FERGUSON, G. & SIM, G. A. (1962). *Acta Cryst.* **15**, 346–350.
FUJII, S. (1979). *The Universal Crystallographic Computing System–Osaka.* The Computation Center, Osaka Univ., Japan.
FUKUYAMA, K., OHKURA, K., KASHINO, S. & HAISA, M. (1973). *Bull. Chem. Soc. Jpn*, **46**, 804–808.
HAISA, M. (1978). *Acta Cryst.* A**34**, 753–759.
International Tables for X-ray Crystallography (1974). Vol. IV, pp. 72–73. Birmingham: Kynoch Press.
KAGAWA, T., KAWAI, R., KASHINO, S. & HAISA, M. (1976). *Acta Cryst.* B**32**, 3171–3175.
KASHINO, S. & HAISA, M. (1980). *Acta Cryst.* B**36**, 346–353.
KATAYAMA, C., FURUSAKI, A. & NITTA, I. (1967). *Bull. Chem. Soc. Jpn*, **40**, 1293.
OHKURA, K., KASHINO, S. & HAISA, M. (1972). *Bull. Chem. Soc. Jpn*, **45**, 2651–2652.
SUNDARALINGAM, M. & JENSEN, L. H. (1965). *Acta Cryst.* **18**, 1053–1058.
TANAKA, N., ASHIDA, T., SASADA, Y. & KAKUDO, M. (1967). *Bull Chem. Soc. Jpn*, **40**, 2717.

Acta Cryst. (1982). B**38**, 1485–1489

The Structure of Benzyl 4-*O*-(2,3-Dideoxy-α-L-pent-2-enopyranos-4-ulosyl)-2,3-*O*-isopropylidene-α-L-rhamnopyranoside

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Abstract

$C_{21}H_{26}O_7$, m.p. 376 K, $M_r = 390{\cdot}42$, is monoclinic, space group $P2_1$, with $a = 9{\cdot}797$ (2), $b = 8{\cdot}739$ (2), $c = 12{\cdot}141$ (3) Å, $\beta = 91{\cdot}90$ (2)°, $Z = 2$, $d_m = 1{\cdot}19$, $d_c = 1{\cdot}25$ Mg m^{-3}. The structure was solved by direct methods and refined by the full-matrix least-squares procedure to $R = 0{\cdot}043$ ($R_w = 0{\cdot}039$, $w = 1/\sigma_I^2$) for 1281 independent reflections with $I > 2\sigma_I$. The unsaturated dihydropyranone ring was found to have the $^{O}H_5$ half-chair conformation. The rhamnopyranose ring exhibits the $^{1}C_4(L)$ chair conformation strongly deformed due to fusion with the non-planar dioxolane ring. The interglycosidic φ and ψ angles are 29 (4) and 27 (2)° respectively.

Introduction

The stannic-chloride-catalyzed reaction between benzyl 2,3-*O*-isopropylidene-α-L-rhamnopyranoside and 1-*O*-benzoyl-2,3-dideoxy-DL-pent-2-enopyranos-4-ulose yields a mixture of two diastereoisomeric benzyl 4-*O*-(2,3-dideoxy-α-L-pent-2-enopyranos-4-ulosyl)-2,3-*O*-isopropylidene-α-L-rhamnopyranosides (Grynkiewicz, 1980). These compounds are the precursors of disaccharides belonging to the 4-*O*-pentopyranosyl-L-rhamnose family; the disaccharides can be obtained by proper chemical modifications of the dihydropyranone moiety.

From the mixture of two diastereoisomeric products the less polar one (Fig. 1), melting at 376 K, was separated by column chromatography and its molecular structure determined. The reasons for undertaking the present study were to determine: (*a*) the

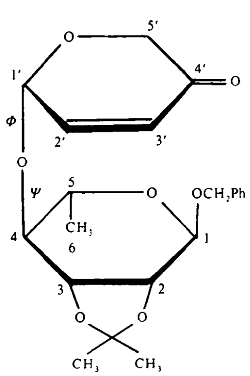

Fig. 1. Haworth formula of the title compound with the systematic atom numbering.

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absolute configuration at the anomeric center in the dihydropyranone part, and (*b*) the conformation of this ring system.

Knowledge of the configuration of the anomeric center is essential for preparative work because it determines the configuration of the sugar which can be obtained in the course of appropriate reactions transforming dihydropyranone into the pentose unit. The conformation of dihydropyranone is interesting from the stereochemical point of view.

It has been concluded from microwave-spectrum data that 3,6-dihydro-2*H*-pyran itself exists in the half-chair form (Wells & Malloy, 1974). For corresponding conjugated enones, half-chair and sofa conformations were considered as the most probable, following a classical conformational analysis of the cyclohexene system (Toromanoff, 1967). On the basis of the microwave spectrum of cyclohex-2-en-1-one (Manley & Tyler, 1970) and ^{1}H NMR data of 2-substituted 6-methoxy-3,6-dihydro-2*H*-pyran-3-ones (Achmatowicz & Burzyńska, 1979) the authors favor a sofa conformation for the compounds examined. In the latter case, however, the conformational analysis based on the data derived from the Karplus-type equation cannot be positively conclusive, since the dihedral H—C—C—H angles deduced are in reasonable agreement with both possible steric arrangements.

The present paper is the first of a series of X-ray investigations of various disaccharide derivatives containing saturated and unsaturated sugar rings. Knowledge of ring conformations obtained by X-ray investigations together with that derived from spectral investigations in solution may reveal several new aspects in the interpretation of conformational relationships in the latter.

Colorless crystals of the title compound were recrystallized from slightly H_2O-diluted ethanol. A well shaped crystal (0·1 × 0·28 × 0·40 mm) was used for intensity collection. 1760 intensities, of which 1281 had $I > 2\sigma_I$, were collected on a four-circle CAD-4 diffractometer (ŚLAFiBS, Kraków, Poland) using graphite-monochromated Mo $K\alpha$ radiation and the $\omega/2\theta$ scan mode up to $2\theta_{\max} = 50°$. No absorption correction was made. The structure was solved by *MULTAN* (Main, Woolfson, Lessinger, Germain & Declercq, 1974). The refinement of the atomic parameters was performed using the XRAY 70 system (Stewart, Kundell & Baldwin, 1970) by the full-matrix least-squares procedure. The atomic scattering factors were taken from *International Tables for X-ray Crystallography* (1974). The positions of all H atoms were located from a difference Fourier synthesis. The final refinement step involved all atomic parameters except H-atom temperature factors ($B_H = B_{eq}$ of the adjacent atom +1, held invariant); R = 0·043 and R_w = 0·039 ($w = 1/\sigma_I^2$), and the average shift/error value = 0·03.

Table 1. *Fractional coordinates* ($\times 10^4$, $\times 10^3$ *for* H) *and equivalent isotropic thermal parameters with e.s.d.'s in parentheses*

$B_{eq} = 8\pi^2(U_1.U_2.U_3)^{1/3}$, where U_i are the eigenvalues of the U_{ij} matrix.

	x	y	z	B_{eq} (Å^2)
C(1)	3030 (5)	5481 (6)	9577 (4)	4·3 (3)
C(2)	4484 (5)	4922 (6)	9511 (4)	4·1 (2)
C(3)	4636 (5)	3340 (6)	9001 (4)	9·9 (2)
C(4)	3608 (5)	3056 (6)	8043 (4)	4·2 (2)
C(5)	2179 (5)	3536 (6)	8342 (4)	4·1 (3)
C(6)	1144 (5)	3377 (8)	7388 (5)	5·9 (3)
C(7)	4438 (7)	980 (8)	6968 (7)	6·3 (4)
C(8)	4664 (7)	−695 (9)	7103 (6)	7·2 (5)
C(9)	4140 (8)	−1742 (9)	6447 (6)	7·4 (5)
C(10)	3193 (7)	−1263 (8)	5568 (6)	6·3 (4)
C(11)	2771 (8)	383 (9)	5571 (5)	7·1 (4)
C(12)	6417 (5)	4936 (7)	8529 (4)	4·7 (3)
C(13)	6811 (6)	5294 (9)	7391 (5)	6·6 (4)
C(14)	7590 (5)	5253 (7)	9342 (5)	5·4 (3)
C(15)	1266 (6)	5395 (8)	10867 (5)	6·1 (3)
C(16)	944 (5)	4685 (7)	11932 (4)	4·8 (3)
C(17)	61 (6)	3466 (9)	11992 (5)	6·0 (4)
C(18)	−212 (6)	2779 (8)	12983 (7)	6·4 (4)
C(19)	402 (7)	3314 (10)	13921 (6)	7·1 (4)
C(20)	1288 (7)	4552 (11)	13895 (6)	7·5 (4)
C(21)	1556 (5)	5229 (8)	12891 (5)	5·8 (3)
O(1)	2531 (3)	4804 (5)	10518 (3)	4·8 (2)
O(2)	5251 (3)	5828 (4)	8790 (3)	4·5 (2)
O(3)	6006 (3)	3364 (4)	8641 (3)	4·4 (2)
O(4)	3573 (4)	1424 (4)	7822 (3)	4·8 (2)
O(5)	2219 (3)	5141*	8617 (3)	4·5 (2)
O(6)	2667 (5)	−2133 (7)	4899 (4)	8·6 (3)
O(7)	3869 (5)	1354 (6)	5918 (4)	7·5 (3)
H(11)	294 (5)	664 (6)	958 (4)	
H(21)	484 (4)	487 (6)	1031 (3)	
H(31)	452 (4)	244 (6)	954 (4)	
H(41)	388 (4)	375 (6)	734 (3)	
H(51)	179 (5)	281 (6)	900 (4)	
H(61)	92 (6)	205 (7)	724 (5)	
H(62)	12 (5)	372 (7)	763 (4)	
H(63)	150 (5)	387 (7)	668 (4)	
H(71)	528 (6)	160 (7)	685 (5)	
H(81)	529 (6)	−99 (8)	777 (5)	
H(91)	431 (6)	−311 (8)	656 (5)	
H(111)	181 (6)	65 (8)	612 (5)	
H(112)	247 (6)	85 (8)	480 (5)	
H(131)	596 (6)	507 (8)	682 (5)	
H(132)	762 (5)	448 (7)	717 (4)	
H(133)	716 (6)	648 (8)	733 (5)	
H(141)	786 (5)	634 (7)	925 (4)	
H(142)	831 (5)	450 (7)	905 (4)	
H(143)	734 (5)	486 (7)	1017 (4)	
H(151)	47 (5)	506 (8)	1025 (4)	
H(152)	125 (5)	658 (7)	1089 (5)	
H(171)	−48 (5)	307 (7)	1125 (4)	
H(181)	−88 (6)	194 (7)	1297 (5)	
H(191)	17 (6)	292 (8)	1456 (4)	
H(201)	172 (5)	505 (8)	1460 (4)	
H(211)	214 (5)	623 (7)	1279 (4)	

* Fixed coordinate.

The refined atomic coordinates are presented in Table 1.*

Discussion

A view of the disaccharide molecule (*ORTEP*, Johnson, 1965) is shown in Fig. 2. The bond lengths and valence angles are listed in Tables 2 and 3 respectively.

The C=C double-bond length in the dihydropyranone ring (*A*) is 1·31 (1) Å. The value is comparable with that found in the 1,2-unsaturated monosaccharide (GLUCAL) [1·311 (7) Å, Krajewski, Urbańczyk-Lipkowska, Gluziński, Bleidelis & Kemme, 1979*a*; Vangehr, Luger & Paulsen, 1979] and 1·337 (5) and 1·338 (5) Å in bis(2-hydroxy-4,4,6,6-tetramethyl-3-oxo-1-cyclohexenyl) selenide (Klinga, Kivekäs, Simonen, Laitalainen, Uggla & Sundberg, 1978).

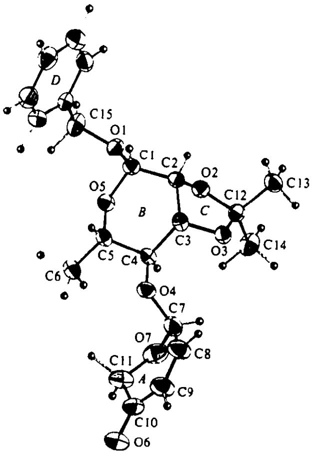

Fig. 2. *ORTEP* (Johnson, 1965) diagram of the title compound with crystallographic atom numbers. Projection on the *ac* plane rotated anticlockwise by 35° around the *a* axis. Thermal-motion ellipsoids are set at the 40% probability level. H atoms are shown as spheres of arbitrary radius.

Table 2. *Bond distances* (Å) *with e.s.d.'s in parentheses*

C(1)–C(2)	1·510 (7)	C(8)–C(9)	1·306 (11)
C(2)–C(3)	1·524 (8)	C(9)–C(10)	1·453 (10)
C(3)–C(4)	1·534 (7)	C(10)–C(11)	1·496 (11)
C(4)–C(5)	1·517 (7)	C(11)–O(7)	1·423 (9)
C(5)–O(5)	1·442 (5)	O(7)–C(7)	1·413 (9)
O(5)–C(1)	1·420 (6)	C(10)–O(6)	1·215 (9)
C(2)–O(2)	1·414 (6)	C(1)–O(1)	1·389 (6)
O(2)–C(12)	1·428 (6)	O(1)–C(15)	1·420 (7)
C(12)–C(13)	1·481 (8)	C(15)–C(16)	1·477 (8)
C(12)–C(14)	1·516 (7)	C(16)–C(17)	1·376 (9)
C(12)–O(3)	1·438 (7)	C(17)–C(18)	1·378 (10)
O(3)–C(3)	1·425 (6)	C(18)–C(19)	1·354 (10)
C(5)–C(6)	1·520 (7)	C(19)–C(20)	1·388 (12)
C(4)–O(4)	1·451 (7)	C(20)–C(21)	1·387 (10)
O(4)–C(7)	1·415 (9)	C(21)–C(16)	1·377 (8)
C(7)–C(8)	1·489 (11)		

Table 3. *Bond angles* (°) *with e.s.d.'s in parentheses*

C(1)–C(2)–C(3)	114·9 (4)	O(4)–C(7)–C(8)	106·2 (6)
C(2)–C(3)–C(4)	112·5 (4)	O(4)–C(7)–O(7)	111·7 (5)
C(3)–C(4)–C(5)	111·3 (4)	C(7)–C(8)–C(9)	124·6 (7)
C(4)–C(5)–O(5)	107·8 (4)	C(8)–C(9)–C(10)	118·3 (7)
C(5)–O(5)–C(1)	113·8 (3)	C(9)–C(10)–C(11)	116·4 (6)
O(5)–C(1)–C(2)	113·0 (4)	C(10)–C(11)–O(7)	111·6 (6)
C(1)–C(2)–O(2)	111·9 (4)	C(11)–O(7)–C(7)	113·6 (5)
C(3)–C(2)–O(2)	101·3 (4)	O(7)–C(7)–C(8)	112·3 (6)
C(2)–O(2)–C(12)	106·1 (4)	C(9)–C(10)–O(6)	123·8 (7)
O(2)–C(12)–C(13)	109·1 (5)	C(11)–C(10)–O(6)	119·5 (6)
O(2)–C(12)–C(14)	110·5 (4)	C(2)–C(1)–O(1)	105·3 (4)
C(13)–C(12)–C(14)	110·7 (5)	O(5)–C(1)–O(1)	112·6 (4)
O(2)–C(12)–O(3)	105·8 (4)	C(1)–O(1)–C(15)	115·2 (4)
O(3)–C(12)–C(13)	111·9 (5)	O(1)–C(15)–C(16)	108·8 (5)
O(3)–C(12)–C(14)	108·8 (4)	C(15)–C(16)–C(17)	121·6 (5)
C(12)–O(3)–C(3)	108·2 (4)	C(15)–C(16)–C(21)	119·7 (5)
O(3)–C(3)–C(2)	102·5 (4)	C(16)–C(17)–C(18)	121·6 (6)
O(3)–C(3)–C(4)	111·8 (4)	C(17)–C(18)–C(19)	119·4 (6)
C(4)–C(5)–C(6)	113·0 (4)	C(18)–C(19)–C(20)	120·6 (7)
O(5)–C(5)–C(6)	106·1 (4)	C(19)–C(20)–C(21)	119·3 (6)
C(3)–C(4)–O(4)	108·1 (4)	C(20)–C(21)–C(16)	120·4 (6)
C(5)–C(4)–O(4)	107·4 (4)	C(21)–C(16)–C(17)	118·6 (5)
C(4)–O(4)–C(7)	113·2 (4)		

The geometry of the endocyclic C—O bonds in ring *A* is very similar to that found in 2,3-unsaturated monosaccharides (Krajewski, Urbańczyk-Lipkowska, Gluziński, Bleidelis & Kemme, 1979*b*). The C—O bond lengths are found now to be 1·423 (9) and 1·413 (9) Å and the C—O—C angle 113·6 (5)°. These values are also comparable with those found in the tetrahydropyran ring of the 1,2,3,4,4a,9a-hexahydro-4,9-dioxafluoren-2-one derivative [1·43 (1), 1·44 (1) Å and 113·7 (7)°, Gluziński, Krajewski, Urbańczyk-Lipkowska, Bleidelis & Kemme, 1979].

In the dioxolane ring (*C*) the average C—O bond lengths are 1·420 (6) and 1·433 (6) Å, the latter value referring to the acetal bonding [with C(12)].

The C(7) atom in *A* has the *S* configuration. This seems to be in accordance with Mills's rule of optical rotation (Grynkiewicz & Zamojski, 1978). The known stereochemistry of reactions converting such rings into pentoses leads to the conclusion that the derived sugars would belong to the L configurational series.

Ring *A* represents the $^{O}H_5$ half-chair conformation. Considering the least-squares plane defined by C(7), C(8), C(9) and C(10), it was found that the deviations of O(7) and C(11) from this plane are 0·401 (5) and −0·239 (7) Å respectively (Fig. 3*A*). The asymmetry parameter (Duax & Norton, 1975) $\Delta C_2^{2'-3'} = 8{\cdot}0\,(9)°$, indicates clearly the somewhat distorted $^{O}H_5$ conformation of the ring. The difference in these deviations shows that the distortion of the ring is directed from the half-chair (*H*) towards the sofa (*E*). This finding seems to be of some importance in view of the wide interest in

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* Lists of structure factors and anisotropic thermal parameters have been deposited with the British Library Lending Division as Supplementary Publication No. SUP 36499 (14 pp.). Copies may be obtained through The Executive Secretary, International Union of Crystallography, 5 Abbey Square, Chester CH1 2HU, England.

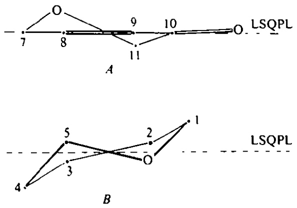

Fig. 3. Distortions of the dihydropyranone (*A*) and rhamnopyranose (*B*) rings.

the stereochemistry of pyranoid conjugated enones (Fraser-Reid, 1975).

The rhamnopyranose ring (*B*) may be characterized as the chair conformation $^1C_4(L)$ strongly deformed towards the twist form (*T*) (Fig. 3). This may be proved when one considers the deviations of atoms C(2), C(3), C(5) and O(5) defining the least-squares plane from that plane (Fig. 3*B*).

The largest ring deformation takes place along the plane intersecting the ring through atoms C(1) and C(4) [asymmetry parameter ΔC_s^1 = 18·3 (6)°]. The other asymmetry parameter along the axis perpendicular to C_s is ΔC_2^{2-3} = 5·4 (6)°. These values indicate the strong deformation of one part of the ring (Table 4). This is certainly caused by the fusion of the rhamnopyranose with the dioxolane ring. The methyl group is in an equatorial position.

Table 4. *Some torsional angles (°) in the molecule with e.s.d.'s in parentheses*

Dihydropyranone ring (*A*)	
C(11)–O(7)–C(7)–C(8)	45·2 (0·8)
O(7)–C(7)–C(8)–C(9)	−14·2 (1·0)
C(7)–C(8)–C(9)–C(10)	−4·6 (1·2)
C(8)–C(9)–C(10)–C(11)	−6·9 (1·0)
C(9)–C(10)–C(11)–O(7)	36·7 (0·8)
C(10)–C(11)–O(7)–C(7)	−56·8 (0·7)
C(8)–C(9)–C(10)–O(6)	178·5 (0·7)
O(7)–C(11)–C(10)–O(6)	−148·5 (0·6)
Rhamnopyranose ring (*B*)	
O(5)–C(1)–C(2)–C(3)	−41·3 (0·6)
C(1)–C(2)–C(3)–C(4)	37·4 (0·6)
C(2)–C(3)–C(4)–C(5)	−46·7 (0·6)
C(3)–C(4)–C(5)–O(5)	59·0 (0·5)
C(4)–C(5)–O(5)–C(1)	−65·2 (0·5)
C(5)–O(5)–C(1)–C(2)	56·4 (0·5)
Dioxolane ring (*C*)	
O(2)–C(2)–C(3)–O(3)	36·9 (0·4)
C(2)–C(3)–O(3)–C(12)	−21·3 (0·5)
C(3)–O(3)–C(12)–O(2)	−2·1 (0·5)
O(3)–C(12)–O(2)–C(2)	27·0 (0·5)
C(12)–O(2)–C(2)–C(3)	−39·2 (0·4)
Glycosidic φ and ψ angles	
H(71)–C(7)–O(4)–C(4)	29 (4·0)
H(41)–C(4)–O(4)–C(7)	27 (3·0)

The five-membered dioxolane ring (*C*) may be characterized by its envelope (*E*) conformation. Its distortion may be regarded as rather small considering the asymmetry parameter ΔC_s^2 = 4·2 (5)°. In contrast, the dioxolane ring in the structure compared as above (Foces-Foces, Cano & García-Blanco, 1976) may be regarded as the hybrid envelope/twist.

The dihedral angles between the least-squares plane through the rhamnopyranoside ring and those through the side rings are: with the phenyl-ring (*D*) plane 77·5 (2)°; with the dioxolane-ring (*C*) plane [through atoms O(2), C(12), O(3) and C(3)] 45·3 (2)°; with the dihydropyranone (*A*) half-chair plane 30·4 (3)° (*PLALIN*, Nardelli, Musatti, Domiano & Andreetti, 1978).

The φ and ψ angles of the interglycosidic parts of the sugar molecule are: for H(71)–C(7)–O(4)–C(4) 29 (4) and for H(41)–C(4)–O(4)–C(7) 27 (2)°. These torsion angles which determine the position of aglycone *vs* the pyranose rings are typical and demonstrate the operation of the *exo*-anomeric effect (Lemieux, Pavia, Martin & Watanabe, 1969).

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References

Achmatowicz, O. Jr & Burzyńska, M. H. (1979). *Pol. J. Chem.* **53**, 265–276.

Duax, W. L. & Norton, D. A. (1975). *Atlas of Steroid Structure*, Vol. 1, pp. 18–19. New York: Plenum.

Foces-Foces, C., Cano, F. H. & García-Blanco, S. (1976). *Acta Cryst.* B**32**, 3029–3033.

Fraser-Reid, B. (1975). *Acc. Chem. Res.* **8**, 192–201.

Gluziński, P., Krajewski, J. W., Urbańczyk-Lipkowska, Z., Bleidelis, J. & Kemme, A. (1979). *Acta Cryst.* B**35**, 2755–2757.

Grynkiewicz, G. (1980). *Carbohydr. Res.* **80**, 53–62.

Grynkiewicz, G. & Zamojski, A. (1978). *Synth. Commun.* **8**, 491–496.

International Tables for X-ray Crystallography (1974). Vol. IV. Birmingham: Kynoch Press.

Johnson, C. K. (1965). *ORTEP*. Report ORNL-3794. Oak Ridge National Laboratory, Tennessee.

Klinga, M., Kivekäs, R., Simonen, T., Laitalainen, T., Uggla, R. & Sundberg, M. (1978). *Cryst. Struct. Commun.* **7**, 531–534.

Krajewski, J. W., Urbańczyk-Lipkowska, Z., Gluziński, P., Bleidelis, J. & Kemme, A. (1979*a*). *Acta Cryst.* B**35**, 1248–1250.

Krajewski, J. W., Urbańczyk-Lipkowska, Z., Gluziński, P., Bleidelis, J. & Kemme, A. (1979*b*). *Acta Cryst.* **B35**, 2625–2629.

Lemieux, R. U., Pavia, A. A., Martin, J. C. & Watanabe, K. A. (1969). *Can. J. Chem.* **47**, 4427–4439.

Main, P., Woolfson, M. M., Lessinger, L., Germain, G. & Declercq, J. P. (1974). *MULTAN 74. A System of Computer Programs for the Automatic Solution of Crystal Structures from X-ray Diffraction Data.* Univs. of York, England, and Louvain, Belgium.

Manley, S. A. & Tyler, J. K. (1970). *J. Chem. Soc. D*, pp. 382–383.

Nardelli, M., Musatti, A., Domiano, P. & Andreetti, G. (1978). *PLALIN.* A program for the calculation of the weighted least-squares planes and lines, of the angles formed by them, and of the e.s.d.'s. Univ. of Parma, Italy.

Stewart, J. M., Kundell, F. A. & Baldwin, J. C. (1970). The XRAY 70 system. Computer Science Center, Univ. of Maryland, College Park, Maryland.

Toromanoff, E. (1967). *Top. Stereochem.* **2**, 157–198.

Vangehr, K., Luger, P. & Paulsen, H. (1979). *Carbohydr. Res.* **70**, 1–11.

Wells, J. A. & Malloy, T. B. Jr (1974). *J. Chem. Phys.* **60**, 3987–3993.

Acta Cryst. (1982). **B38**, 1489–1495

Structure d'un Antidépresseur Tricyclique, le Chlorhydrate d'Amineptine, Dérivé du Dihydro-10,11 5*H*-Dibenzo[*a*,*d*]cycloheptène

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Abstract

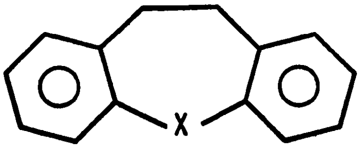
Crystals of amineptine hydrochloride ($C_{22}H_{28}NO_2^+.Cl^-$; $M_r = 373\cdot92$) are monoclinic, $C2/c$, with $a = 22\cdot456$ (3), $b = 7\cdot673$ (1), $c = 26\cdot328$ (7) Å, $\beta = 117\cdot41$ (1)°, $V = 4027\cdot2$ Å^3, $Z = 8$, $D_c = 1\cdot23$, $D_m = 1\cdot23$ (1) Mg m^{-3}, $F(000) = 1600$, μ(Cu $K\alpha$) = $1\cdot69$ mm^{-1}. The structure was determined by multi-solution direct methods and refined by full-matrix least squares to an R of 0·066 for 2971 independently measured reflections. The dihedral angle between the two planes of the benzene rings is 118·2 (2)°; a part of the side chain appears to exhibit a small movement. Conformational parameters are calculated and compared to those of similar tricyclic antidepressant drugs.

Introduction

Dans le cadre d'un programme de recherches cristallographiques consacrées à divers médicaments psychotropes tricycliques et à leurs supports structuraux de base, nous avons récemment résolu la structure du dihydro-10,11 5*H*-dibenzo[*a*,*d*]cycloheptène (Reboul, Cristau & Pèpe, 1981).

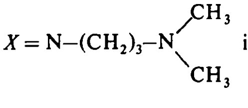
Le présent mémoire est consacré à son dérivé, le chlorhydrate de l'acide (dihydro-10,11 5*H*-dibenzo[*a*,*d*]cycloheptyl-5 amino)-7 heptanoïque ou chlorhydrate d'amineptine.

Il s'agit d'un médicament découvert en France et proposé depuis 1978 en psychiatrie comme antidépresseur (Survector^R). Au plan de la pharmacologie moléculaire, son mécanisme d'action est réputé être essentiellement dopaminergique alors que les autres antidépresseurs sont plutôt noradrénergiques et sérotoninergiques.



$X = CH_2$ dihydro-10,11 5*H*-dibenzo[*a*,*d*]cycloheptène (DDCH)

$X = CH{-}NH{-}(CH_2)_6{-}COOH$ amineptine



$X = N{-}(CH_2)_3{-}N(CH_3)_2$ imipramine

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