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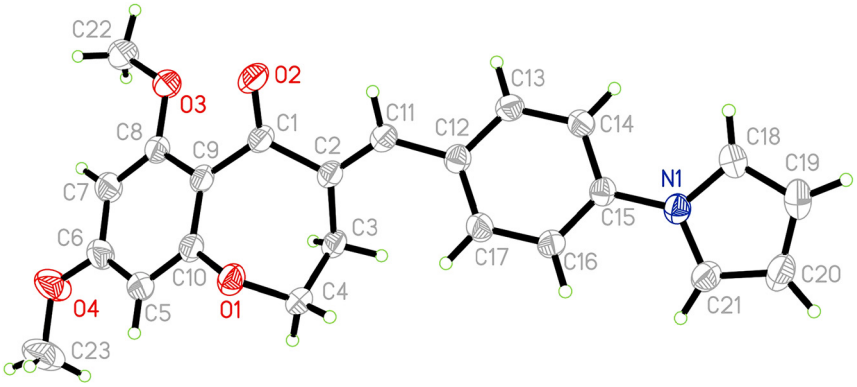
Crystal structure of (*E*)-4-(4-(1*H*-pyrrol-1-yl) benzylidene)-6,8-dimethoxy-3,4-dihydrobenzo [(*b*)]oxepin-5(2*H*)-one, $C_{23}H_{21}NO_4$



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Abstract

$C_{23}H_{21}NO_4$, monoclinic, $P2_1/c$ (no. 14), a = 18.4694(3) Å, b = 6.9105(1) Å, c = 14.9464(3) Å, β = 93.749(2)°, V = 1903.57(6) Å^3, Z = 4, $R_{gt}(F)$ = 0.0426(3375), $wR_{ref}(F^2)$ = 0.1183(3743), T = 293 K.

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The molecular structure is shown in the figure. Table 1 contains the crystallographic data and the list of the atoms including atomic coordinates and displacement parameters can be found in the cif-file attached to this article.

Table 1: Data collection and handling.

Crystal:	Clear light colourless block
Size:	0.15 × 0.13 × 0.11 mm
Wavelength:	Cu *K*α radiation (1.54178 Å)
μ:	0.73 mm^{-1}
Diffractometer, scan mode:	Rigaku Synergy, ω scan
θ_{max}, completeness:	74.9°, 99 %
$N(hkl)_{measured}$, $N(hkl)_{unique}$, R_{int}:	11441, 3743, 0.015
Criterion for I_{obs}, $N(hkl)_{gt}$:	$I_{obs} > 2\ \sigma(I_{obs})$, 3375
$N(param)_{refined}$:	255
Programs:	Rigaku,[1] SHELX[2,3]

1 Source of material

Based on the literature synthesis,[4,5] 1*H*-pyrrole (10.73 g, 0.16 mol), potassium carbonate (27.80 g, 0.20 mol) and *N*,*N*-dimethylformamide (6 mL) were added into a 250 mL round flask. The mixture was stirred and reacted under an oil bath at 353 K for 4 h. After that, the temperature was raised to 383 K, and 4-fluorobenzaldehyde (2.5 g, 0.02 mol) was added. The reaction was continued for another 5 h. After filtration and spin evaporation, the residue was purified on a silica gel column chromatography (dichloromethane:methanol = 30:1, *v*:*v*) to afford the intermediate. Next, the intermediate (0.86 g, 5.0 mmol) and 6,8-dimethoxy-3,4-dihydrobenzo[(*b*)]oxepin-5(2*H*)-one (1.11 g, 5.0 mmol) were dissolved in 3 mL methanol. A 25 % sodium hydroxide solution (3 mL) was used as a catalyst. The system was reacted on ice for 10 min and then stirred at room temperature for 30 min. The reaction was stopped when it was monitored by thin-layer chromatography (TLC) that the intermediate had been completely consumed. The precipitate obtained by suction filtration was rinsed with 50 % methanol. The precipitate was collected and recrystallized from a dichloromethane and methanol solution

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(10 mL, 1:1, *v*:*v*) at room temperature to gain clear light yellow block crystals after three days.

2 Experimental details

The H atoms were placed in idealized positions and treated as riding on their parent atoms, with *d*(C–H) = 0.96 Å (methyl), U_{iso}(H) = 1.5U_{eq}(C), and *d*(C–H) = 0.97 Å (methylene), U_{iso}(H) = 1.2U_{eq}(C), and *d*(C–H) = 0.93 Å (aromatic), U_{iso}(H) = 1.2U_{eq}(C).

3 Comment

Previous studies revealed that 3,4-dihydrobenzo[(*b*)]oxepin-5(2*H*)-one compounds have excellent anti-inflammatory properties.[6,7] It has been demonstrated that biological activity can be increased with the aid of introducing another pharmacophore, *α*,*β*-unsaturated ketone.[8] In addition, some research indicates that the introduction of a nitrogen-containing heterocycle at the end of the compound may reduce the toxicity and increase the biological activity of the compound.[9,10] Therefore, a 1*H*-pyrrole substituent at the C(15) position was introduced to obtain the title compound.

The single-crystal structure analysis reveals that the title compound crystallizes in the monoclinic space group, with one molecule in the asymmetric unit (*cf*. the figure). The bond lengths and bond angles are within the normal range. In this seven-membered oxazepine ring, dihedral angles are C(9)–C(1)–C(2)–C(3), C(1)–C(2)–C(3)–C(4), C(2)–C(3)–C(4)–O(1), and C(3)–C(4)–O(1)–C(10) are 4.09(17)°, −72.44(14)°, 43.21(16)° and 49.42(16)°, respectively. At the C(2) position, the *α*,*β*-unsaturated ketone was obtained through the Claisen–Schmidt condensation reaction.[11, 12] The bond lengths of O(2)=C(1) is 1.2172(16) Å, while the bond length of C(2)=C(11) is 1.3381(18) Å. The torsion angle of O(2)=C(1)–C(2)=C(11) is about 2.97(19)°, while the torsion angle of C(1)–C(2)=C(11)–C(12) is about 177.57(12)°. There is a 1*H*-pyrrole substitution at the C(15) position. The bond length of C(15)–N(1) is 1.4192(15) Å. The torsion angle of C(18)–N(1)–C(15) is about 125.92(12)°, the torsion angle of C(21)–N(1)–C(18) is about 108.15(12)° and the torsion angle of C(21)–N(1)–C(15) is about 125.80(11)°. Because of the structural characteristics and the substituent effect, there is a large dihedral angle between the central parent nucleus and the substituted 1*H*-pyrrole, with the dihedral angle of about 34.01(3)°. Overall, the title compound has a linear structure.[13] This twisting and linear structure may increase the possibility of interaction with bioactive molecules.[14,15]

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