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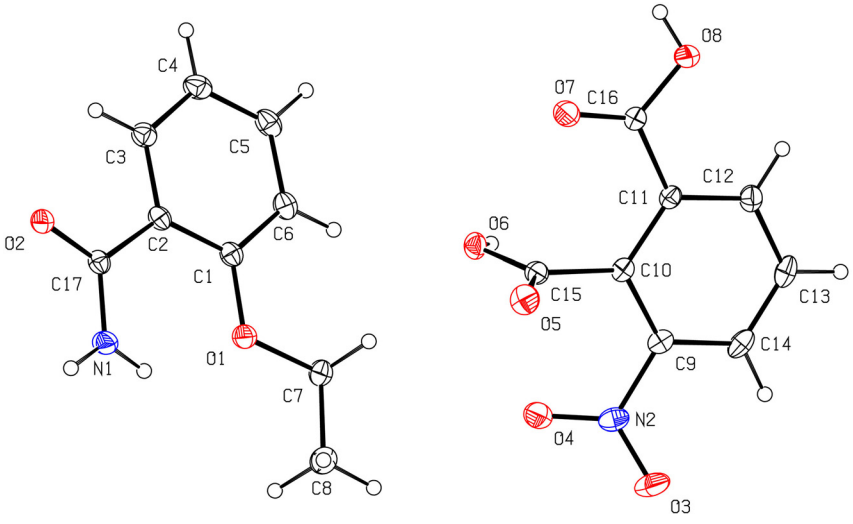
The crystal structure of 3-nitrobenzene-1,2-dicarboxylic acid–2-ethoxybenzamide (1/1), $C_{17}H_{16}N_2O_8$



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Abstract

$C_{17}H_{16}N_2O_8$, monoclinic, $P2_1/c$ (no. 14), a = 7.0825(4) Å, b = 15.6168(9) Å, c = 15.1086(9) Å, β = 93.3830(10)°, V = 1668.19(17) Å^3, Z = 4, $R_{gt}(F)$ = 0.0543, $wR_{ref}(F^2)$ = 0.1443, T = 170.15 K.

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Table 1 contains crystallographic data and Table 2 contains the list of the atoms including atomic coordinates and displacement parameters.

Table 1: Data collection and handling.

Crystal:	Colourless block
Size:	0.48 × 0.28 × 0.26 mm
Wavelength:	Mo *Kα* radiation (0.71073 Å)
μ:	0.12 mm^{-1}
Diffractometer, scan mode:	Bruker APEX-II, φ and ω
θ_{max}, completeness:	27.5°, 99 %
$N(hkl)_{measured}$, $N(hkl)_{unique}$, R_{int}:	18,714, 3807, 0.048
Criterion for I_{obs}, $N(hkl)_{gt}$:	$I_{obs} > 2\ \sigma(I_{obs})$, 3160
$N(param)_{refined}$:	245
Programs:	Bruker [1], Olex2 [2], Shelx [3, 4]

1 Source of materials

A mixture of 2-ethoxybenzamide (100.0 mg, 0.6 mmol) and 3-nitrobenzene-1,2-dicarboxylic acid (126.7 mg, 0.6 mmol) was dissolved in a mixed solution of 3 mL of toluene and 3 mL of ethyl acetate, and the resulting mixture was stirred and dissolved at 60 °C to obtain a clear solution, which was filtered and placed in a 10 mL glass vial. The filtrate was slowly evaporated at room temperature. A large number of colourless crystals were obtained after 2 days.

2 Experimental details

Absorption corrections were applied by using multi-scan program [1]. Using Olex2 [2], the structure was solved with

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

Atom	*x*	*y*	*z*	U_{iso}*/U_{eq}
O1	0.1664 (2)	0.60831 (10)	0.66641 (10)	0.0301 (4)
O2	0.2041 (2)	0.62660 (9)	0.94128 (10)	0.0299 (4)
N1	0.2103 (3)	0.53700 (12)	0.82582 (12)	0.0299 (4)
H1A	0.245643	0.494218	0.860962	0.036*
H1B	0.193463	0.528598	0.768312	0.036*
C1	0.1301 (3)	0.68500 (13)	0.70530 (14)	0.0245 (4)
C2	0.1352 (3)	0.68771 (13)	0.79897 (14)	0.0243 (4)
C3	0.0930 (3)	0.76490 (14)	0.83985 (15)	0.0276 (4)
H3	0.092788	0.767164	0.902679	0.033*
C4	0.0515 (3)	0.83813 (14)	0.79123 (16)	0.0322 (5)
H4	0.023675	0.890193	0.820270	0.039*
C5	0.0510 (3)	0.83469 (14)	0.69956 (16)	0.0321 (5)
H5	0.024462	0.885053	0.665819	0.039*
C6	0.0886 (3)	0.75906 (14)	0.65654 (15)	0.0290 (5)
H6	0.086150	0.757555	0.593623	0.035*
C7	0.1765 (3)	0.60590 (14)	0.57092 (14)	0.0304 (5)
H7A	0.268124	0.648925	0.551637	0.036*
H7B	0.051023	0.618634	0.541472	0.036*
C8	0.2390 (4)	0.51727 (16)	0.54715 (16)	0.0383 (6)
H8A	0.148729	0.475257	0.567804	0.057*
H8B	0.364604	0.506027	0.575499	0.057*
H8C	0.244518	0.512758	0.482661	0.057*
C17	0.1850 (3)	0.61423 (13)	0.85870 (13)	0.0239 (4)
O3	0.5794 (3)	0.60686 (12)	0.25502 (13)	0.0505 (5)
O4	0.4651 (2)	0.63373 (10)	0.38157 (11)	0.0367 (4)
O5	0.7498 (2)	0.71289 (11)	0.50604 (10)	0.0359 (4)
O6	0.4659 (2)	0.76899 (10)	0.51791 (9)	0.0288 (3)
H6A	0.378764	0.786120	0.482051	0.043*
O7	0.7129 (3)	0.91351 (11)	0.52629 (10)	0.0437 (5)
O8	0.7643 (3)	1.01652 (11)	0.42930 (11)	0.0489 (5)
H8	0.743629	1.049295	0.471773	0.073*
N2	0.5450 (3)	0.65582 (12)	0.31529 (13)	0.0309 (4)
C9	0.6002 (3)	0.74615 (14)	0.30746 (14)	0.0254 (4)
C10	0.6291 (3)	0.79590 (13)	0.38380 (13)	0.0228 (4)
C11	0.6775 (3)	0.88201 (13)	0.37162 (13)	0.0233 (4)
C12	0.6908 (3)	0.91495 (15)	0.28633 (14)	0.0282 (5)
H12	0.720828	0.973686	0.278758	0.034*
C13	0.6607 (3)	0.86286 (16)	0.21256 (14)	0.0318 (5)
H13	0.670191	0.885978	0.154833	0.038*
C14	0.6172 (3)	0.77783 (16)	0.22282 (14)	0.0308 (5)
H14	0.599108	0.741435	0.172653	0.037*
C15	0.6218 (3)	0.75584 (13)	0.47516 (13)	0.0254 (4)
C16	0.7187 (3)	0.93834 (14)	0.45070 (14)	0.0267 (4)

the SHELXT [3] structure solution program and refined with the SHELXL [4] refinement package.

3 Comment

Increased interest in the synthesis and design of new forms of drugs, such as cocrystals, is caused by their ability to change physical and chemical properties of active pharmaceutical ingredients. The 2-ethoxybenzamide is a poorly-water soluble drug used for treatment of moderate and mild pain. Combinations of 2-ethoxybenzamide with aspirin, caffeine or paracetamol are widely used e.g. in Japan and Poland. Many structures of 2-ethoxybenzamide cocrystal have been published and deposited in CSD (Cambridge Structural Database). For example, with Furosemide (CCDC:2114160, SARQOV) [5], Sinapic Acid (CCDC:1581650, DEYQUW) [6], 2,5-dihydroxybenzoic acid (CCDC:1522933, FENQEX), 3,4-dihydroxybenzoic acid (CCDC:1522937, FENRIC) [7], phenol (CCDC:1879336, VUKSEC) [8], 3,5-dinitrobenzoic acid (CCDC:752467, WUZHOP) [9], 2,4-dihydroxybenzoic acid (CCDC:1825011, JIFHAK) [10], 3,4,5-trihydroxybenzoic acid (CCDC:1468148, ORIKIL), 2-nitrobenzoic acid (CCDC:1468153, ORIKOR), 3-nitrobenzoic acid (CCDC:1468154, ORIKUX), 2,4-dinitrobenzoic acid (CCDC:1468159, ORILAE), 3-methylbenzoic acid (CCDC:1468161, ORILEI) [11], 2–hydroxybenzoic acid (CCDC:752480, REHSAA) [12] and so on. In this paper, we report a new cocrystal of 2-ethoxybenzamide.

In the unit cell of the title crystal, the main forces are the formation of intermolecular hydrogen bonds between the amide groups on 2-ethoxybenzamide and the carboxyl groups and nitro group on 3-nitrobenzene-1,2-dicarboxylic acid (see figure). The O2 atom on the amide group of the 2-ethoxybenzamide molecule is a hydrogen bond acceptor, and the H6A atom on the carboxyl group (O6–H6) of the 3-nitrobenzene-1,2-dicarboxylic acid molecule is a hydrogen bond donor, forming an intermolecular hydrogen bond O6–H6A···O2^1 (^{1} = $+X$, 3/2 − Y, −1/2 + Z; d(O6···O2) = 2.680(2) Å; O6–H6A···O2 = 150.3°). The O2 atom on the amide group of the 2-ethoxybenzamide molecule is a hydrogen bond acceptor, and the H8 atom on the carboxyl group (O8–H8) of the 3-nitrobenzene-1,2-dicarboxylic acid molecule is a hydrogen bond donor, forming an intermolecular hydrogen bond O8–H8···O2. The O7 atom on the carboxyl group of the 3-nitrobenzene-1,2-dicarboxylic acid molecule is a hydrogen bond acceptor, and the H1 atom on the amide group (N1–H1) of the 2-ethoxybenzamide molecule is a hydrogen bond donor, forming an intermolecular hydrogen bond N1–H1···O7. The O3 atom on the nitro group of the 3-nitrobenzene-1,2-dicarboxylic acid molecule is a hydrogen bond acceptor, and the H1 atom on the amide group (N1–H1) of the 2-ethoxybenzamide molecule is a hydrogen bond donor, forming an intermolecular hydrogen bond N1–H1···O3.

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