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Isolation and crystal structure of bufotalinin – methanol (1/1), C₂₅H₃₄O₇

Table 1: Data collection and handling.

Crystal:	Colourless block
Size:	0.28 × 0.26 × 0.20 mm
Wavelength:	Cu K α radiation (1.54178 Å)
μ :	0.78 mm ⁻¹
Diffractometer, scan mode:	Gemini S ultra, ω
$\theta_{\max}$, completeness:	62.8°, 99%
$N(hkl)_{\text{measured}}$, $N(hkl)_{\text{unique}}$, R_{int} :	17729, 3544, 0.026
Criterion for I_{obs} , $N(hkl)_{\text{gt}}$:	$I_{\text{obs}} > 2 \sigma(I_{\text{obs}})$, 3516
$N(\text{param})_{\text{refined}}$:	297
Programs:	CrysAlis ^{PRO} [1], SHELX [2]

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Abstract

C₂₅H₃₄O₇, monoclinic, $P2_1$ (no. 4), $a = 9.24730(10)$ Å, $b = 9.9061(2)$ Å, $c = 12.5907(2)$ Å, $\beta = 101.264(2)^\circ$, $V = 1131.15(3)$ Å³, $Z = 2$, $R_{\text{gt}}(F) = 0.0380$, $wR_{\text{ref}}(F^2) = 0.1025$, $T = 173$ K.

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The molecular structure and the solvate molecule methanol is shown in the figure. Table 1 contains crystallographic data and Table 2 contains the list of the atoms including atomic coordinates and displacement parameters.

Source of material

The ChanSu crude drug was purchased from Guangzhou qingping medicine market, Guangdong, China. Powder

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Table 2: Fractional atomic coordinates and isotropic or equivalent isotropic displacement parameters (Å²).

Atom	<i>x</i>	<i>y</i>	<i>z</i>	$U_{\text{iso}}^*/U_{\text{eq}}$
O1	0.0734(3)	1.0505(3)	−0.06854(19)	0.0414(6)
H1	−0.023(7)	1.091(7)	−0.077(5)	0.098(19)*
O2	0.2639(2)	0.8830(2)	0.04728(17)	0.0330(5)
H2	0.1813	0.9098	0.0138	0.049*
O3	0.8950(2)	1.1349(2)	0.27709(15)	0.0309(5)
O4	0.2733(3)	0.9575(3)	0.3296(2)	0.0546(7)
O5	1.1480(3)	1.3115(3)	0.67529(18)	0.0419(6)
O6	1.3620(3)	1.2062(3)	0.72423(19)	0.0484(6)
C1	0.1910(3)	1.1351(3)	0.1577(2)	0.0317(7)
H1A	0.1125	1.0656	0.1475	0.038*
H1B	0.1838	1.1873	0.2235	0.038*
C2	0.1638(3)	1.2303(3)	0.0600(3)	0.0363(7)
H2A	0.0635	1.2689	0.0513	0.044*
H2B	0.2354	1.3057	0.0733	0.044*
C3	0.1792(4)	1.1577(3)	−0.0432(2)	0.0351(7)
H3	0.1664	1.2234	−0.1046	0.042*
C4	0.3304(3)	1.0925(3)	−0.0286(2)	0.0296(7)
H4A	0.4061	1.1644	−0.0192	0.035*
H4B	0.3372	1.0421	−0.0953	0.035*
C5	0.3647(3)	0.9964(3)	0.0677(2)	0.0256(6)
C6	0.5187(3)	0.9367(3)	0.0758(2)	0.0302(7)
H6A	0.5282	0.8563	0.1234	0.036*
H6B	0.5304	0.9065	0.0030	0.036*
C7	0.6421(3)	1.0358(4)	0.1202(2)	0.0312(7)
H7A	0.6399	1.1123	0.0693	0.037*
H7B	0.7387	0.9901	0.1272	0.037*
C8	0.6230(3)	1.0883(3)	0.2306(2)	0.0249(6)
H8	0.6205	1.0082	0.2786	0.030*
C9	0.4736(3)	1.1625(3)	0.2205(2)	0.0243(6)
H9	0.4718	1.2364	0.1661	0.029*
C10	0.3428(3)	1.0640(3)	0.1755(2)	0.0249(6)

Table 2 (continued)

Atom	x	y	z	U_{iso}^*/U_{eq}
C11	0.4597(3)	1.2286(3)	0.3279(2)	0.0305(7)
H11A	0.3692	1.2846	0.3164	0.037*
H11B	0.4488	1.1571	0.3807	0.037*
C12	0.5918(3)	1.3170(3)	0.3756(3)	0.0337(7)
H12A	0.5771	1.3544	0.4456	0.040*
H12B	0.5970	1.3937	0.3261	0.040*
C13	0.7393(3)	1.2390(3)	0.3936(2)	0.0272(6)
C14	0.7476(3)	1.1778(3)	0.2846(2)	0.0264(6)
C15	0.8403(3)	1.2640(4)	0.2313(3)	0.0347(7)
H15	0.8160	1.2758	0.1509	0.042*
C16	0.8972(4)	1.3815(4)	0.3022(3)	0.0392(8)
H16A	0.8442	1.4653	0.2751	0.047*
H16B	1.0039	1.3948	0.3046	0.047*
C17	0.8683(3)	1.3443(3)	0.4158(2)	0.0307(7)
H17	0.8293	1.4271	0.4459	0.037*
C18	0.7484(3)	1.1350(3)	0.4840(2)	0.0329(7)
H18A	0.7476	1.1813	0.5526	0.049*
H18B	0.8398	1.0830	0.4899	0.049*
H18C	0.6636	1.0739	0.4674	0.049*
C19	0.3435(3)	0.9536(4)	0.2589(2)	0.0327(7)
H19	0.4031	0.8764	0.2549	0.039*
C20	1.0066(3)	1.3021(3)	0.4951(2)	0.0285(6)
C21	1.0272(3)	1.3449(4)	0.5990(3)	0.0356(7)
H21	0.9540	1.4008	0.6198	0.043*
C22	1.1207(3)	1.2213(3)	0.4674(2)	0.0315(7)
H22	1.1117	1.1894	0.3952	0.038*
C23	1.2416(3)	1.1892(3)	0.5418(2)	0.0287(6)
H23	1.3167	1.1364	0.5204	0.034*
C24	1.2598(3)	1.2321(3)	0.6514(3)	0.0332(7)
O7	1.7878(4)	1.1263(4)	0.8885(3)	0.0737(10)
H7	1.7853	1.2111	0.8894	0.111*
C25	1.7137(6)	1.0812(5)	0.7918(4)	0.0723(14)
H25A	1.7357	1.1393	0.7340	0.108*
H25B	1.6076	1.0832	0.7910	0.108*
H25C	1.7442	0.9885	0.7803	0.108*

of ChanSu (100 g) was dissolved in water and extracted three times with acetate at room temperature. The extracts were concentrated in vacuum to give a residue (25 g). The obtained solid was purified by silica gel column chromatography with petroleum ether-acetone as mobile phase and preparative liquid chromatography. Then the title compound (systematic name: (1*R*,3*aS*,5*aS*,7*S*,9*aS*,11*aR*)-5*a*,7-dihydroxy-11*a*-methyl-1-(2-oxo-2*H*-pyran-5-yl)tetradecahydronaphtho[1',2':6,7]indeno[1,7*a-b*]oxirene-9*a*(1*H*)-carbaldehyde was obtained and crystallized in methanol. The title compound is a 1/1 cocrystal of the organic target molecule and methanol (*cf.* the figure).

Experimental details

The C-bound H atoms were positioned geometrically and were included in the refinement in the riding-model approximation. The crystal structure was solved by direct method and

refined by full-matrix least-squares refinement with SHELX program [2]. The Flack-Parsons parameter was $-0.01(6)$ based on 1593 quotients $[(I+) - (I-)] / [(I+) + (I-)]$ [2].

Comment

ChanSu is a valuable medicinal material produced from the skin secretions of *Bufo gargarizans* Cantor or *Bufo melanostictus* Schneider. Earlier studies have demonstrated bufadienolides were the main active ingredients in ChanSu [3–6]. These compounds have a δ -lactone at C17 position and possess multiple biological activities such as antiviral and anticancer [7–11].

The crystals of title compound, bufotalinin methanol monosolvate, were obtained by slow evaporation from a methanol solution. The title compound is composed of five rings, one five-numbered and four six-numbered. The torsion angles of O1–C1–C2–C3 and O2–C5–C10–C19 are 61.4(3), 165.1(2)° respectively. The dihedral angle between the planes of the lactone ring (mean deviation 0.0071 Å) and the epoxy group is 74.6(1)°. A short intramolecular interaction between the C5 hydroxy and C3 hydroxy is present [O2–H2...O1 = 1.90 Å, 147°]. The bond lengths and in general all geometric parameters are in the expected ranges [12, 13].

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