

# 1-(2,2-Diphenylethen-1-yl)tropylium perchlorate

Dieter Schollmeyer and Heiner Detert\*

University of Mainz, Department of Chemistry, Duesbergweg 10-14, 55099 Mainz, Germany. \*Correspondence e-mail: detert@uni-mainz.de

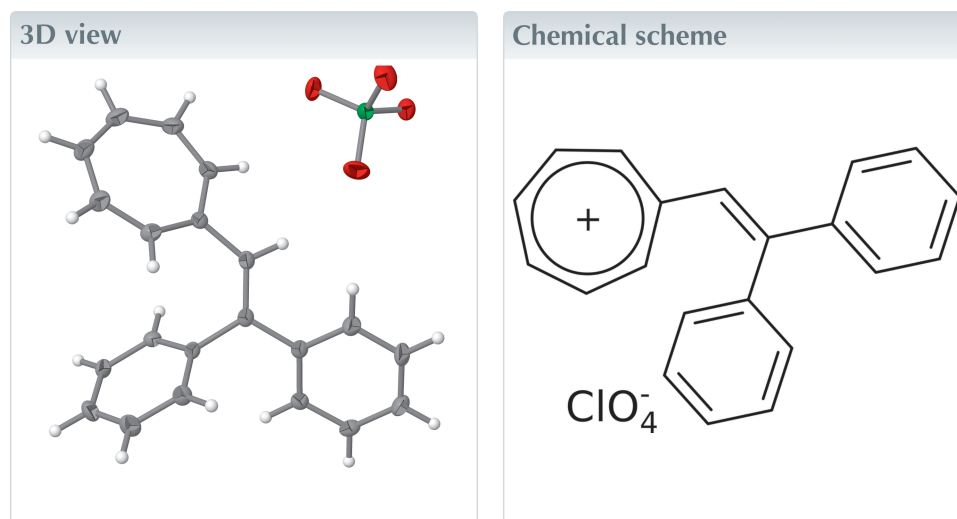
Received 28 April 2026

Accepted 5 May 2026

Edited by M. Bolte, Goethe-Universität Frankfurt, Germany

**Keywords:** crystal structure; tropylium; conjugated  $\pi$ -system.**CCDC reference:** 2551594**Structural data:** full structural data are available from iucrdata.iucr.org

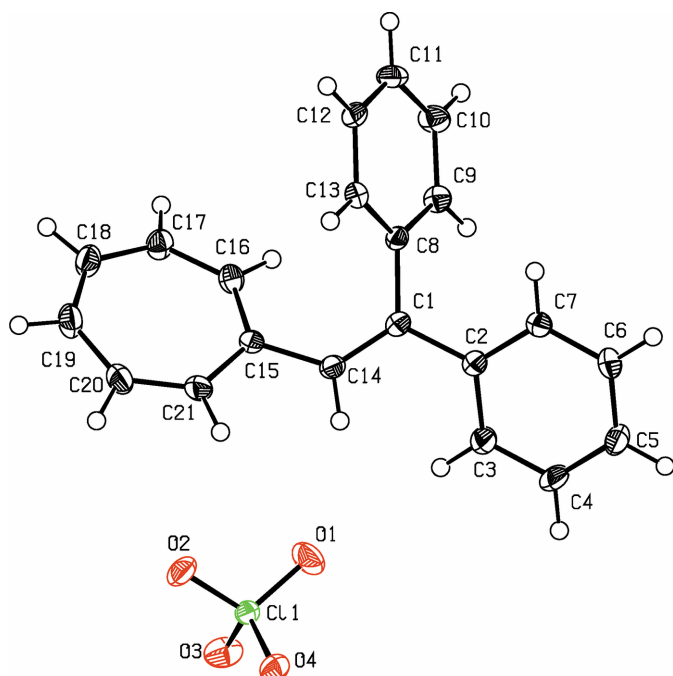
In the title salt,  $C_{21}H_{17}^+ \cdot ClO_4^-$ , two hydrogen bonds from the tropylium moiety and the vinyl group connect the cation with oxygen atoms of the perchlorate anion. The perchlorate anion is surrounded by three tropylium cations. The tropylium rings of the cations, which are related *via* a  $C_2$  axis, are mostly parallel with a short distance between the centroids.



## Structure description

The title compound,  $C_{21}H_{17}^+ \cdot ClO_4^-$  (Fig. 1), was reported by Jutz & Voitenleitner (1964) as part of a series of polymethine dyes. An analogous system with fluorene has been tested as starting material for an all-carbon stable carbene (Alcarazo *et al.*, 2010). Three essentially planar rings are attached to a vinyl group. This central unit is almost planar [torsion angles:  $C2-C1-C14-C15 = -177.6(2)^\circ$  and  $C8-C1-C14-C15 = 7.8(4)^\circ$ ]. All rings are essentially planar but significant torsion angles between rings and the vinyl group are noted. The tropylium system  $C15-C21$  and the ethene moiety include a  $C21-C15-C14-C1$  torsion angle of  $-152.8(2)^\circ$  while the torsion angle between the *trans*-phenyl ring  $C2-C7$  and the ethene moiety is to  $27.4(3)^\circ$  ( $C3-C2-C1-C14$ ) and the torsion angle between the ethene group and the *cis*-phenyl ring is  $-128.9(2)^\circ$  ( $C9-C8-C1-C14$ ). The least-squares planes of the two phenyl rings subtend a dihedral angle of  $73.43(8)^\circ$ , the angles between the tropylium and phenyl rings are smaller:  $60.35(8)^\circ$  for tropylium and *trans*-phenyl and only  $50.76(8)^\circ$  for tropylium and *cis*-phenyl.

Hydrogen bonds connect the perchlorate ion to the cation: one to the vinyl group [ $C14-H14 \cdots O1$ :  $3.347(3) \text{ \AA}$  with  $H14 \cdots O1 = 2.49 \text{ \AA}$  and a bond angle of  $151^\circ$ ], the other to tropylium: [ $C21-H21 \cdots O2 = 3.173(3) \text{ \AA}$  with  $H21 \cdots O2 = 2.55(3) \text{ \AA}$  and an angle of  $123(2)^\circ$ ] (Table 1, Fig. 2). Eight ion pairs fill the monoclinic unit cell. The perchlorate ion is closely connected *via* hydrogen bonds to one cation. In the *ac* plane, the perchlorate ion is surrounded by three tropylium rings. Small distances of  $3.8756(14) \text{ \AA}$

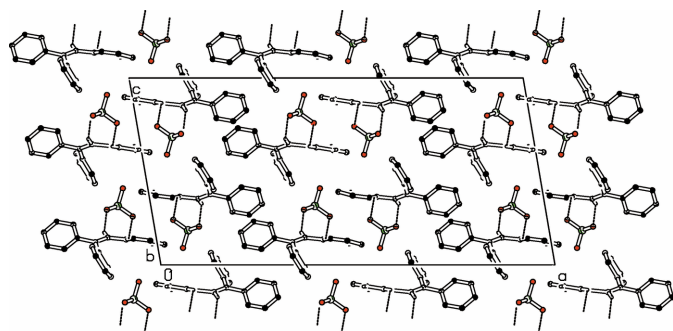


**Figure 1**  
View of the title compound. Displacement ellipsoids are drawn at the 50% probability level.

between tropylium centroids, a small dihedral angle of  $6.98(10)^\circ$  and a small slippage ( $0.451 \text{ \AA}$ ) indicate a significant  $\pi$ - $\pi$  interaction. These units are connected *via*  $C_2$  symmetry.

### Synthesis and crystallization

The title compound was prepared according to Jutz & Voithenleitner (1964) in a Grignard reaction of 2,2-diphenylvinyl bromide and methoxycycloheptatriene followed by deprotonation with tritylium perchlorate. Dark red-violet crystals, m.p. 457 K.  $^1\text{H-NMR}$  ( $\text{CD}_2\text{Cl}_2$ , 400 MHz): 7.26 (*dm*, 2 H,  $J = 7 \text{ Hz}$ ), 7.31–7.53 (*m*, 6 H), 7.54 (*s*, 1 H), 7.55 (*m*, 2H), 8.54–8.61 (*m*, 2 H), 8.64 (*d*,  $J = 9 \text{ Hz}$ , 2 H), 8.68–8.73 (*m*, 2 H).  $^{13}\text{C-NMR}$  ( $\text{CD}_2\text{Cl}_2$ , 100 MHz): 128.2 (CH), 129.22 (2 CH),



**Figure 2**  
Part of the packing diagram. Hydrogen bonds are shown as dashed lines. View along the *b*-axis direction. Only hydrogen atoms involved in hydrogen bonds are shown for clarity.

**Table 1**  
Hydrogen-bond geometry ( $\text{\AA}$ ,  $^\circ$ ).

$D-H\cdots A$	$D-H$	$H\cdots A$	$D\cdots A$	$D-H\cdots A$
C14–H14 $\cdots$ O1	0.95	2.49	3.347 (3)	151
C21–H21 $\cdots$ O2	0.95 (3)	2.55 (3)	3.173 (3)	123 (2)

**Table 2**  
Experimental details.

Crystal data	
Chemical formula	$\text{C}_{21}\text{H}_{17}^+\cdot\text{ClO}_4^-$
$M_r$	368.80
Crystal system, space group	Monoclinic, $C2/c$
Temperature (K)	120
$a, b, c$ ( $\text{\AA}$ )	31.1356 (11), 7.7899 (2), 14.9686 (6)
$\beta$ ( $^\circ$ )	99.678 (3)
$V$ ( $\text{\AA}^3$ )	3578.9 (2)
$Z$	8
Radiation type	Mo $K\alpha$
$\mu$ ( $\text{mm}^{-1}$ )	0.24
Crystal size (mm)	$0.98 \times 0.29 \times 0.10$
Data collection	
Diffractometer	Stoe <i>IPDS 2T</i>
Absorption correction	Integration
$T_{\text{min}}, T_{\text{max}}$	0.901, 0.981
No. of measured, independent and observed [ $I > 2\sigma(I)$ ] reflections	9146, 4227, 3203
$R_{\text{int}}$	0.041
$(\sin \theta/\lambda)_{\text{max}}$ ( $\text{\AA}^{-1}$ )	0.658
Refinement	
$R[F^2 > 2\sigma(F^2)], wR(F^2), S$	0.054, 0.135, 1.06
No. of reflections	4227
No. of parameters	253
H-atom treatment	H atoms treated by a mixture of independent and constrained refinement
$\Delta\rho_{\text{max}}, \Delta\rho_{\text{min}}$ ( $\text{e \AA}^{-3}$ )	0.37, $-0.43$

Computer programs: *X-AREA WinXpose, Recipe* and *Integrate*(Stoe & Cie, 2020), *SHELXT2014* (Sheldrick, 2015a), *SHELXL2019/2* (Sheldrick, 2015b) and *PLATON* (Spek, 2009).

129.84 (2 CH), 130.39 (2 CH), 131.16 (2 CH), 131.23 (CH), 131.93 (CH), 136.58 (Cq), 140.71 (Cq), 151.08 (2 CH), 151.79 (2 CH), 153.40 (2 CH), 161.29 (Cq), 167.89 (Cq).

### Refinement

Crystal data, data collection and structure refinement details are summarized in Table 2.

### References

- Alcarazo, M., Suárez, R. M., Goddard, R. & Fürstner, A. (2010). *Chem. Eur. J.* **16**, 9746–9749.  
 Jutz, C. & Voithenleitner, F. (1964). *Chem. Ber.* **97**, 1590–1598.  
 Sheldrick, G. M. (2015a). *Acta Cryst.* **A71**, 3–8.  
 Sheldrick, G. M. (2015b). *Acta Cryst.* **C71**, 3–8.  
 Spek, A. L. (2009). *Acta Cryst.* **D65**, 148–155.  
 Stoe & Cie (2020). *X-RED* and *X-AREA*. Stoe & Cie, Darmstadt, Germany.

## full crystallographic data

*IUCrData* (2026). **11**, x260464 [https://doi.org/10.1107/S2414314626004645]

## 1-(2,2-Diphenylethen-1-yl)tropylium perchlorate

Dieter Schollmeyer and Heiner Detert

## 1-(2,2-Diphenylethen-1-yl)cyclohepta-2,4,6-trien-1-ylum perchlorate

*Crystal data*

$C_{21}H_{17}^+ \cdot ClO_4^-$

$M_r = 368.80$

Monoclinic,  $C2/c$

$a = 31.1356$  (11) Å

$b = 7.7899$  (2) Å

$c = 14.9686$  (6) Å

$\beta = 99.678$  (3)°

$V = 3578.9$  (2) Å<sup>3</sup>

$Z = 8$

$F(000) = 1536$

$D_x = 1.369$  Mg m<sup>-3</sup>

Melting point: 457 K

Mo  $K\alpha$  radiation,  $\lambda = 0.71073$  Å

Cell parameters from 8512 reflections

$\theta = 2.7$ – $28.4$ °

$\mu = 0.24$  mm<sup>-1</sup>

$T = 120$  K

Plate, brown

$0.98 \times 0.29 \times 0.10$  mm

*Data collection*

Stoe IPDS 2T

diffractometer

Detector resolution: 6.67 pixels mm<sup>-1</sup>

rotation method,  $\omega$  scans

Absorption correction: integration

$T_{\min} = 0.901$ ,  $T_{\max} = 0.981$

9146 measured reflections

4227 independent reflections

3203 reflections with  $I > 2\sigma(I)$

$R_{\text{int}} = 0.041$

$\theta_{\max} = 27.9$ °,  $\theta_{\min} = 2.7$ °

$h = -40 \rightarrow 40$

$k = -10 \rightarrow 10$

$l = -19 \rightarrow 13$

*Refinement*

Refinement on  $F^2$

Least-squares matrix: full

$R[F^2 > 2\sigma(F^2)] = 0.054$

$wR(F^2) = 0.135$

$S = 1.06$

4227 reflections

253 parameters

0 restraints

Primary atom site location: dual

Hydrogen site location: mixed

H atoms treated by a mixture of independent

and constrained refinement

$w = 1/[\sigma^2(F_o^2) + (0.051P)^2 + 8.3409P]$

where  $P = (F_o^2 + 2F_c^2)/3$

$(\Delta/\sigma)_{\max} = 0.001$

$\Delta\rho_{\max} = 0.37$  e Å<sup>-3</sup>

$\Delta\rho_{\min} = -0.42$  e Å<sup>-3</sup>

*Special details*

**Geometry.** All esds (except the esd in the dihedral angle between two l.s. planes) are estimated using the full covariance matrix. The cell esds are taken into account individually in the estimation of esds in distances, angles and torsion angles; correlations between esds in cell parameters are only used when they are defined by crystal symmetry. An approximate (isotropic) treatment of cell esds is used for estimating esds involving l.s. planes.

**Refinement.** Hydrogen atoms attached to phenyl and ethene carbon atoms were placed at calculated positions and were refined in the riding-model approximation with C–H = 0.99 Å, and with  $U_{\text{iso}}(\text{H}) = 1.2 U_{\text{eq}}(\text{C})$ . The coordinates of the hydrogen atoms of the tropylium cation were refined with  $U_{\text{iso}}(\text{H}) = 1.2 U_{\text{eq}}(\text{C})$ .

*Fractional atomic coordinates and isotropic or equivalent isotropic displacement parameters ( $\text{\AA}^2$ )*

	<i>x</i>	<i>y</i>	<i>z</i>	$U_{\text{iso}}^*/U_{\text{eq}}$
C11	0.41609 (2)	0.29334 (7)	0.81544 (4)	0.01892 (14)
O1	0.38676 (6)	0.4359 (2)	0.79513 (14)	0.0363 (5)
O2	0.44931 (6)	0.3007 (2)	0.75909 (13)	0.0303 (4)
O3	0.43658 (6)	0.3005 (2)	0.90919 (12)	0.0332 (4)
O4	0.39243 (5)	0.1345 (2)	0.79900 (12)	0.0257 (4)
C1	0.34337 (7)	0.8688 (3)	0.62122 (15)	0.0177 (4)
C2	0.29973 (7)	0.8240 (3)	0.64183 (15)	0.0180 (4)
C3	0.29527 (8)	0.7190 (3)	0.71512 (17)	0.0280 (5)
H3	0.320546	0.681002	0.754824	0.034*
C4	0.25442 (8)	0.6692 (4)	0.73085 (19)	0.0323 (6)
H4	0.251951	0.598505	0.781455	0.039*
C5	0.21727 (7)	0.7218 (3)	0.67336 (17)	0.0267 (5)
H5	0.189381	0.685822	0.683784	0.032*
C6	0.22093 (7)	0.8267 (3)	0.60080 (16)	0.0224 (5)
H6	0.195461	0.863167	0.561233	0.027*
C7	0.26197 (7)	0.8797 (3)	0.58518 (15)	0.0192 (4)
H7	0.264178	0.953945	0.535816	0.023*
C8	0.34711 (7)	1.0256 (3)	0.56708 (15)	0.0173 (4)
C9	0.33371 (7)	1.1853 (3)	0.59630 (16)	0.0218 (5)
H9	0.321355	1.192816	0.650043	0.026*
C10	0.33857 (8)	1.3316 (3)	0.54661 (18)	0.0268 (5)
H10	0.329943	1.439723	0.567043	0.032*
C11	0.35600 (8)	1.3220 (3)	0.46682 (18)	0.0268 (5)
H11	0.359674	1.423210	0.433474	0.032*
C12	0.36792 (7)	1.1638 (3)	0.43660 (16)	0.0226 (5)
H12	0.379058	1.156112	0.381405	0.027*
C13	0.36371 (7)	1.0165 (3)	0.48636 (15)	0.0187 (4)
H13	0.372196	0.908645	0.465320	0.022*
C14	0.37713 (7)	0.7594 (3)	0.64594 (16)	0.0194 (4)
H14	0.370215	0.655682	0.673732	0.023*
C15	0.42274 (7)	0.7792 (3)	0.63569 (15)	0.0190 (4)
C16	0.44191 (7)	0.9440 (3)	0.64043 (16)	0.0214 (5)
H16	0.4243 (9)	1.034 (4)	0.6558 (19)	0.026*
C17	0.48350 (7)	0.9909 (3)	0.62940 (18)	0.0251 (5)
H17	0.4887 (9)	1.109 (4)	0.639 (2)	0.030*
C18	0.51770 (8)	0.8898 (3)	0.60906 (19)	0.0277 (5)
H18	0.5431 (9)	0.951 (4)	0.600 (2)	0.033*
C19	0.51942 (8)	0.7143 (3)	0.60262 (19)	0.0291 (5)
H19	0.5455 (10)	0.667 (4)	0.592 (2)	0.035*
C20	0.48716 (8)	0.5961 (3)	0.6146 (2)	0.0304 (6)
H20	0.4949 (9)	0.477 (4)	0.616 (2)	0.036*
C21	0.44509 (8)	0.6241 (3)	0.62903 (18)	0.0260 (5)
H21	0.4286 (9)	0.523 (4)	0.634 (2)	0.031*

*Atomic displacement parameters (Å<sup>2</sup>)*

	$U^{11}$	$U^{22}$	$U^{33}$	$U^{12}$	$U^{13}$	$U^{23}$
C11	0.0196 (2)	0.0177 (3)	0.0203 (3)	0.00058 (19)	0.00565 (19)	0.0014 (2)
O1	0.0407 (10)	0.0284 (10)	0.0420 (12)	0.0180 (8)	0.0132 (9)	0.0049 (8)
O2	0.0292 (9)	0.0293 (9)	0.0372 (11)	−0.0029 (7)	0.0196 (8)	0.0024 (8)
O3	0.0414 (10)	0.0349 (10)	0.0212 (9)	−0.0102 (8)	−0.0009 (8)	0.0008 (8)
O4	0.0247 (8)	0.0246 (9)	0.0279 (9)	−0.0061 (7)	0.0045 (7)	0.0000 (7)
C1	0.0195 (10)	0.0173 (10)	0.0171 (11)	−0.0019 (8)	0.0054 (8)	−0.0023 (8)
C2	0.0194 (10)	0.0169 (10)	0.0185 (11)	−0.0006 (8)	0.0053 (8)	−0.0025 (8)
C3	0.0203 (11)	0.0370 (14)	0.0267 (13)	0.0011 (10)	0.0044 (9)	0.0105 (11)
C4	0.0257 (12)	0.0434 (15)	0.0296 (15)	−0.0026 (11)	0.0102 (10)	0.0168 (12)
C5	0.0187 (10)	0.0330 (13)	0.0297 (13)	−0.0027 (10)	0.0083 (9)	0.0007 (10)
C6	0.0172 (10)	0.0270 (12)	0.0221 (12)	0.0027 (9)	0.0005 (9)	−0.0027 (9)
C7	0.0218 (10)	0.0185 (10)	0.0177 (11)	0.0020 (8)	0.0047 (8)	−0.0008 (8)
C8	0.0150 (9)	0.0186 (10)	0.0183 (11)	−0.0020 (8)	0.0027 (8)	0.0008 (8)
C9	0.0243 (11)	0.0220 (11)	0.0196 (11)	0.0001 (9)	0.0055 (9)	−0.0016 (9)
C10	0.0345 (13)	0.0171 (11)	0.0300 (14)	0.0020 (10)	0.0092 (10)	−0.0016 (9)
C11	0.0325 (12)	0.0230 (12)	0.0261 (13)	0.0018 (10)	0.0086 (10)	0.0093 (9)
C12	0.0211 (10)	0.0282 (12)	0.0200 (11)	0.0007 (9)	0.0080 (9)	0.0056 (9)
C13	0.0170 (10)	0.0192 (10)	0.0197 (11)	0.0018 (8)	0.0024 (8)	−0.0007 (8)
C14	0.0203 (10)	0.0181 (10)	0.0204 (11)	−0.0016 (8)	0.0053 (8)	0.0016 (8)
C15	0.0184 (10)	0.0210 (10)	0.0173 (11)	0.0008 (8)	0.0021 (8)	0.0041 (9)
C16	0.0203 (11)	0.0222 (11)	0.0215 (12)	0.0022 (9)	0.0029 (9)	−0.0036 (9)
C17	0.0209 (11)	0.0219 (11)	0.0319 (14)	−0.0041 (9)	0.0027 (9)	−0.0044 (10)
C18	0.0184 (11)	0.0298 (13)	0.0352 (15)	−0.0034 (10)	0.0052 (10)	−0.0017 (11)
C19	0.0197 (11)	0.0286 (13)	0.0395 (15)	0.0045 (10)	0.0067 (10)	−0.0041 (11)
C20	0.0230 (11)	0.0232 (12)	0.0443 (17)	0.0052 (10)	0.0041 (11)	0.0044 (11)
C21	0.0229 (11)	0.0187 (11)	0.0355 (15)	−0.0005 (9)	0.0025 (10)	0.0059 (10)

*Geometric parameters (Å, °)*

C11—O1	1.4372 (17)	C10—C11	1.395 (4)
C11—O4	1.4397 (17)	C10—H10	0.9500
C11—O3	1.4416 (18)	C11—C12	1.385 (3)
C11—O2	1.4417 (17)	C11—H11	0.9500
C1—C14	1.356 (3)	C12—C13	1.386 (3)
C1—C8	1.481 (3)	C12—H12	0.9500
C1—C2	1.485 (3)	C13—H13	0.9500
C2—C3	1.394 (3)	C14—C15	1.462 (3)
C2—C7	1.398 (3)	C14—H14	0.9500
C3—C4	1.387 (3)	C15—C21	1.406 (3)
C3—H3	0.9500	C15—C16	1.412 (3)
C4—C5	1.382 (4)	C16—C17	1.382 (3)
C4—H4	0.9500	C16—H16	0.94 (3)
C5—C6	1.379 (3)	C17—C18	1.399 (3)
C5—H5	0.9500	C17—H17	0.94 (3)
C6—C7	1.399 (3)	C18—C19	1.372 (4)

C6—H6	0.9500	C18—H18	0.95 (3)
C7—H7	0.9500	C19—C20	1.396 (4)
C8—C13	1.394 (3)	C19—H19	0.93 (3)
C8—C9	1.405 (3)	C20—C21	1.380 (3)
C9—C10	1.383 (3)	C20—H20	0.96 (3)
C9—H9	0.9500	C21—H21	0.95 (3)
O1—C11—O4	109.82 (11)	C11—C10—H10	119.7
O1—C11—O3	109.73 (12)	C12—C11—C10	119.4 (2)
O4—C11—O3	109.24 (10)	C12—C11—H11	120.3
O1—C11—O2	109.77 (11)	C10—C11—H11	120.3
O4—C11—O2	109.34 (11)	C11—C12—C13	120.4 (2)
O3—C11—O2	108.92 (11)	C11—C12—H12	119.8
C14—C1—C8	122.62 (19)	C13—C12—H12	119.8
C14—C1—C2	119.36 (19)	C12—C13—C8	120.4 (2)
C8—C1—C2	117.81 (18)	C12—C13—H13	119.8
C3—C2—C7	118.3 (2)	C8—C13—H13	119.8
C3—C2—C1	121.1 (2)	C1—C14—C15	128.9 (2)
C7—C2—C1	120.4 (2)	C1—C14—H14	115.6
C4—C3—C2	120.9 (2)	C15—C14—H14	115.6
C4—C3—H3	119.6	C21—C15—C16	125.1 (2)
C2—C3—H3	119.6	C21—C15—C14	114.7 (2)
C5—C4—C3	120.4 (2)	C16—C15—C14	120.0 (2)
C5—C4—H4	119.8	C17—C16—C15	129.1 (2)
C3—C4—H4	119.8	C17—C16—H16	115.4 (16)
C6—C5—C4	119.6 (2)	C15—C16—H16	115.4 (16)
C6—C5—H5	120.2	C16—C17—C18	129.8 (2)
C4—C5—H5	120.2	C16—C17—H17	112.5 (17)
C5—C6—C7	120.3 (2)	C18—C17—H17	117.7 (17)
C5—C6—H6	119.8	C19—C18—C17	128.1 (2)
C7—C6—H6	119.8	C19—C18—H18	116.4 (17)
C2—C7—C6	120.4 (2)	C17—C18—H18	115.5 (17)
C2—C7—H7	119.8	C18—C19—C20	127.6 (2)
C6—C7—H7	119.8	C18—C19—H19	116.7 (19)
C13—C8—C9	119.2 (2)	C20—C19—H19	115.6 (18)
C13—C8—C1	120.5 (2)	C21—C20—C19	129.7 (2)
C9—C8—C1	120.3 (2)	C21—C20—H20	113.0 (17)
C10—C9—C8	119.8 (2)	C19—C20—H20	117.3 (17)
C10—C9—H9	120.1	C20—C21—C15	129.8 (2)
C8—C9—H9	120.1	C20—C21—H21	114.8 (17)
C9—C10—C11	120.7 (2)	C15—C21—H21	115.4 (17)
C9—C10—H10	119.7		
C14—C1—C2—C3	27.4 (3)	C9—C10—C11—C12	1.0 (4)
C8—C1—C2—C3	-157.7 (2)	C10—C11—C12—C13	-1.8 (4)
C14—C1—C2—C7	-149.4 (2)	C11—C12—C13—C8	0.5 (3)
C8—C1—C2—C7	25.4 (3)	C9—C8—C13—C12	1.5 (3)
C7—C2—C3—C4	0.8 (4)	C1—C8—C13—C12	-178.8 (2)

C1—C2—C3—C4	-176.1 (2)	C8—C1—C14—C15	7.8 (4)
C2—C3—C4—C5	0.6 (4)	C2—C1—C14—C15	-177.6 (2)
C3—C4—C5—C6	-1.1 (4)	C1—C14—C15—C21	-152.8 (2)
C4—C5—C6—C7	0.1 (4)	C1—C14—C15—C16	32.3 (4)
C3—C2—C7—C6	-1.8 (3)	C21—C15—C16—C17	8.2 (4)
C1—C2—C7—C6	175.2 (2)	C14—C15—C16—C17	-177.4 (2)
C5—C6—C7—C2	1.3 (3)	C15—C16—C17—C18	1.3 (5)
C14—C1—C8—C13	51.5 (3)	C16—C17—C18—C19	-6.2 (5)
C2—C1—C8—C13	-123.2 (2)	C17—C18—C19—C20	0.3 (5)
C14—C1—C8—C9	-128.9 (2)	C18—C19—C20—C21	5.3 (5)
C2—C1—C8—C9	56.4 (3)	C19—C20—C21—C15	0.0 (5)
C13—C8—C9—C10	-2.3 (3)	C16—C15—C21—C20	-8.9 (4)
C1—C8—C9—C10	178.1 (2)	C14—C15—C21—C20	176.5 (3)
C8—C9—C10—C11	1.1 (4)		

*Hydrogen-bond geometry (Å, °)*

<i>D</i> —H... <i>A</i>	<i>D</i> —H	H... <i>A</i>	<i>D</i> ... <i>A</i>	<i>D</i> —H... <i>A</i>
C14—H14...O1	0.95	2.49	3.347 (3)	151
C21—H21...O2	0.95 (3)	2.55 (3)	3.173 (3)	123 (2)