

anti-Anisaldehyde Oxime

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Abstract. $C_8H_9NO_2$, $M_r = 151.17$, orthorhombic, $Pna2_1$, $a = 7.750$ (4), $b = 11.572$ (1), $c = 17.701$ (1) Å at 298 K, $V = 1587.36$ Å³, $D_x = 1.265$ Mg m⁻³, $Z = 8$; $R = 0.077$ for 719 reflexions. The (*anti*) configuration of the molecule is related to taste for the first time for oximes. Each molecule forms hydrogen bonds with two other molecules. The two molecules forming the independent asymmetric unit are nearly identical.

Introduction. The title compound (AAO) was prepared according to standard organic-chemistry recipes (Vogel, 1961) and separated from the *syn* isomer by means of silica-column chromatography. Weissenberg photographs showed systematic absences consistent with the orthorhombic space group $Pna2_1$.

A thin colourless needle was used to collect intensity data (Ni-filtered Cu $K\alpha$ radiation, $\lambda = 1.5418$ Å) on a CAD-4 Enraf-Nonius automatic single-crystal diffractometer. Reflexions with $2\theta < 110^\circ$ were scanned in the ω mode; 1034 independent reflexions were collected and corrected for polarization and Lorentz factors. 315 of these reflexions having $I < 3\sigma(I)$ were not considered in the refinement. The structure was solved by means of the direct method using the program *MULTAN* (Germain, Main & Woolfson, 1971) included in the Enraf-Nonius structure determination package (SDP) for a PDP-11 computer. The Fourier map, calculated with the set of phases presenting the highest combined figure of merit given by *MULTAN*, revealed all the non-hydrogen atoms except for one N and one O of one of the two molecules of the independent unit; no H atoms were found. Refinement was achieved by least-squares procedures for all except the H atoms; for these, positions were calculated stereochemically and isotropic thermal factors equal to those of the carrier atoms were assigned. These parameters were kept fixed in the refinement. The refinement with weights $w = 1/\sigma(F_o)^2$ was ended when the maximum shifts in the atomic coordinates and isotropic thermal factors were less than $\frac{1}{3}$ and $\frac{1}{3}$ of the corresponding standard deviations respectively. The final R value is 0.077. The number of independent reflexions does not justify further refinement with anisotropic thermal factors but

Table 1. *Positional and isotropic thermal parameters and their estimated standard deviations*

	<i>x</i>	<i>y</i>	<i>z</i>	<i>B</i> (Å ²)
O(1)	0.9209 (9)	0.5767 (6)	0.5865 (4)	6.6 (2)
O(2)	0.9511 (9)	0.8879 (6)	0.7227 (4)	6.8 (2)
O(<i>X</i> 1)	0.9871 (9)	0.7865 (6)	1.0832 (4)	6.5 (2)
O(<i>X</i> 2)	0.7951 (9)	0.6038 (6)	0.2244 (4)	5.9 (1)
N(1)	1.123 (1)	0.8643 (7)	1.0881 (5)	6.0 (2)
N(2)	0.911 (1)	0.6977 (7)	0.2231 (5)	5.8 (2)
C(1)	0.930 (1)	0.6032 (8)	0.5123 (0)	4.9 (2)
C(2)	0.864 (1)	0.5348 (8)	0.4560 (5)	4.4 (2)
C(3)	0.876 (1)	0.5675 (8)	0.3803 (6)	5.0 (2)
C(4)	0.959 (1)	0.6729 (7)	0.3626 (6)	4.7 (2)
C(5)	1.026 (1)	0.7383 (8)	0.4223 (5)	4.9 (2)
C(6)	1.009 (1)	0.7062 (8)	0.4957 (6)	5.2 (2)
C(7)	0.814 (2)	0.4846 (11)	0.6109 (7)	7.7 (3)
C(8)	0.981 (1)	0.7243 (8)	0.2857 (5)	5.4 (2)
C(9)	0.811 (2)	0.8187 (10)	0.6994 (7)	7.4 (3)
C(10)	0.996 (1)	0.8878 (8)	0.7976 (5)	5.1 (2)
C(11)	1.114 (1)	0.9676 (9)	0.8193 (6)	5.8 (2)
C(12)	1.168 (1)	0.9736 (8)	0.8969 (5)	4.8 (2)
C(13)	1.104 (1)	0.8946 (8)	0.9490 (5)	4.4 (2)
C(14)	0.981 (1)	0.8126 (8)	0.9256 (5)	5.2 (2)
C(15)	0.929 (1)	0.8086 (2)	0.8494 (6)	5.1 (2)
C(16)	1.166 (1)	0.9119 (8)	1.0254 (6)	5.4 (2)

the R achieved is largely satisfactory for the determination of the configuration of the molecule.

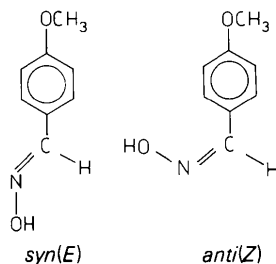
Table 1 contains the final positional parameters of AAO.*

Discussion. Determination of the configuration of oximes in solution is a most arduous task by any of the known physico-chemical methods. Accordingly, it is not surprising to find that opposite configurations are often assigned to the same oximes on the basis of these methods (Sidgwick, Millar & Spingall, 1966).

The situation is further complicated when correlating configuration with other properties, such as taste (Acton, Stone, Leaffer & Oliver, 1970).

* A list of structure factors has been deposited with the British Library Lending Division as Supplementary Publication No. SUP 35767 (8 pp.). Copies may be obtained through The Executive Secretary, International Union of Crystallography, 5 Abbey Square, Chester CH1 2HU, England.

A crucial position in this problem is occupied by the isomers of anisaldehyde oxime.



According to most of the literature data the *anti* isomer should be intensely sweet while the *syn* isomer should be tasteless. This view is in agreement with a recent model for the active site of the sweet-taste receptor (Temussi, Lej & Tancredi, 1978) but is challenged by an older paper (Unterhalt & Böschmeyer, 1971); this older paper, however, does not furnish any numerical data in support of the configurational assignment. We have undertaken the X-ray analysis of the crystal structure of the isomer of anisaldehyde oxime with the higher melting point (397 K), a tasteless compound.

In agreement with the X-ray determinations of the two isomers of *p*-chlorobenzaldehyde oxime (Jerslev,

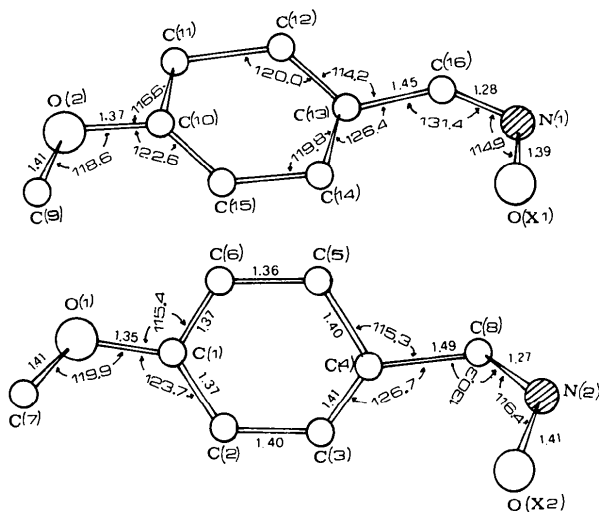


Fig. 1. Molecular models of the two molecules of AAO forming the independent unit with some final geometrical parameters. The mean e.s.d.'s for distances (Å) and angles ($^{\circ}$) are 0.008 Å and 0.3° respectively.

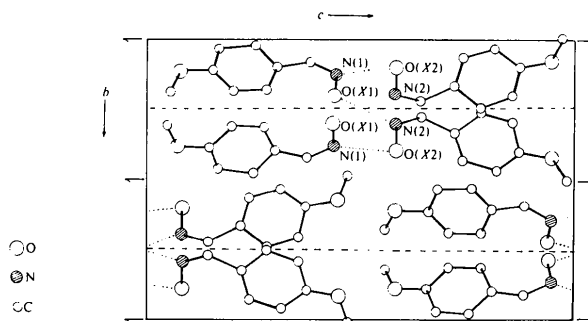


Fig. 2. Mode of packing of AAO along the [100] direction. The main hydrogen bond between N(2) and O(X1) is indicated by broken lines.

1957), we find that the higher-melting isomer has an *anti* configuration.

The molecular model of AAO is given in Fig. 1 with bond lengths and bond angles.

All molecular parameters are consistent with those of related aromatic molecules.

Fig. 2 shows a projection of the structure of AAO along the *a* axis. The two molecules of the independent unit are linked by hydrogen bonds. The hydrogen-bond length $\text{N}(2)\cdots\text{H}-\text{O}(X1)$ is 2.75 (1) Å. The other bond between O(X2) and N(1) is 2.85 (1) Å, a slightly high value that may reflect a bent hydrogen bond, consistent with the stereochemical position of the O(X2) hydrogen.

The correlation of taste and configuration is in disagreement with the model of the active site proposed by Temussi, Lej & Tancredi (1978). Such a discrepancy is most probably linked to the possibility of multiple hydrogen-bonding sites in the molecule and will be discussed at length in a subsequent paper.

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