179.

Experimental details

The hydrogen atoms were placed in calculated positions and refined using a riding on attached atoms with isotropic thermal parameters 1.2 times those of their carrier atoms. The U_{iso}

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

Atom	*x*	*y*	*z*	U_{iso}*/U_{eq}
O1	1.3606(3)	0.34435(19)	0.19243(10)	0.0702(5)
O2	1.3491(3)	0.20458(18)	−0.03785(10)	0.0671(5)
N1	1.3690(3)	0.23895(19)	0.08784(10)	0.0458(5)
N3	0.4264(3)	0.3040(2)	0.53184(12)	0.0566(5)
N2	0.6471(3)	0.1649(2)	0.41737(11)	0.0576(5)
C1	1.1706(3)	0.7217(3)	−0.01292(16)	0.0572(6)
H1	1.1356(3)	0.8175(3)	−0.01374(16)	0.0686(8)*
C2	1.1686(3)	0.6810(3)	−0.08286(15)	0.0584(6)
H2	1.1336(3)	0.7498(3)	−0.13014(15)	0.0701(8)*
C3	1.2180(3)	0.5388(3)	−0.08417(14)	0.0540(6)
C4	1.2691(3)	0.4401(2)	−0.01262(13)	0.0432(5)
C5	1.2724(3)	0.4819(2)	0.05728(12)	0.0431(5)
C6	1.2234(3)	0.6232(3)	0.05836(15)	0.0539(6)
H6	1.2260(3)	0.6509(3)	0.10551(15)	0.0647(7)*
C7	1.3310(3)	0.2824(2)	0.00648(13)	0.0471(5)
C8	1.3372(3)	0.3531(2)	0.12281(14)	0.0479(5)
C9	1.4372(3)	0.0910(2)	0.13228(15)	0.0550(6)
H9a	1.5065(3)	0.0344(2)	0.09666(15)	0.0660(7)*
H9b	1.5311(3)	0.0841(2)	0.17363(15)	0.0660(7)*
C10	1.2653(3)	0.0327(2)	0.16960(13)	0.0476(6)
C11	1.1771(4)	−0.0421(2)	0.13126(15)	0.0586(7)
H11	1.2270(4)	−0.0598(2)	0.08302(15)	0.0703(8)*
C12	1.0153(4)	−0.0906(3)	0.16437(17)	0.0667(7)
H12	0.9561(4)	−0.1405(3)	0.13833(17)	0.0801(9)*
C13	0.9415(4)	−0.0649(2)	0.23598(16)	0.0620(7)
H13	0.8329(4)	−0.0983(2)	0.25796(16)	0.0744(8)*
C14	1.0266(4)	0.0102(2)	0.27594(14)	0.0539(6)
C15	1.1886(3)	0.0577(2)	0.24168(13)	0.0512(6)
H15	1.2478(3)	0.1079(2)	0.26763(13)	0.0614(7)*
C16	0.9417(4)	0.0406(3)	0.35338(15)	0.0673(8)
H16a	0.9225(4)	−0.0462(3)	0.38833(15)	0.0807(9)*
H16b	1.0372(4)	0.0719(3)	0.37893(15)	0.0807(9)*
C17	0.7464(4)	0.1512(3)	0.34247(15)	0.0681(8)
H17a	0.6584(4)	0.1276(3)	0.30915(15)	0.0817(9)*
H17b	0.7699(4)	0.2417(3)	0.31497(15)	0.0817(9)*
C18	0.7362(5)	0.2389(4)	0.46012(19)	0.0920(11)
H18a	0.8775(5)	0.1923(4)	0.46845(19)	0.1104(13)*
H18b	0.7240(5)	0.3347(4)	0.42857(19)	0.1104(13)*
C19	0.6392(4)	0.2442(5)	0.53975(19)	0.1046(14)
H19a	0.6979(4)	0.3005(5)	0.56505(19)	0.1255(16)*
H19b	0.6659(4)	0.1491(5)	0.57374(19)	0.1255(16)*
C20	0.4397(4)	0.2362(5)	0.40643(19)	0.1030(13)
H20a	0.4260(4)	0.3325(5)	0.37540(19)	0.1236(16)*
H20b	0.3763(4)	0.1888(5)	0.37663(19)	0.1236(16)*
C21	0.3346(4)	0.2394(4)	0.4837(2)	0.0889(11)
H21a	0.3370(4)	0.1434(4)	0.5126(2)	0.1067(13)*
H21b	0.1960(4)	0.2918(4)	0.4732(2)	0.1067(13)*
C22	0.3241(4)	0.3358(2)	0.59987(14)	0.0531(6)
C23	0.4231(4)	0.3255(3)	0.66963(17)	0.0782(9)
H23	0.5614(4)	0.2908(3)	0.67322(17)	0.0938(10)*
C24	0.3199(5)	0.3657(4)	0.7337(2)	0.0959(11)
H24	0.3896(5)	0.3570(4)	0.7799(2)	0.1151(13)*
C25	0.1166(5)	0.4182(4)	0.7303(2)	0.0834(9)
H25	0.0483(5)	0.4484(4)	0.7729(2)	0.1001(11)*
C26	0.0160(4)	0.4253(3)	0.66336(18)	0.0714(8)
H26	−0.1226(4)	0.4586(3)	0.66087(18)	0.0857(9)*
C27	0.1166(4)	0.3840(3)	0.59920(15)	0.0597(7)
H27	0.0443(4)	0.3883(3)	0.55451(15)	0.0717(8)*

values of the hydrogen atoms of methyl groups and oxygen were set to $1.5U_{eq}$(C, O). All calculations were performed using the SHELXL-2014 program [2].

Discussion

Compounds with arylpiperazine moieties have a wide range of bioactivities including antiarrhythmic [3], diuretic [4], antiallergic [5], antidepressant [6], anxiolytic [7], antipsychotic [8], antimalarial [9], antiplasmodial [10] and antiproliferative [11] properties. In addition, these compounds also display receptor-blocking properties [12]. Moreover, arylpiperazine derivatives have shown significant cytotoxic activity against the tested prostate cancer cells [13]. Although some crystal structures of arylpiperazine derivatives have been reported recently [14, 15], the different functional groups and organic ligands would lead to various properties of molecules. Therefore, to further study and explore the new arylpiperazine derivatives, we report the crystal structure of the title compound.

The molecule of the title compound presents the isoindoline-1,3-dione, piperazine ring, and two benzene ring groups. One nitrogen atom of piperazine connects the phenyl group *via* C—N bond, and the other N links the phenylethyl moiety. Then, the above phenylethyl is further connect to the isoindoline-1,3-dione group. The isoindoline-1,3-dione, and two aryl moieties are not in the same plane. The whole molecule displays the twisty conformation. In the molecule, the N(1)—C(7), N(1)—C(8), N(1)—C(9), N(3)—C(22), N(3)—C(21), N(3)—C(19), N(2)—C(17), N(2)—C(20), and N(2)—C(18) bond lengths are found to be 1.388(3) Å, 1.394(3) Å, 1.465(3) Å, 1.409(3) Å, 1.437(3) Å, 1.440(3) Å, 1.460(3) Å, 1.428(3) Å, and 1.431(3) Å, respectively. The bond lengths of O(2)—C(7) and O(1)—C(8) are found to be 1.209(2) Å and 1.205(3) Å, respectively. The bond angles C8—N1—C7, C9—N1—C7, C9—N1—C8, C21—N3—C22, C19—N3—C22, C19—N3—C21, C20—N2—C—17, C18—N2—C17, and C18—N2—C20 are 112.05(18)°, 124.49(18)°, 123.46(19)°, 117.7(2)°, 117.1(2)°, 111.9(2)°, 112.5(2)°, 112.8(2)°, and 107.6(2)°, respectively. N1—C7—O2, C4—C7—O2, C4—C7—N1, N1—C8—O1, C5—C8—O1, C5—C8—N1, C27—C22—N3, C23—C22—N3, and C10—C9—N1 are 125.3(2), 128.9(2), 105.843(17), 125.3(2), 128.8(2), 105.88(18), 120.9(2), 122.4(2), and 111.83(18), respectively. Finally, a

supramolecular framework structure is formed by the weak intermolecular force.

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