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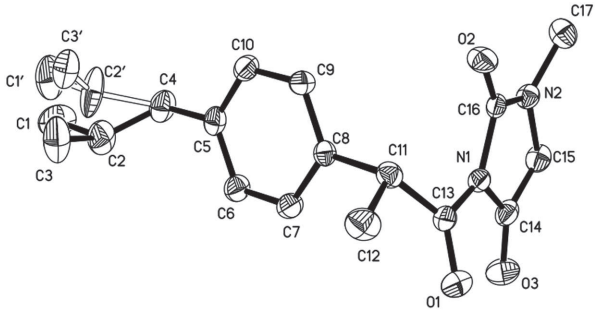
Crystal structure of 3-(2-(4-isobutylphenyl) propanoyl)-1-methylimidazolidine-2,4-dione, $C_{17}H_{22}N_2O_3$



DOI 10.1515/ncrs-2016-0384
Received December 4, 2016; accepted April 12, 2017; available online May 8, 2017

Table 1: Data collection and handling.

Crystal:	Colourless block
Size:	0.21 × 0.18 × 0.11 mm
Wavelength:	Mo $K\alpha$ radiation (0.71073 Å)
μ:	0.8 cm^{-1}
Diffractometer, scan mode:	Bruker APEXII, φ and ω
$2\theta_{max}$, completeness:	52.8°, >99%
$N(hkl)_{measured}$, $N(hkl)_{unique}$, R_{int}:	8567, 3355, 0.045
Criterion for I_{obs}, $N(hkl)_{gt}$:	$I_{obs} > 2\ \sigma(I_{obs})$, 2137
$N(param)_{refined}$:	232
Programs:	Bruker [1], SHELX [2]

Abstract

$C_{17}H_{22}N_2O_3$, monoclinic, $P2_1/c$, (no. 14) $a = 18.419(4)$ Å, $b = 5.7524(12)$ Å, $c = 17.575(4)$ Å, $\beta = 117.267(3)°$, $V = 1655.2(6)$ Å^3, $Z = 4$, $R_{gt}(F) = 0.0724$, $wR_{ref}(F^2) = 0.1899$, T = 187(2) K.

CCDC no.: 1480851

The asymmetric unit of the title crystal structure is shown in the figure. Hydrogen atoms are omitted for clarity. Tables 1 and 2 contain details on crystal structure and measurement conditions and a list of the atoms including atomic coordinates and displacement parameters.

Source of material

Ibuprofen ((4-isobutylphenyl)propionic acid; 6.0 g, 29 mmol) and $SOCl_2$ (3.5 g, 30 mmol) were added to 20 mL of CH_2Cl_2. After refluxing for 1.5 h, the reaction solution was added dropwise into another solution of 1-methylhydantoin (1-methylimidazolidine-2,4-dione; 3.3 g, 29 mmol) and pyridine (6.0 g, 60 mmol) at room temperature and stirred for 4 h. After reacting, the mixture was filtered and concentrated to give a crude product. The crude product was purified by recrystallization in ethyl acetate and *n*-hexane (v/v, 1:30). Colorless block-shaped crystals were obtained (yield: 85%). **^{1}H-NMR** ($CDCl_3$, 400 MHz): 0.89 (d, J = 6.8 Hz, 6H, $2CH_3$), 1.49 (d, J = 6.8 Hz, 3H, CH_3), 1.83–1.85 (m, 1H, CH), 2.42 (d, J = 7.2 Hz, 2H, CH_2), 2.93 (s, 3H, CH_3), 3.77 (s, 2H, CH_2), 4.85 (q, J = 6.8 Hz, 1H, CH), 7.07 (d, J = 8.0 Hz, 2H, 2ArH), 7.16 (d, J = 8.0 Hz, 2H, 2ArH); **^{13}C-NMR** ($CDCl_3$, 100 MHz): 172.58, 166.93, 152.86, 140.88, 136.68, 129.57, 129.57, 127.64, 127.64, 50.85, 46.62, 44.97, 30.06, 29.52, 22.32, 22.32, 18.57; **ESI-MS** [M + H]+, m/z: 303.3; Found: 303.1712.

Experimental details

All H atoms were placed in calculated positions and refined using the riding model approximation. For the methyl groups, C—H bonds were fixed at 0.98 Å, the U_{iso} values of the hydrogen atoms of methyl groups were set to 1.5 U_{eq}(C) and the U_{iso} values of all other hydrogen atoms were set to 1.2 U_{eq} (C), with aromatic C—H distances of 0.95 Å. The isopropyl moiety is disordered over two split positions (*cf*. the figure).

Discussion

Qviductus Ranne [3] has significant pharmacological activities, mainly in anti-oxidation, anti-inflammatory, anti-anxiety, antitussive, and anti-fatigue [4–7]. 1-Methylhydantoin, as a main effective constituent in Oviducts Ranne, has been widely used in pharmaceutical industry

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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}
C1[a]	0.4599(9)	−0.411(2)	0.8904(6)	0.097(4)
H1A[a]	0.4453	−0.5748	0.8759	0.145*
H1B[a]	0.4342	−0.3533	0.9247	0.145*
H1C[a]	0.5194	−0.3969	0.9233	0.145*
C1'[a]	0.4528(7)	−0.295(2)	0.9233(7)	0.094(4)
H1'A[a]	0.4948	−0.2185	0.9744	0.140*
H1'B[a]	0.4741	−0.4421	0.9138	0.140*
H1'C[a]	0.4044	−0.3246	0.9313	0.140*
C2[a]	0.4309(5)	−0.2720(19)	0.8103(5)	0.068(2)
H2A[a]	0.4351	−0.3822	0.7685	0.082*
C2'[a]	0.4286(6)	−0.1289(18)	0.8418(6)	0.084(4)
H2'[a]	0.4650	−0.2024	0.8205	0.101*
C3[b]	0.4957(3)	−0.0918(14)	0.8250(4)	0.087(2)
H3A[b]	0.4779	0.0067	0.7740	0.130*
H3B[b]	0.5469	−0.1698	0.8359	0.130*
H3C[b]	0.5043	0.0045	0.8744	0.130*
C3'[c]	0.4618(9)	0.065(3)	0.8583(9)	0.089(5)
H3'A[c]	0.4324	0.1694	0.8098	0.133*
H3'B[c]	0.5186	0.0493	0.8687	0.133*
H3'C[c]	0.4606	0.1282	0.9094	0.133*
C4	0.3503(2)	−0.2073(7)	0.77167(19)	0.0569(9)
H4A	0.3405	−0.1173	0.8141	0.068*
H4B	0.3173	−0.3509	0.7596	0.068*
C5	0.31678(17)	−0.0671(6)	0.69016(17)	0.0425(7)
C6	0.32311(19)	−0.1494(5)	0.61925(18)	0.0455(8)
H6A	0.3498	−0.2934	0.6230	0.055*
C7	0.29163(18)	−0.0269(5)	0.54361(18)	0.0437(7)
H7A	0.2972	−0.0876	0.4963	0.052*
C8	0.25185(16)	0.1835(5)	0.53525(16)	0.0327(6)
C9	0.24489(17)	0.2672(5)	0.60447(17)	0.0397(7)
H9A	0.2175	0.4105	0.5999	0.048*
C10	0.27761(17)	0.1446(6)	0.68206(18)	0.0442(8)
H10A	0.2729	0.2070	0.7297	0.053*
C11	0.21897(17)	0.3179(5)	0.45082(17)	0.0381(7)
H11A	0.1862	0.4528	0.4539	0.046*
C12	0.2877(2)	0.4097(6)	0.4329(2)	0.0541(9)
H12A	0.2643	0.5051	0.3809	0.081*
H12B	0.3174	0.2785	0.4249	0.081*
H12C	0.3252	0.5042	0.4814	0.081*
C13	0.16354(18)	0.1598(5)	0.37835(17)	0.0407(7)
C14	0.04497(19)	−0.1123(5)	0.33390(18)	0.0451(8)
C15	−0.03161(19)	−0.1134(5)	0.34351(19)	0.0459(8)
H15A	−0.0805	−0.1056	0.2870	0.055*
H15B	−0.0349	−0.2547	0.3739	0.055*
C16	0.04303(16)	0.2164(5)	0.41027(16)	0.0338(6)
C17	−0.09250(18)	0.1915(6)	0.4026(2)	0.0515(8)
H17A	−0.0730	0.3212	0.4433	0.077*
H17B	−0.1165	0.0721	0.4240	0.077*
H17C	−0.1339	0.2479	0.3469	0.077*
N1	0.08919(14)	0.0872(4)	0.37723(13)	0.0368(6)
N2	−0.02442(14)	0.0927(4)	0.39325(14)	0.0378(6)
O1	0.18075(14)	0.0879(5)	0.32445(13)	0.0644(7)
O2	0.06259(12)	0.4020(4)	0.44656(13)	0.0478(6)
O3	0.06621(16)	−0.2551(4)	0.29864(15)	0.0669(7)

[a]Occupancy: 0.5; [b]Occupancy: 0.7; [c]Occupancy: 0.3.

[8]. The synthesis and structure characterization of 1-methylhydantoin derivatives are quite important in academia and medicinal applications [9]. A series of 1-methylhydantoin derivatives were successfully synthesized in our previous studies [10]. On the other hand, ibuprofen is a widely used anti-inflammatory drug. Therefore, the combination of 1-methylhydantoin and ibuprofen has emerged. The coupling reaction of 1-methylhydantoin with ibuprofen was carried out by nucleophilic substitution. 1-Methylhydantoin ibuprofen was purified through crystallization process and showed a lot of biological activities, such as anti-inflammatory, antitussive [10], analgesic and gastric ulcerogenic [11].

The asymmetric unit of the title crystal structure consists of one molecule. There are no hydrogen bonds between adjacent molecules. All bond lengths and angles are in the expected ranges. The imidazole ring and the phenyl ring are not on the same plane, the bond lengths of C13—N1, C14—N1 and C16—N1 are 1.423(4) Å, 1.437(3) Å and 1.411(4) Å, respectively. The angles of C14—N1—C13, C14—N1—C16 and C13—N1—C16 are 124.1(2)°, 109.7(2)°, 125.9(2)°, respectively.

Acknowledgements: The authors extend their appreciation to College of Pharmacy at Jilin University for their funding of this research.

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