A Precursor of the Natural Product 5,7-Dihydroxy-4,6-dimethyl-1(3H)-isobenzofuranone: Crystal and Molecular Structure of 6-Carbomethoxy-4-formyl-2-methyl-5-pivaloyloxymethyl-1,3-benzenediol

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An area of interest to us is the various synthetic approaches to highly substituted aromatic natural products. 6-Carbomethoxy-4-formyl-2-methyl-5-pivaloyloxy-methyl-1,3-benzenediol, **1**, which is an intermediary of the metabolite 5,7-dihydroxy-4,6-dimethyl-1(3H)-isobenzofuranone obtained from cultures of *Aspergillus duricaulis*,² was synthesized in our laboratory; upon crystallization it was obtained as colorless crystals. Its structure was determined by an X-ray crystal analysis. Data were collected on a Siemens P4 diffractometer. The crystallographic data, details of the X-ray data collection and a structure refinement are summarized in Table 1. The intensities were collected using a nickel-filtered Mo K α radiation ($\lambda=0.71073$ Å) at room temperature, and were corrected for Lorentz and polarization effects.³ The structure was solved by direct methods⁴ and refined by full-matrix least-squares with anisotropic

temperature factors for the non-hydrogen atoms. The structure solution and refinement included observed reflections with $I>2\sigma(I)$ only. The hydroxyl H-atoms were located on a difference Fourier map, and their positional parameters were refined.

A diagram of the structure of compound **1** is shown in Fig. 1. The molecular structure with atomic numbering is shown in Fig. 2. The bond lengths and angles agree with the expected values. Two strong intramolecular hydrogen bonds render the carbonyl and the hydroxyl groups coplanar [H1...O7, 1.73(6) Å; O1...O7, 2.489(5) Å, O1-H1...O7, 153(6)°; H2...O3, 1.66(6) Å; O2...O3, 2.516(6) Å; O2-H2...O3, 148(6)°].

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Table 1 Crystallographic data for 6-carbomethoxy-4-formyl-2-methyl-5-pivaloyloxymethyl-1,3-benzenediol

Formula: C ₁₆ H ₂₀ O ₇
Formula weight = 324.32
Crystal system: triclinic
Space group: P1
Z = 2
Crystal dimensions: 0.48×0.24×0.24 mm
a = 9.255(2) Å
b = 10.174(3) Å
c = 10.498(2) Å
α = 68.53(2)°
β = 68.19(2)°
γ = 69.62(2)°
V = 827.9(3) Å ³
D _x = 1.301 g/cm ³
θ range: 1.5 – 25.0°
h k l range: -0<h<10, -10<k<11 and -11<l<12
F(0 0 0) = 344
μ = 0.102 mm ⁻¹
R = 6.64%
Rw = 15.77%
Goodness-of-fit = 1.0
Independent reflections = 2885 ($R_{int.} = 4.02\%$)
($\Delta\rho$) _{max} = 0.206 eÅ ⁻³
($\Delta\rho$) _{min} = -0.192 eÅ ⁻³

Table 2 Atomic coordinates ($\times 10^4$) and equivalent isotropic displacement coefficients (Å²×10³)

	x	y	z	U _{eq}
O(1)	4793(4)	7272(4)	-2477(3)	69(1)
O(2)	2163(5)	3633(5)	-1184(4)	82(1)
O(3)	658(5)	2710(5)	1377(5)	93(1)
O(4)	353(3)	6839(3)	2658(3)	53(1)
O(5)	515(5)	6874(4)	4706(4)	81(1)
O(6)	3235(4)	7760(4)	1563(4)	77(1)
O(7)	4706(5)	8363(4)	-672(4)	82(1)
C(1)	3848(4)	6427(4)	-1424(4)	50(1)
C(2)	3450(5)	5473(5)	-1834(4)	55(1)
C(3)	2541(5)	4563(5)	-790(5)	55(1)
C(4)	1978(5)	4585(4)	664(4)	49(1)
C(5)	2364(4)	5576(4)	1047(4)	43(1)
C(6)	3318(5)	6521(4)	6(4)	46(1)
C(7)	3965(7)	5462(7)	-3368(5)	80(2)
C(8)	964(6)	3630(5)	1678(6)	69(1)
C(9)	1752(5)	5623(4)	2589(4)	52(1)
C(10)	3803(5)	7616(5)	256(5)	55(1)
C(11)	-119(5)	7393(4)	3763(4)	48(1)
C(12)	-1505(5)	8740(5)	3629(5)	60(1)
C(13)	-1005(9)	9802(7)	2158(9)	140(4)
C(14)	-1913(9)	9404(9)	4820(10)	142(4)
C(15)	-2962(6)	8296(8)	3756(7)	95(2)
C(16)	3685(8)	8842(8)	1847(8)	104(2)

*Equivalent isotropic U defined as one third of the trace of the orthogonalized U_{ij} tensor.

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Table 3 Bond lengths (Å)

O(1)-C(1)	1.355 (5)	O(2)-C(3)	1.346 (5)
O(3)-C(8)	1.234 (6)	O(4)-C(11)	1.336 (5)
O(4)-C(9)	1.447 (5)	O(5)-C(11)	1.198 (5)
O(6)-C(10)	1.318 (5)	O(6)-C(16)	1.458 (6)
O(7)-C(10)	1.233 (5)	C(1)-C(2)	1.392 (6)
C(1)-C(6)	1.424 (5)	C(2)-C(3)	1.371 (6)
C(2)-C(7)	1.503 (6)	C(3)-C(4)	1.424 (6)
C(4)-C(5)	1.399 (6)	C(4)-C(8)	1.448 (7)
C(5)-C(6)	1.416 (6)	C(5)-C(9)	1.517 (5)
C(6)-C(10)	1.470 (6)	C(11)-C(12)	1.520 (6)
C(12)-C(14)	1.501 (7)	C(12)-C(15)	1.511 (7)
C(12)-C(13)	1.537 (8)		

Table 4 Bond angles (°)

O(1)-C(1)	1.355 (5)	O(2)-C(3)	1.346 (5)
O(3)-C(8)	1.234 (6)	O(4)-C(11)	1.336 (5)
O(4)-C(9)	1.447 (5)	O(5)-C(11)	1.198 (5)
O(6)-C(10)	1.318 (5)	O(6)-C(16)	1.458 (6)
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C(12)-C(13)	1.537 (8)

Fig. 1 Chemical structure of 6-carbomethoxy-4-formyl-2-methyl-5-pivaloyloxymethyl-1,3-benzenediol.

Fig. 2 Plot of 6-carbomethoxy-4-formyl-2-methyl-5-pivaloyloxymethyl-1,3-benzenediol, showing the numbering scheme for the atoms.

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