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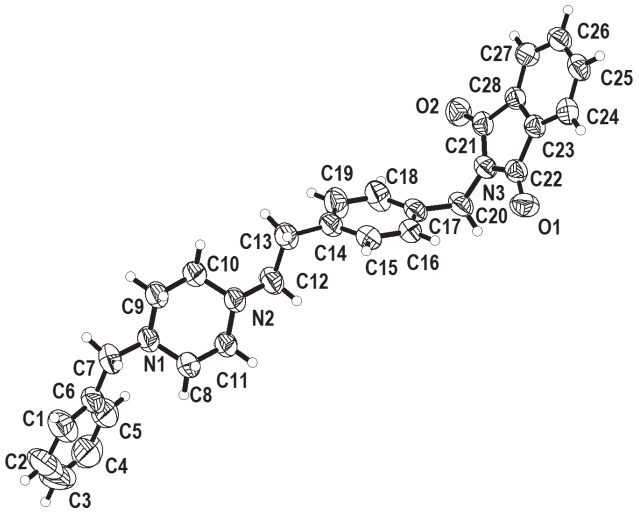
Crystal structure of 2-(4-(2-(4-benzylpiperazin-1-yl)ethyl)benzyl)isoindoline-1,3-dione, $C_{28}H_{29}N_3O_2$



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Abstract

$C_{28}H_{29}N_3O_2$, triclinic, $P\bar{1}$ (no. 2), $a = 6.7598(9)$ Å, $b = 10.1294(13)$ Å, $c = 18.386(3)$ Å, $\alpha = 78.536(7)°$, $\beta = 83.758(8)°$, $\gamma = 76.550(8)°$, $V = 1197.4(3)$ Å^3, $Z = 2$, $R_{gt}(F) = 0.0492$, $wR_{ref}(F^2) = 0.1473$, $T = 293$ K.

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The asymmetric unit 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.

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Table 1: Data collection and handling.

Crystal:	Colourless block
Size:	0.3 × 0.2 × 0.2 mm
Wavelength:	Cu $K\alpha$ radiation (1.54178 Å)
μ:	6.1 cm^{-1}
Diffractometer, scan mode:	Bruker P4, ω scans
$2\theta_{max}$, completeness:	136.4°, 98.1%
$N(hkl)_{measured}$, $N(hkl)_{unique}$, R_{int}:	13600, 4280, 0.061
Criterion for I_{obs}, $N(hkl)_{gt}$:	$I_{obs} > 2\,\sigma(I_{obs})$, 2724
$N(param)_{refined}$:	299
Programs:	SHELX [1], Bruker programs [2]

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

Atom	x	y	z	U_{iso}*/U_{eq}
O1	0.8660(2)	0.65881(13)	0.53863(8)	0.0713(4)
O2	0.8327(2)	0.97962(14)	0.32486(7)	0.0689(4)
N1	0.1450(3)	0.10231(16)	0.13796(9)	0.0598(5)
N2	0.2960(2)	0.25639(16)	0.22743(8)	0.0574(4)
N3	0.8640(2)	0.79341(15)	0.42150(8)	0.0512(4)
C1	0.0248(5)	−0.2082(3)	0.08416(13)	0.0992(9)
H1	−0.1063	−0.2047	0.1063	0.119*
C2	0.1187(8)	−0.3172(3)	0.04869(18)	0.1390(16)
H2	0.0498	−0.3859	0.0470	0.167*
C3	0.3127(8)	−0.3247(3)	0.0160(2)	0.1496(19)
H3	0.3754	−0.3987	−0.0073	0.179*
C4	0.4138(5)	−0.2224(3)	0.01788(15)	0.1215(12)
H4	0.5450	−0.2267	−0.0043	0.146*
C5	0.3186(4)	−0.1118(3)	0.05332(13)	0.0852(7)
H5	0.3872	−0.0425	0.0542	0.102*
C6	0.1244(4)	−0.1039(2)	0.08702(11)	0.0683(6)
C7	0.0148(3)	0.0144(2)	0.12364(11)	0.0703(6)
H7A	−0.0914	0.0707	0.0924	0.084*
H7B	−0.0508	−0.0219	0.1705	0.084*
C8	0.2778(3)	0.0350(2)	0.19798(11)	0.0640(6)
H8A	0.3601	−0.0513	0.1865	0.077*
H8B	0.1959	0.0145	0.2438	0.077*
C9	0.0214(3)	0.2297(2)	0.15857(12)	0.0686(6)
H9A	−0.0612	0.2080	0.2040	0.082*
H9B	−0.0696	0.2768	0.1197	0.082*
C10	0.1552(3)	0.3232(2)	0.17003(11)	0.0677(6)
H10A	0.2318	0.3490	0.1237	0.081*
H10B	0.0703	0.4068	0.1840	0.081*
C11	0.4142(3)	0.12719(19)	0.20814(11)	0.0610(5)
H11A	0.5047	0.0802	0.2472	0.073*

Table 2 (continued)

Atom	x	y	z	U_{iso}*/U_{eq}
H11B	0.4974	0.1463	0.1625	0.073*
C12	0.4298(3)	0.3438(2)	0.23836(11)	0.0661(6)
H12A	0.5044	0.3692	0.1915	0.079*
H12B	0.5284	0.2909	0.2736	0.079*
C13	0.3190(3)	0.4747(2)	0.26657(12)	0.0692(6)
H13A	0.2488	0.5400	0.2265	0.083*
H13B	0.2182	0.4530	0.3062	0.083*
C14	0.4701(3)	0.53845(19)	0.29533(11)	0.0587(5)
C15	0.5202(3)	0.49898(19)	0.36845(11)	0.0608(5)
H15	0.4510	0.4394	0.4009	0.073*
C16	0.6702(3)	0.54561(18)	0.39467(10)	0.0573(5)
H16	0.7026	0.5154	0.4440	0.069*
C17	0.7726(3)	0.63633(19)	0.34878(11)	0.0543(5)
C18	0.7201(4)	0.6791(2)	0.27633(12)	0.0747(7)
H18	0.7858	0.7414	0.2445	0.090*
C19	0.5707(4)	0.6309(2)	0.24977(12)	0.0787(7)
H19	0.5381	0.6615	0.2005	0.094*
C20	0.9407(3)	0.68385(19)	0.37745(11)	0.0601(5)
H20A	1.0236	0.6056	0.4079	0.072*
H20B	1.0272	0.7172	0.3355	0.072*
C21	0.8221(3)	0.93345(19)	0.39085(11)	0.0501(5)
C22	0.8389(3)	0.77143(19)	0.49878(11)	0.0512(5)
C23	0.7753(3)	0.90985(18)	0.51921(10)	0.0480(4)
C24	0.7336(3)	0.9490(2)	0.58849(10)	0.0578(5)
H24	0.7403	0.8839	0.6321	0.069*
C25	0.6818(3)	1.0886(2)	0.58983(11)	0.0614(5)
H25	0.6500	1.1181	0.6353	0.074*
C26	0.6760(3)	1.1854(2)	0.52503(12)	0.0622(6)
H26	0.6423	1.2788	0.5278	0.075*
C27	0.7194(3)	1.14630(19)	0.45619(11)	0.0574(5)
H27	0.7161	1.2114	0.4126	0.069*
C28	0.7678(3)	1.00705(18)	0.45474(10)	0.0470(4)

Source of material

To a mixture of 2-(4-((1,3-dioxoisoindolin-2-yl)methyl)phenyl) ethyl-4-methylbenzenesulfonate (217.8 mg, 0.5 mmol) in 50 mL EtOH and KOH (112.2 mg, 2.0 mmol), 1-benzylpiperazine (96.9 mg, 0.55 mmol) was added at ambient temperature. The reaction mixture was stirred and heated to reflux for 2–3 h, until TLC indicated the end of reaction. Solvent was removed under reduced pressure, and the residue was extracted with CH_2Cl_2 (100 mL, 3 times). The combined organic layer was successively washed with water, brine, dried over anhydrous sodium sulfate, and concentrated in vacuo. The residue was purified by silica gel column chromatography using ethyl acetate/petroleum ether (1:8, *v*/*v*) as eluent, to afford the title compound as a white solid.

Experimental details

The structure was solved with SHELXT [1] and refined with SHELXL [1]. All H atoms were placed in geometrically idealized positions and refined using a riding model, with C—H = 0.97 (methylene), 0.93 Å (benzene), and with $U_{iso}(H) = 1.2U_{eq}(C)$ for H atoms on methylene and benzene.

Comment

The arylpiperazine moiety as an important pharmacophore is widely used to generate pharmacological activities [3–5]. Arylpiperazine derivatives referred to in this paper possess antitumor activity. The asymmetric unit contains only one independent molecule.

The title compound contains three aryl rings, a piperanzinyl and a pyrrole moiety. Ring (C23—C28) and ring (C21—N3—C22—C23—C28) are coplanar. The dihedral angles made by the planes of the ring (C1—C6) and ring (N1—C8—C11—N2—C10—C9), ring (C1—C6) and ring (C15—C19), ring (C1—C6) and ring (C23—C28) are 52.25(8)°, 104.97(8)° and 66.35(8)°, respectively. The packing structure shows some weak non-classical hydrogen bonds.

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