

2-(3-Chlorophenyl)-4-(2-hydroxyethyl)-3-methylmorpholin-2-ol monohydrate

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Key indicators

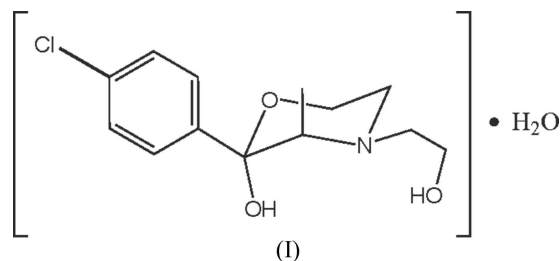
Single-crystal X-ray study
 $T = 123\text{ K}$
Mean $\sigma(\text{C}-\text{C}) = 0.008\text{ \AA}$
 R factor = 0.100
 wR factor = 0.228
Data-to-parameter ratio = 15.5For details of how these key indicators were automatically derived from the article, see <http://journals.iucr.org/e>.

The title compound, $\text{C}_{13}\text{H}_{18}\text{ClNO}_3 \cdot \text{H}_2\text{O}$, was synthesized by the reaction of diethanolamine and 2-bromo-1-(3-chlorophenyl)propan-1-one. In the molecule, the morpholine ring adopts a typical chair conformation. It has axial methyl and hydroxy groups and equatorial chlorophenyl and hydroxyethyl groups. The solvent water molecule links with the organic molecule *via* $\text{O}-\text{H} \cdots \text{O}$ hydrogen bonding.

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Comment

Selective and reversible inhibitors of monoaminooxidase A (MAO-A) were among the first drugs to be used in the treatment of depression. A prominent example is moclobemide (Alireza *et al.*, 1996), which includes a morpholine ring in its structure. By structural modification of the drug, it is possible to obtain new compounds with comparable activity and lower toxicity. We report here the preparation and structure of the title compound, (I), which is a potential psychotropic drug.



The molecular structure of (I) is illustrated in Fig. 1. The morpholine ring is in a chair conformation. The dihedral angles between the C1/C2/O1 and C2/O1/C4/N1 planes and between the C3/C4/N1 and C2/O1/C4/N1 planes are 54.2 (4) and 52.3 (3)°, respectively. The morpholine ring has axial methyl and hydroxy groups and equatorial chlorophenyl and hydroxyethyl groups. The methyl, hydroxyethyl and chlorophenyl groups are on the same side of the morpholine ring but the hydroxy group is on the opposite side.

The hydroxy and hydroxyethyl groups of (I) are hydrogen bonded with the solvent water molecule (Table 1). The combination of $\text{O}-\text{H} \cdots \text{O}$ hydrogen bonds generates two cyclic centrosymmetric $R_4^4(8)$ aggregates of four molecules (Bernstein *et al.*, 1995) (Fig. 2).

Experimental

2-Bromo-1-(3-chlorophenyl)propan-1-one (2.46 g) was added to a solution of diethanolamine (2.10 g) in *N*-methyl-2-pyrrolone (10 ml) and stirred for 1 h at 323 K. The mixture was diluted with 25 ml water,

yielding a white precipitate, which was filtered off to give the crude product; this was recrystallized from methanol to give (I) (yield 2.31 g, 85.2%). Single crystals of (I) were obtained by slow evaporation of an ethanol solution at room temperature.

Crystal data

$C_{13}H_{18}ClNO_3 \cdot H_2O$
 $M_r = 289.75$
 Monoclinic, $C2/c$
 $a = 15.6667$ (12) Å
 $b = 6.1850$ (5) Å
 $c = 29.427$ (2) Å
 $\beta = 101.3080$ (10)°
 $V = 2796.1$ (4) Å³

$Z = 8$
 $D_x = 1.377$ Mg m⁻³
 Mo $K\alpha$ radiation
 $\mu = 0.28$ mm⁻¹
 $T = 123$ (2) K
 Block, colourless
 $0.48 \times 0.44 \times 0.18$ mm

Data collection

Bruker AXS SMART 1000 CCD diffractometer
 ω scans
 Absorption correction: multi-scan (SADABS; Sheldrick, 1996)
 $T_{min} = 0.876$, $T_{max} = 0.951$

6286 measured reflections
 2683 independent reflections
 2142 reflections with $I > 2\sigma(I)$
 $R_{int} = 0.052$
 $\theta_{max} = 26.0^\circ$

Refinement

Refinement on F^2
 $R[F^2 > 2\sigma(F^2)] = 0.100$
 $wR(F^2) = 0.228$
 $S = 1.02$
 2683 reflections
 173 parameters
 H-atom parameters constrained

$w = 1/[\sigma^2(F_o^2) + (0.0008P)^2 + 58.9521P]$
 where $P = (F_o^2 + 2F_c^2)/3$
 $(\Delta/\sigma)_{max} < 0.001$
 $\Delta\rho_{max} = 0.48$ e Å⁻³
 $\Delta\rho_{min} = -0.50$ e Å⁻³

Table 1

Hydrogen-bond geometry (Å, °).

$D-H \cdots A$	$D-H$	$H \cdots A$	$D \cdots A$	$D-H \cdots A$
$O2-H2A \cdots O4W$	0.84	2.04	2.794 (5)	149
$O3-H3 \cdots O4W$	0.84	2.04	2.837 (5)	158
$O4W-H4C \cdots O2^i$	0.90	2.09	2.914 (5)	153
$O4W-H4D \cdots O3^{ii}$	0.77	2.08	2.730 (6)	142

Symmetry codes: (i) $-x + \frac{1}{2}, -y + \frac{3}{2}, -z + 1$; (ii) $-x, -y + 1, -z + 1$.

Methyl H atoms were positioned geometrically ($C-H = 0.98$ Å) and the torsion angle refined to fit the electron density, with $U_{iso}(H) = 1.5U_{eq}(C)$. H atoms of the water molecule were located in a difference Fourier map and then refined as riding, with $U_{iso}(H) = 1.5U_{eq}(O)$. The hydroxy H atoms were positioned geometrically ($O-H = 0.84$ Å) and refined as riding, with $U_{iso}(H) = 1.5U_{eq}(O)$. Other H atoms were included in the refinement at calculated positions in the riding model, with $C-H$ distances of 0.99 (methylene) and 0.95 Å (aromatic), and with $U_{iso}(H) = 1.2U_{eq}(C)$.

Data collection: SMART (Bruker, 2001); cell refinement: SAINT-Plus (Bruker, 2003); data reduction: SAINT-Plus; program(s) used to solve structure: SHELXS97 (Sheldrick, 1997); program(s) used to refine structure: SHELXL97 (Sheldrick, 1997); molecular graphics: SHELXTL (Bruker, 1997); software used to prepare material for publication: SHELXTL.

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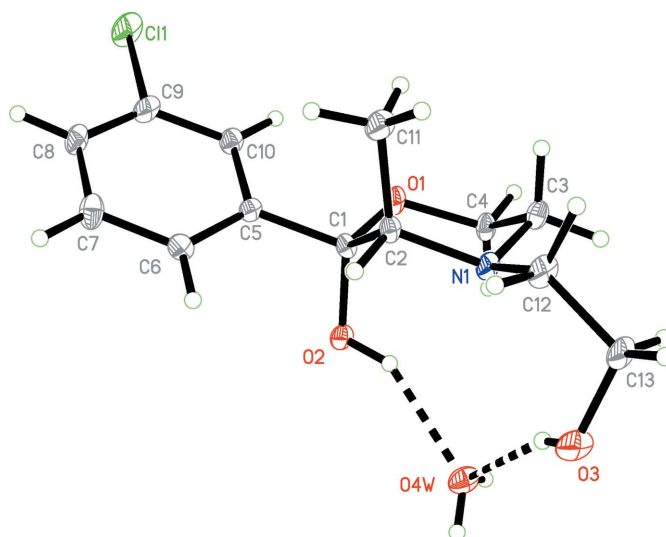


Figure 1 The asymmetric unit of (I), showing 30% probability displacement ellipsoids (arbitrary spheres for H atoms). Dashed lines indicate hydrogen bonds.

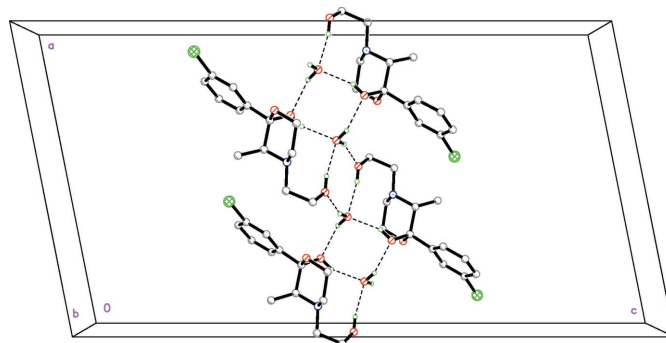


Figure 2 A partial packing diagram for (I). H atoms bonded to C atoms have been omitted for clarity. Dashed lines indicate hydrogen bonds.

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