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tert-Butyl (2*S*)-2-(9*H*-fluoren-9-ylmethoxycarbonylamino)-3-(3′,4′-dimethoxyphenyl)propionate chloroform sesquisolvate

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Key indicators

Single-crystal X-ray study
T = 160 K
Mean σ(C–C) = 0.005 Å
Some non-H atoms missing
R factor = 0.053
wR factor = 0.153
Data-to-parameter ratio = 14.7

For details of how these key indicators were automatically derived from the article, see http://journals.iucr.org/e.

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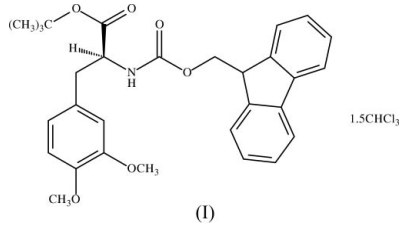
The title compound, $C_{30}H_{33}NO_6\cdot1.5CHCl_3$, a derivative of L-DOPA, forms chains in its crystal structure, *via* weak N—H···O=C hydrogen bonds involving the carbamate N—H and carbonyl groups of adjacent molecules, supported by N—H···O=C interactions of the same carbonyl. The staggered conformation about the C—C bond joining the dimethoxyphenyl group to the chiral centre is similar to that in L-DOPA, but different from that in the iodo derivative from which the title compound was prepared. Extensive disorder of the chloroform solvent molecules, which could not be modelled by discrete atomic sites, prevents the confirmation of the absolute configuration of the main molecule on the basis of anomalous scattering effects of chlorine atoms, demonstrating a limitation of this otherwise useful technique.

Comment

The title compound is a derivative of L-DOPA, which is used in the treatment of Parkinson's disease. It was obtained by a new zinc coupling method (Deboves *et al.*, 2001) from a chiral reagent derived from L-serine; we have recently described the structure of this reagent (Clegg & Horsburgh, 2003).



(I)

The molecular structure is shown in Fig. 1, with selected torsion angles in Table 1. Bond lengths and angles are normal. The fluorenyl group, the carbamate linkage (from C10 to C17, including O5), the ester group (from C10 to C12, including O3), and the dimethoxy-substituted phenyl ring are all essentially planar. The two methoxy groups lie in the plane of the ring to which they are attached, pointing in opposite directions, as indicated by the torsion angles.

The conformation about the C9—C10 bond is almost perfectly staggered. The dimethoxyphenyl substituent is *gauche* to the carbamate group and *anti* to the ester group. This is in contrast to its parent iodo derivative, in which the iodine atom is *gauche* to both the other groups (Clegg & Horsburgh, 2003), but is the same arrangement as in L-DOPA (Howard *et al.*, 1995) and is more in accord with expectations.

Molecules are linked together by relatively weak N—H···O=C hydrogen bonds, supported by C—H···O=C interactions involving the dimethoxyphenyl group (Table 2

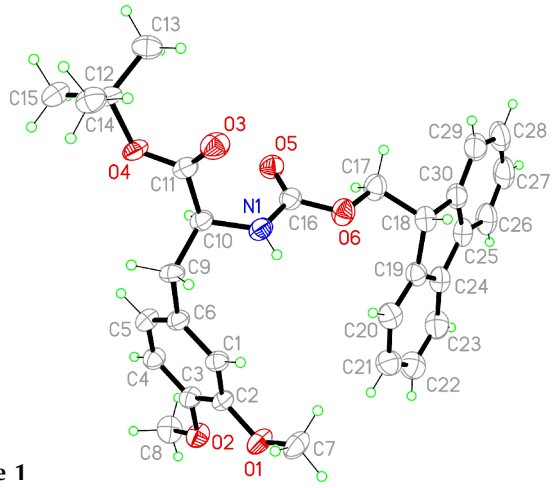


Figure 1
The molecular structure, with atom labels and 50% probability ellipsoids for non-H atoms.

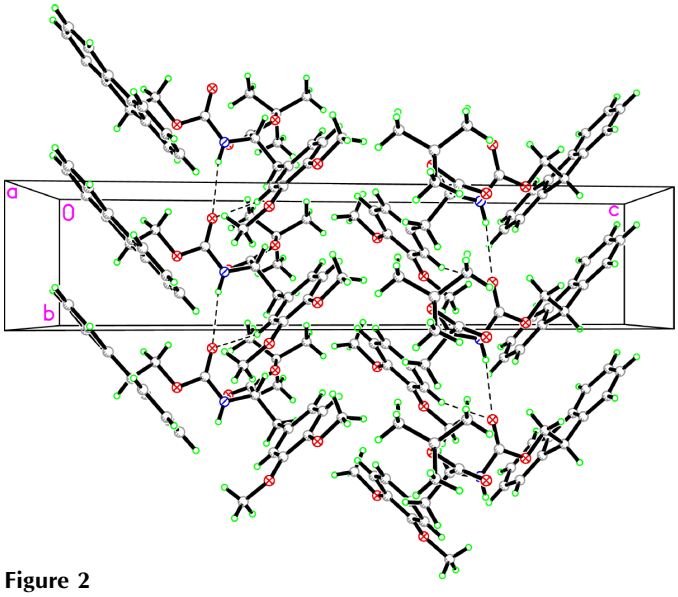


Figure 2
The crystal packing, viewed down the *a* axis, showing the chains of molecules generated by hydrogen bonding.

and Fig. 2), to form chains along the short *b* axis.

The chains of molecules surround large voids, which contain highly disordered chloroform solvent molecules (Fig. 3). The extensive disorder of the solvent, for which no atomic sites could be successfully resolved, prevents the exploitation of the large anomalous scattering effect of the chlorine atoms for the determination of the absolute configuration of the main molecule. Such solvent disorder represents a limitation of this method, described by Flack & Bernardinelli (1999). In the present case, the absolute configuration is known from the synthesis.

Experimental

The synthesis and spectroscopic characterization of the title compound have been fully described by Deboves *et al.* (2001). Crystals were obtained from chloroform solution by slow evaporation.

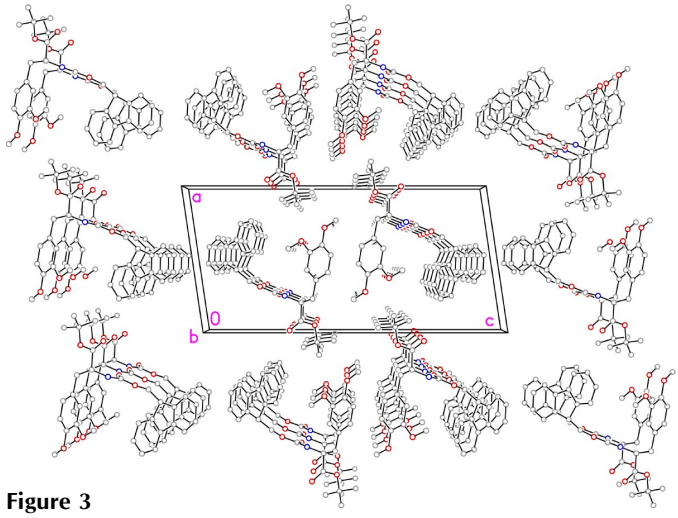


Figure 3
The crystal packing, viewed down the *b* axis, showing the channels occupied by disordered solvent molecules.

Crystal data

$C_{30}H_{33}NO_6\cdot1.5CHCl_3$
$M_r = 682.63$
Monoclinic, $P2_1$
$a = 12.1419\ (11)$ Å
$b = 5.3779\ (6)$ Å
$c = 24.926\ (2)$ Å
$\beta = 98.435\ (10)^\circ$
$V = 1610.0\ (3)$ Å^3
$Z = 2$
$D_x = 1.408$ Mg m^{-3}
Cu $K\alpha$ radiation
Cell parameters from 56 reflections
$\theta = 19.2$–24.9°
$\mu = 4.09$ mm^{-1}
$T = 160\ (2)$ K
Plate, colourless
0.33 × 0.15 × 0.08 mm

Data collection

Stoe–Siemens four-circle diffractometer
ω/θ scans with on-line profile fitting (Clegg, 1981)
Absorption correction: multi-scan (*SHELXTL*; Sheldrick, 2001)
$T_{min} = 0.571$, $T_{max} = 0.721$
8184 measured reflections
5020 independent reflections
4567 reflections with $I > 2\sigma(I)$
$R_{int} = 0.037$
$\theta_{max} = 67.2^\circ$
$h = -14 \rightarrow 14$
$k = -6 \rightarrow 6$
$l = -27 \rightarrow 28$
5 standard reflections
frequency: 60 min
intensity decay: 1%

Refinement

Refinement on F^2
$R[F^2 > 2\sigma(F^2)] = 0.053$
$wR(F^2) = 0.153$
$S = 1.14$
5020 reflections
341 parameters
H-atom parameters constrained
$w = 1/[\sigma^2(F_o^2) + (0.0588P)^2 + 1.03P]$ where $P = (F_o^2 + 2F_c^2)/3$
$(\Delta/\sigma)_{max} < 0.001$
$\Delta\rho_{max} = 0.31$ e Å^{-3}
$\Delta\rho_{min} = -0.28$ e Å^{-3}
Extinction correction: *SHELXTL*
Extinction coefficient: 0.0100 (8)
Absolute structure: Flack (1983), 2019 Friedel pairs
Flack parameter = 0.2 (3)

Table 1
Selected torsion angles (°).

C1—C2—O1—C7	−0.5 (4)	C10—C11—O4—C12	−178.3 (2)
C3—C2—O1—C7	178.8 (3)	O3—C11—O4—C12	3.1 (5)
C2—C3—O2—C8	−175.8 (3)	C9—C10—N1—C16	158.5 (2)
C4—C3—O2—C8	5.1 (4)	C11—C10—N1—C16	−77.5 (3)
C6—C9—C10—C11	167.7 (3)	C10—N1—C16—O5	−3.2 (4)
C6—C9—C10—N1	−68.1 (3)	C10—N1—C16—O6	179.5 (2)
C9—C10—C11—O3	98.7 (3)	N1—C16—O6—C17	173.3 (2)
C9—C10—C11—O4	−80.0 (3)	O5—C16—O6—C17	−3.9 (4)
N1—C10—C11—O3	−24.3 (4)	C16—O6—C17—C18	−161.5 (3)
N1—C10—C11—O4	157.1 (2)		

Table 2
Hydrogen-bonding geometry (Å, °).

D—H···A	D—H	H···A	D···A	D—H···A
N1—H1A···O5^{i}	0.88	2.36	3.204 (3)	161
C1—H1···O5^{i}	0.95	2.42	3.305 (4)	154

Symmetry code: (i) $x, 1+y, z$.

H atoms were positioned geometrically, with C—H = 0.95–1.00 Å and N—H = 0.88 Å, and refined with a riding model (including free rotation about C—C bonds), and with U_{iso} = 1.2 (1.5 for methyl groups) times U_{eq} of the carrier atom.

Examination of the structure with *PLATON* (Spek, 2001) showed that it contains large regions between the molecules; these are occupied by chloroform solvent molecules, but disorder is so extensive that an atomic model could not be developed. The solvent contribution was modelled by the SQUEEZE procedure of *PLATON*, from which an estimate of the solvent content was obtained on the basis of the volume of the voids and the approximate number of electrons contained in them.

The extensive disorder of the solvent prevents the successful use of the anomalous scattering effect of chlorine for establishing the absolute configuration of the main molecule. Refinement of the Flack (1983) parameter gives an inconclusive result, with a high standard uncertainty, despite the inclusion of a large number of Friedel pairs in the data set.

Data collection: *DIF*4 (Stoe & Cie, 1988); cell refinement: *DIF*4; data reduction: local programs; program(s) used to solve structure: *SHELXTL* (Sheldrick, 2001); program(s) used to refine structure: *SHELXTL*; molecular graphics: *SHELXTL*; software used to prepare material for publication: *SHELXTL* and local programs.

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