

1-(4-Carboethoxyphenylmethyl)-2-ethoxynaphthalene

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Key indicators

Single-crystal X-ray study

$T = 150\text{ K}$

Mean $\sigma(\text{C}-\text{C}) = 0.006\text{ \AA}$

R factor = 0.059

wR factor = 0.158

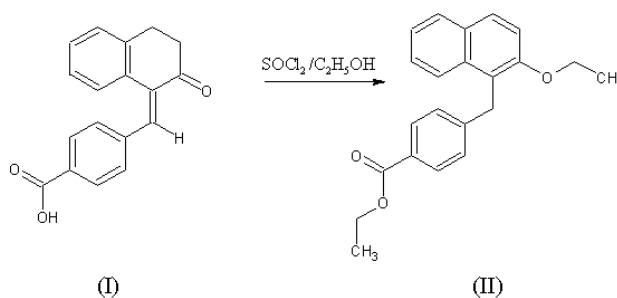
Data-to-parameter ratio = 13.4

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

While attempting to prepare the ethyl ester of (*E*)-1-(4-carboxyphenylmethylene)-2-tetralone, (I), $\text{C}_{18}\text{H}_{14}\text{O}_3$, the unexpected product 1-(4-carboethoxyphenylmethyl)-2-ethoxynaphthalene, (II), $\text{C}_{22}\text{H}_{22}\text{O}_3$, was obtained. Compound (II) crystallizes in space group $P\bar{1}$, with molecules paired by π -stacking of the naphthalene moieties around inversion centres.

Comment

One of the major interests in this laboratory is the preparation of novel α,β -unsaturated ketones and related compounds as candidate cytotoxic and anticancer agents (Dimmock *et al.*, 1999, 2000). We have reported the synthesis, crystal structure, and toxicity studies of (*E*)-1-(4-carboxyphenylmethylene)-2-tetralone, (I) (Oloo *et al.*, 2002), in the preceding paper.



In an attempt to convert (I) into the corresponding carboethoxy ester using thionyl chloride and ethanol, the product isolated was identified as the unanticipated substituted naphthalene 1-(4-carboethoxyphenylmethyl)-2-ethoxynaphthalene, (II). This observation reveals a novel route to naphthalenes. The transformation of (I) into (II) was accompanied by a greater than twofold reduction in cytotoxicity to P388 cells [IC_{50} of (II) is $42.9\text{ }\mu\text{M}$] and, in addition, neurotoxicity was noted at 100 mg kg^{-1} when the compound was administered to mice.

Compound (II) has no possibility of classical hydrogen bonding. The naphthalene moieties are planar ($\chi^2 = 99.5$ with a largest deviation of 0.025 \AA) and lie in parallel planes in the crystal structure. The perpendicular distance between these parallel planes is $3.200(18)\text{ \AA}$. The phenyl rings all lie in parallel planes at an angle of $75.9(1)^\circ$ to the naphthalene planes. In Table 1, non-classical hydrogen bonds, which link the molecules into chains, are listed.

Experimental

Compound (II) (m.p. $357\text{--}358\text{ K}$) was prepared in 71% yield by a literature method (Jha *et al.*, 2002). The single-crystal used in the X-ray crystallographic determination was obtained by vapour diff-

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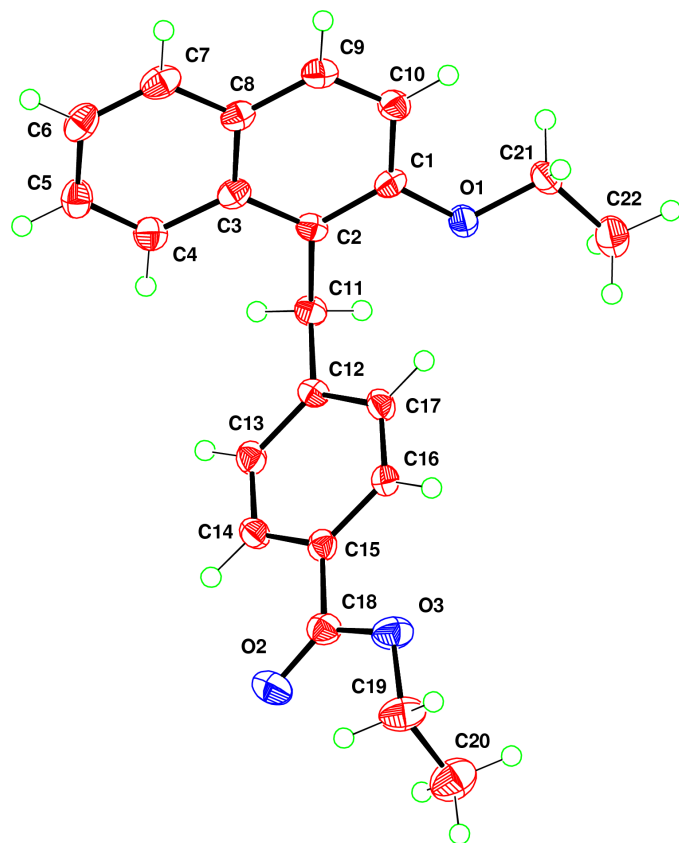


Figure 1
A general view of (II), with ellipsoids drawn at the 50% probability level.

usion of diethyl ether into a solution in chloroform at room temperature. The evaluation using P388 cells was carried out by a literature procedure (Phillips *et al.*, 1989), and murine toxicity was determined at the end of 0.5 and 4 h using a reported method (Stables & Kupferberg, 1997).

Crystal data

$C_{22}H_{22}O_3$
 $M_r = 334.40$
 Triclinic, $P\bar{1}$
 $a = 8.947$ (3) Å
 $b = 9.109$ (2) Å
 $c = 12.495$ (3) Å
 $\alpha = 90.87$ (2)°
 $\beta = 104.15$ (2)°
 $\gamma = 118.17$ (2)°
 $V = 860.2$ (5) Å³

Data collection

Enraf-Nonius CAD-4
 diffractometer
 ω scans
 Absorption correction: none
 3385 measured reflections
 3025 independent reflections
 1482 reflections with $I > 2\sigma(I)$
 $R_{int} = 0.022$

$Z = 2$
 $D_x = 1.291$ Mg m⁻³
 Mo $K\alpha$ radiation
 Cell parameters from 25
 reflections
 $\theta = 9.1$ – 18.3 °
 $\mu = 0.09$ mm⁻¹
 $T = 150$ (2) K
 Prism, colourless
 $0.30 \times 0.30 \times 0.10$ mm

$\theta_{max} = 25.0$ °
 $h = -10 \rightarrow 10$
 $k = -10 \rightarrow 10$
 $l = -14 \rightarrow 3$
 3 standard reflections
 frequency: 120 min
 intensity decay: <2%

Refinement

Refinement on F^2
 $R[F^2 > 2\sigma(F^2)] = 0.059$
 $wR(F^2) = 0.158$
 $S = 0.98$
 3025 reflections
 226 parameters

H-atom parameters constrained
 $w = 1/[\sigma^2(F_o^2) + (0.0655P)^2]$
 where $P = (F_o^2 + 2F_c^2)/3$
 $(\Delta/\sigma)_{max} < 0.001$
 $\Delta\rho_{max} = 0.25$ e Å⁻³
 $\Delta\rho_{min} = -0.34$ e Å⁻³

Table 1

Hydrogen-bonding geometry (Å, °).

$D-H \cdots A$	$D-H$	$H \cdots A$	$D \cdots A$	$D-H \cdots A$
C11–H11A \cdots O1	0.99	2.33	2.737 (4)	104
C21–H21B \cdots O2 ⁱ	0.99	2.57	3.477 (5)	153

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

All H atoms were placed in calculated positions (C–H = 0.98 Å on terminal methyl C atoms, 0.99 Å on methylene C atoms, and 0.95 Å on aromatic C atoms). $U_{iso}(H)$ values were assigned as $1.2U_{eq}$ of the attached C atom. The crystals were weakly diffracting, leading to a high proportion of 'unobserved' reflections.

Data collection: *CAD-4 EXPRESS* (Enraf-Nonius, 1992); cell refinement: *CAD-4 EXPRESS*; data reduction: *Xtal3.7* (Hall *et al.*, 2000); program(s) used to solve structure: *SHELXS97* (Sheldrick, 1997); program(s) used to refine structure: *SHELXL97* (Sheldrick, 1997); molecular graphics: *Xtal3.7*; software used to prepare material for publication: *SHELXL97*.

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