

## Synthesis and Circular Dichroism of (1*R*)-N-Nitroso-1-deuterioapocamphidine†

Tadeusz Połtoński

*Department of Organic Chemistry, Technical University, 80 952 Gdańsk, Poland*

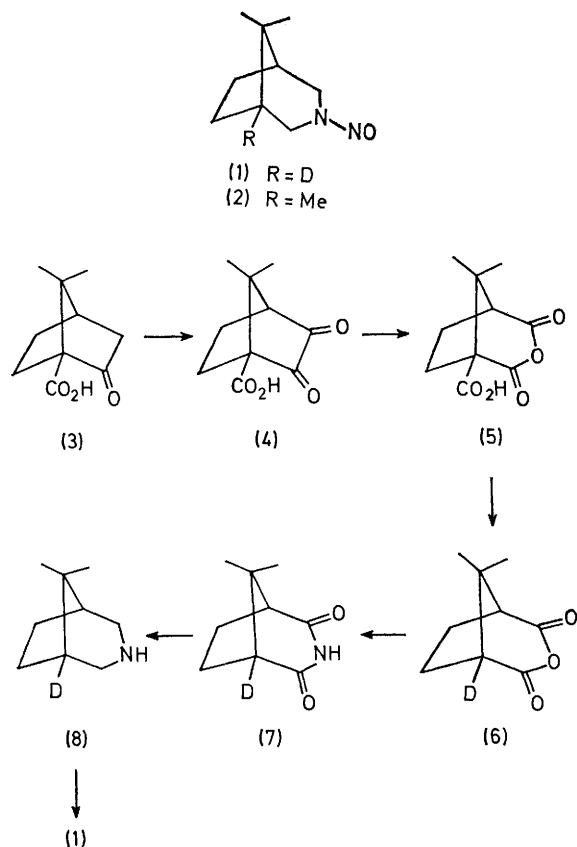
Comparison of the c.d. spectrum of the title compound (**1**) with that of (1*R*)-N-nitrosocamphidine (**2**) shows that the deuterium substituent makes a dissignate contribution to the Cotton effect.

---

Numerous examples of compounds owing their chirality to deuterium substitution are known.<sup>1,2</sup> It has often been dif-

† Apocamphidine = 8,8-dimethyl-3-azabicyclo[3.2.1]octane.

ficult to investigate the chiroptical properties of these compounds because of their low rotation, in many cases combined with high absorption. Most investigations have therefore been focused on the carbonyl chromophore.<sup>3</sup> We turned our



Scheme 1

attention to nitrosamines which, owing to their weak and long-wavelength absorption, are interesting for studying chiroptical properties.<sup>4</sup> We report the synthesis of (1*R*)-*N*-nitroso-1-deuterioapocamphidine (**1**) by multistep transformation from the (+)-acid (**3**), which in view of its well established derivation from (+)-camphor,<sup>5</sup> is recognized to have the absolute configuration indicated in Scheme 1. Oxidation of (**3**) with SeO<sub>2</sub> in acetic acid gave the  $\alpha$ -diketone (**4**), m.p. 239 °C;  $[\alpha]_D^{20} -204^\circ$  (*c* 0.5, CHCl<sub>3</sub>), which on oxidation with hydrogen peroxide in AcOH afforded (**5**), m.p. 201–202 °C (decomp.);  $[\alpha]_D^{20} -1.5^\circ$  (*c* 5, AcOEt); n.m.r.  $\delta$  (CDCl<sub>3</sub>) 9.86 (s, 1H), 2.70 (t, 1H), 2.7–1.7 (m, 4H), 1.23 (s, 3H), and 0.95 (s, 3H). Deuterium exchange of the carboxy-proton of the acid (**5**) with D<sub>2</sub>O followed by decarboxylation at 220 °C led to the anhydride (**6**), m.p. 175 °C; *m/e* 170 (*M* + 1); n.m.r.  $\delta$  (CDCl<sub>3</sub>) 2.65 (t, 2H), 2.3–1.5 (m, 4H), 1.08 (s, 3H), and 0.97 (s, 3H); i.r.  $\nu$  (KBr) 1800 and 1770 cm<sup>-1</sup>. The smooth decarboxylation of (**5**) shows that the Bredt rule is not absolutely valid for this compound.<sup>6</sup> By the action of methanolic ammonia followed by heating at 180 °C, (**6**) was converted into the imide (**7**), m.p. 190–191 °C; *m/e* 168 (*M*); i.r.  $\nu$  (KBr) 3220 br., 3095, 1720, and 1690 cm<sup>-1</sup>. Reduction of (**7**) with LiAlH<sub>4</sub> yielded the amine (**8**) (hydrobromide, m.p. 277–278 °C) which was nitrosated with HNO<sub>2</sub> to give the nitrosamine (**1**), m.p. 114 °C; *m/e* 168 (*M*); isotopic purity 76%.

The compounds (**1**) and (**2**) exhibited a Cotton effect near 370 nm (Figure 1)<sup>†</sup> corresponding to an  $n \rightarrow \pi^*$  transition.<sup>4</sup>

<sup>†</sup> Compounds (**6**), (**7**), and (**8**) also owe their chirality solely to the deuterium substitution but their optical activities in relation to their rather high absorptions are low. However, we are attempting to measure their c.d. spectra.

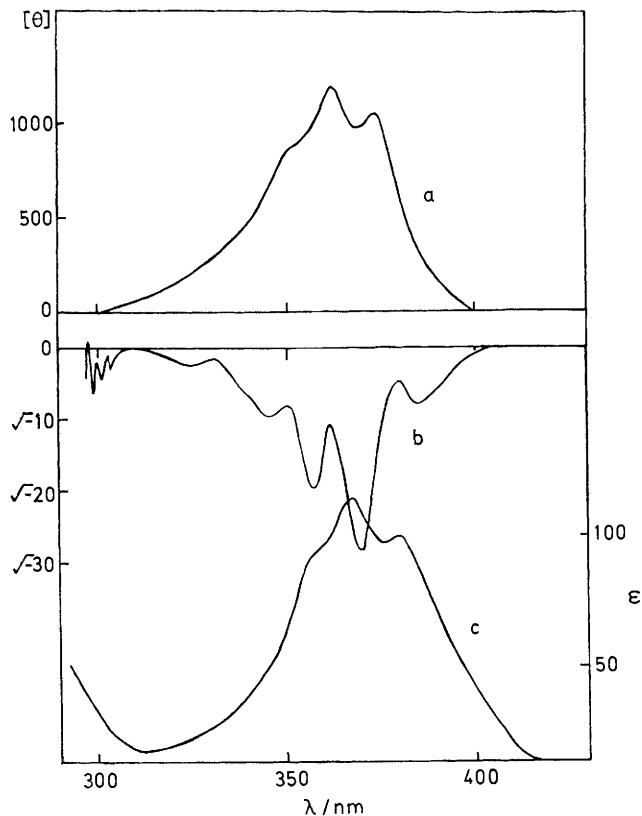


Figure 1. C.d. spectra of (a) (1*R*)-*N*-nitrosoapocamphidine (**2**), (b) (1*R*)-*N*-nitroso-1-deuterioapocamphidine (**1**), and (c) u.v. spectrum of (**1**) in cyclohexane.

Comparison of the c.d. spectra of (**1**) and (**2**) shows that the contributions of the C–D and C–CH<sub>3</sub> groups in the 1-position of *N*-nitrosoapocamphidine to the optical activity of the  $n \rightarrow \pi^*$  transition are disignate,<sup>7</sup> according to the general trend observed for the other chromophoric systems.<sup>2,3</sup> This behaviour might be explained by the lower polarizability of the deuterium atom compared to that of hydrogen, and also by the fact that the C–D bond is shorter than the C–H bond.

Partial financial support by Polish Academy of Sciences is gratefully acknowledged.

Received, 6th August 1981; Com. 944

## References

- L. Verbit, *Prog. Phys. Org. Chem.*, 1970, **7**, 51; D. Arigoni and L. Eliel, *Top. Stereochem.*, 1969, **4**, 127.
- L. A. Paquette, C. W. Doecke, F. R. Kearney, A. F. Drake, and S. F. Mason, *J. Am. Chem. Soc.*, 1980, **102**, 7228, and references therein.
- M. T. Edgar, G. Barth, and C. Djerassi, *J. Org. Chem.*, 1980, **45**, 2680, and references therein.
- G. Snatzke, H. Ripperger, Chr. Horstmann, and K. Schreiber, *Tetrahedron*, 1966, **22**, 3103; W. Gaffield, L. Keefer, and W. Lijinsky, *Tetrahedron Lett.*, 1972, 779; H. Ripperger and K. Schreiber, *J. Prakt. Chem.*, 1971, **313**, 825; T. Połoński and K. Prajer, *Tetrahedron*, 1976, **32**, 847.
- P. D. Bartlett and L. H. Knox, *Org. Synth.*, 1965, **45**, 55; W. C. M. C. Kokke and F. A. Varkevissier, *J. Org. Chem.*, 1974, **39**, 1653.
- G. Köbrich, *Angew. Chem., Int. Ed. Engl.*, 1971, **12**, 464.
- W. Klyne and D. N. Kirk, *Tetrahedron Lett.*, 1973, 1483.