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Crystal structure of ethyl 1-[(2′-cyanobiphenyl-4-yl)methyl]-2-ethoxybenzimidazole-7-carboxylate, $C_{26}H_{23}N_3O_3$

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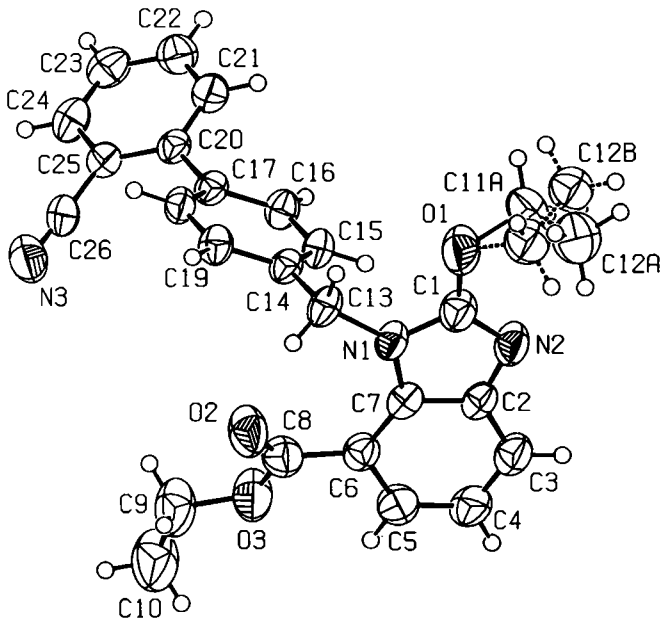

Abstract

$C_{26}H_{23}N_3O_3$, monoclinic, $P12_1/n1$ (no. 14), a = 11.480(1) Å, b = 8.377(1) Å, c = 22.824(3) Å, β = 90.299(3)°, V = 2195.0 Å^3, Z = 4, $R_{gt}(F)$ = 0.051, $wR_{ref}(F^2)$ = 0.111, T = 293 K.

Source of material

Acetic acid (0.4 g) was added to a solution of ethyl 3-amino-2-*N*-[(2′-cyanobiphenyl-4-yl)methyl]aminobenzoate (2.0 g) in ethyl orthocarbonate (10 mL). The mixture was stirred at 353 K for one hour. The reaction mixture was concentrated, and the concentrate was dissolved in ethyl acetate. The solution was washed with an aqueous solution of sodium hydrogen carbonate and water. The solvent was evaporated to give crystals. Colorless single crystals of title compound suitable for diffraction analysis were obtained from an ethyl acetate solution after one week.

Experimental details

The disordered ethyl group was split into two positions and the atomic positions were refined under using of restraints for C—O and C—C bond lengths. While the C atoms of the major part could be refined anisotropically, the respective atoms of the minor part had to be refined isotropically.

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Discussion

The title compound is an important intermediate in the synthesis of candesartan cilexetil, which is a clinical drug use as treating hypertension and heart failure [1] and was synthesized by the cyclic reaction of ethyl 3-amino-2-*N*-[(2′-cyanobiphenyl-4-yl)-methyl]aminobenzoate with ethyl orthocarbonate in the presence of acetic acid [2].

In title structure, the bond lengths and angles are in normal range. The torsion angles C16–C17–C20–C21 of 41.1(5)° and C18–C17–C20–C25 of 43.3(5)° are very closely to those of 4′-(bromomethyl)-1,1′-biphenyl-2-carbonitrile (48.6(7)° and 48.3(7)°, respectively) [3] and to those of 4′-[(2-butyl-4-oxo-1,3-diazaspiro[4,4]non-1-en-3-yl)methyl]-(1,1′-biphenyl)-2-carbonitrile (54.7(2)° and 50.0(3)°, respectively) [4]. The corresponding torsion angle for the candesartan cilexetil molecule is also in the same range (49.6(4)°) [5]. The crystal packing of the title structure is stabilized by weak intermolecular C–H···O and C–H···N interactions.

Table 1. Data collection and handling.

Crystal:	colorless prism, size 0.167 × 0.331 × 0.417 mm
Wavelength:	Mo K_α radiation (0.71073 Å)
μ:	0.86 cm^{-1}
Diffractometer, scan mode:	Bruker SMART CCD, φ/ω
$2\theta_{max}$:	56.6°
$N(hkl)_{measured}$, $N(hkl)_{unique}$:	12904, 5085
Criterion for I_{obs}, $N(hkl)_{gt}$:	$I_{obs} > 2\,\sigma(I_{obs})$, 1380
$N(param)_{refined}$:	300
Programs:	SHELXS-97 [6], SHELXL-97 [7]

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

Atom	Site	Occ.	x	y	z	U_{iso}
H(3)	4e		0.2684	0.7528	0.9715	0.074
H(4)	4e		0.2728	0.6349	0.8797	0.080
H(5)	4e		0.4430	0.5486	0.8408	0.075
H(9A)	4e		0.7611	0.3467	0.8113	0.116
H(9B)	4e		0.8115	0.5148	0.7940	0.116
H(10A)	4e		0.6381	0.3563	0.7312	0.184
H(10B)	4e		0.7684	0.3679	0.7113	0.184
H(10C)	4e		0.6910	0.5220	0.7136	0.184
H(11A)	4e	0.724	0.5213	1.0218	1.1097	0.081
H(11B)	4e	0.724	0.6280	1.0190	1.1534	0.081
H(12A)	4e	0.724	0.4609	0.9314	1.2023	0.141
H(12B)	4e	0.724	0.5505	0.7906	1.1985	0.141
H(12C)	4e	0.724	0.4436	0.7964	1.1555	0.141
C(11B)	4e	0.276	0.561(1)	0.836(1)	1.1496(4)	0.075(5)

Table 2. Continued.

Atom	Site	Occ.	x	y	z	U_{iso}
H(11C)	4e	0.276	0.6069	0.7947	1.1822	0.090
H(11D)	4e	0.276	0.4920	0.7704	1.1451	0.090
C(12B)	4e	0.276	0.529(1)	1.008(1)	1.1600(5)	0.072(5)
H(12D)	4e	0.276	0.4827	1.0155	1.1949	0.108
H(12E)	4e	0.276	0.4842	1.0467	1.1272	0.108
H(12F)	4e	0.276	0.5980	1.0706	1.1645	0.108
H(13A)	4e		0.7768	0.5828	0.9946	0.063
H(13B)	4e		0.7831	0.6972	1.0489	0.063

Table 2. Continued.

Atom	Site	Occ.	x	y	z	U_{iso}
H(15)	4e		0.6894	0.9645	0.9587	0.057
H(16)	4e		0.7934	1.1526	0.9075	0.058
H(18)	4e		1.0785	0.8849	0.9224	0.054
H(19)	4e		0.9744	0.6953	0.9729	0.057
H(21)	4e		0.9406	1.3509	0.9137	0.065
H(22)	4e		1.0330	1.5458	0.8600	0.073
H(23)	4e		1.1624	1.4778	0.7884	0.079
H(24)	4e		1.1974	1.2131	0.7674	0.076

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

Atom	Site	Occ.	x	y	z	U_{11}	U_{22}	U_{33}	U_{12}	U_{13}	U_{23}
O(1)	4e		0.6287(2)	0.8343(3)	1.0966(1)	0.055(2)	0.143(3)	0.062(2)	0.011(2)	–0.002(1)	–0.030(2)
O(2)	4e		0.7423(2)	0.4910(3)	0.9065(1)	0.058(2)	0.117(2)	0.076(2)	0.030(2)	–0.008(1)	–0.019(2)
O(3)	4e		0.6464(2)	0.5255(3)	0.8228(1)	0.061(2)	0.122(2)	0.064(2)	0.017(2)	0.003(1)	–0.008(2)
N(1)	4e		0.6297(2)	0.7075(3)	1.0066(1)	0.034(2)	0.062(2)	0.048(2)	0.003(1)	0.000(1)	0.003(1)
N(2)	4e		0.4582(2)	0.8006(3)	1.0412(1)	0.039(2)	0.087(2)	0.059(2)	0.009(2)	–0.001(2)	–0.004(2)
N(3)	4e		1.1329(3)	0.8317(4)	0.7979(1)	0.076(2)	0.079(2)	0.076(2)	0.007(2)	0.020(2)	–0.011(2)
C(1)	4e		0.5686(3)	0.7836(4)	1.0501(2)	0.047(2)	0.079(3)	0.052(2)	0.001(2)	–0.001(2)	0.000(2)
C(2)	4e		0.4423(3)	0.7307(4)	0.9870(2)	0.035(2)	0.053(2)	0.061(2)	0.000(2)	–0.002(2)	0.006(2)
C(3)	4e		0.3381(3)	0.7163(4)	0.9559(2)	0.045(2)	0.063(3)	0.077(3)	0.003(2)	0.001(2)	0.004(2)
C(4)	4e		0.3414(3)	0.6463(4)	0.9011(2)	0.045(2)	0.069(3)	0.087(3)	0.007(2)	–0.017(2)	–0.006(2)
C(5)	4e		0.4441(3)	0.5937(4)	0.8781(1)	0.058(2)	0.069(3)	0.060(2)	0.003(2)	–0.007(2)	–0.004(2)
C(6)	4e		0.5512(3)	0.6043(4)	0.9079(2)	0.044(2)	0.049(2)	0.058(2)	0.003(2)	–0.001(2)	0.003(2)
C(7)	4e		0.5468(3)	0.6724(4)	0.9637(1)	0.039(2)	0.052(2)	0.056(2)	–0.003(2)	–0.000(2)	0.005(2)
C(8)	4e		0.6569(3)	0.5357(4)	0.8811(2)	0.060(3)	0.068(3)	0.056(3)	0.004(2)	–0.003(2)	–0.004(2)
C(9)	4e		0.7428(3)	0.4477(5)	0.7926(2)	0.072(3)	0.161(4)	0.058(3)	0.016(3)	0.008(2)	–0.007(3)
C(10)	4e		0.7070(3)	0.4212(5)	0.7320(2)	0.094(3)	0.205(5)	0.070(3)	0.008(3)	0.008(3)	–0.021(3)
C(11A)	4e	0.724(6)	0.5710(4)	0.9533(5)	1.1332(2)	0.076(4)	0.057(4)	0.070(4)	0.007(3)	0.005(3)	–0.010(3)
C(12A)	4e	0.724	0.5001(4)	0.8595(6)	1.1762(2)	0.101(5)	0.112(6)	0.068(4)	–0.013(4)	0.016(4)	–0.001(4)
C(13)	4e		0.7569(2)	0.6887(4)	1.0086(1)	0.031(2)	0.069(3)	0.057(2)	0.004(2)	–0.005(2)	0.008(2)
C(14)	4e		0.8206(2)	0.8116(4)	0.9719(1)	0.035(2)	0.052(2)	0.040(2)	–0.001(2)	–0.002(2)	0.002(2)
C(15)	4e		0.7681(2)	0.9476(4)	0.9515(1)	0.034(2)	0.055(2)	0.053(2)	0.007(2)	0.003(2)	0.004(2)
C(16)	4e		0.8303(2)	1.0600(4)	0.9203(1)	0.042(2)	0.049(2)	0.053(2)	0.006(2)	0.001(2)	0.008(2)
C(17)	4e		0.9473(2)	1.0367(4)	0.9077(1)	0.035(2)	0.050(2)	0.037(2)	–0.002(2)	–0.001(2)	0.002(2)
C(18)	4e		0.9995(2)	0.9011(4)	0.9290(1)	0.034(2)	0.059(2)	0.043(2)	0.004(2)	0.001(2)	–0.003(2)
C(19)	4e		0.9374(2)	0.7878(4)	0.9600(1)	0.040(2)	0.057(2)	0.046(2)	0.010(2)	–0.002(2)	0.006(2)
C(20)	4e		1.0108(2)	1.1595(4)	0.8736(1)	0.034(2)	0.052(2)	0.044(2)	–0.001(2)	–0.004(2)	–0.000(2)
C(21)	4e		0.9920(2)	1.3211(4)	0.8843(1)	0.047(2)	0.061(3)	0.055(2)	–0.001(2)	0.005(2)	–0.002(2)
C(22)	4e		1.0479(3)	1.4388(4)	0.8522(2)	0.058(2)	0.055(3)	0.070(3)	0.004(2)	–0.005(2)	–0.003(2)
C(23)	4e		1.1244(3)	1.3983(4)	0.8094(2)	0.061(2)	0.061(3)	0.076(3)	–0.014(2)	0.004(2)	0.008(2)
C(24)	4e		1.1456(3)	1.2405(4)	0.7969(1)	0.052(2)	0.073(3)	0.065(2)	–0.007(2)	0.011(2)	0.009(2)
C(25)	4e		1.0883(3)	1.1199(4)	0.8292(1)	0.041(2)	0.055(2)	0.051(2)	–0.003(2)	0.001(2)	–0.005(2)
C(26)	4e		1.1118(3)	0.9578(5)	0.8124(1)	0.050(2)	0.065(3)	0.054(2)	–0.004(2)	0.016(2)	–0.002(2)

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