

ASYMMETRIC SYNTHESIS OF (-)-NORCAMPHOR USING L-PROLINE PERCHLORATE

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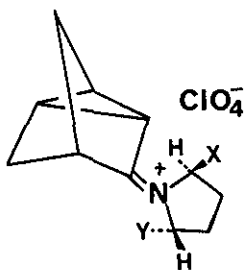
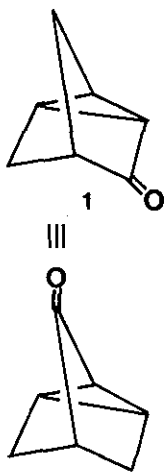
Asymmetric synthesis of (-)-norcamphor(5) from a nonchiral nortricyclanone(1) and L-proline perchlorate *via* the iminium perchlorate(2) has been described.

Successful asymmetric induction using proline has been reported by Hajos and Parrish¹, however, extensive studies using proline itself have not been made. We report here another example of convenient use of L-proline as a chiral controlling agent in a synthesis of (-)-norcamphor(5) from a symmetrical precursor, nortricyclanone (1)². Use of L-proline perchlorate allowed facile formation of the iminium perchlorate(2), as in the case of ordinary secondary amine perchlorates³, which underwent smooth cleavage and hydrolysis with hydrobromic acid to afford the chiral ketone(4).

Treating of nortricyclanone(1) with an equimolar amount of L-proline perchlorate⁴ in ethanol at room temperature for 2 days afforded the iminium perchlorate(2) as an oily form in nearly quantitative yield which, without further purification, on heating with two molar equivalents of 47% hydrobromic acid in acetic acid⁵ at refluxing temperature for 24h, gave *exo*-5-bromonorcamphor⁶(4),

mp 26.5-27.5°, bp 120-122° (17 mm Hg) [lit.⁶ mp 31-32°], $[\alpha]_D -6.25^\circ$ (CHCl_3), in 88% overall yield from **1**. Reductive debromination was carried out by using tri-*n*-butyltin hydride⁷ to form (-)-norcamphor(**5**), $[\alpha]_D -4.7^\circ$ (CHCl_3), in 69% yield. Comparison of the optical rotation of the product(**5**) with that of the reported value⁸ ($[\alpha]_D -29.2^\circ$ (CHCl_3)) indicated a 16.1% of optical purity.

Similar treatment of nortricyclanone(**1**) with pyrrolidine perchlorate⁹ furnished the tricyclic iminium perchlorate(**3**) in a crystalline form¹⁰, mp 168.5-171.5°, in 96% yield, which, however, could not be converted into racemic exo-5-bromonorcamphor(**4**) under the same conditions as above and the bicyclic iminium perchlorate (**6**), mp 168.5-171.5° was formed in 92% yield instead.

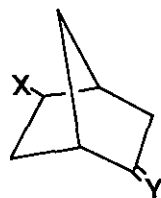


2 : X=CO₂H, Y=H

or

X=H, Y=CO₂H

3 : X=Y=H



4 : X=Br, Y=O

5 : X=H, Y=O

6 : X=Br

Y =  ClO₄⁻

REFERENCES AND NOTES

1. Z.G. Hajos and D.R. Parrish, *J. Org. Chem.*, 39, 1615 (1975).
2. H.C. Brown and E.N. Peters, *J. Amer. Chem. Soc.*, 97, 1927 (1975); J. Meinwald, J. Crandall, and W.E. Hymans, *Org. Synth. Coll. Vol.*, 5, 866 (1973).
3. Cf. L.W. Haynes, *Enamines; Synthesis, Structure, and Reactions* (A.G. Cook, ed.), pp. 79-81, Marcel Dekker, 1969 and J.V. Paukstelis, *idem.*, pp. 170-176.
4. A colorless crystalline solid, prepared from L-proline by treating with an equimolar amount of 60% perchloric acid in isopropyl alcohol followed by azeotropic removal of water using benzene under reduced pressure (aspirator) below 60°.
5. Cf. R. Peel and J.K. Sutherland, *Chem. Comm.*, 151 (1974).
6. H. Krieger, *Suomen Kemistilehti*, 34B, 24 (1961) (*Chem. Abstr.*, 55, 23370f(1961)).
7. S. Danishefsky, P. Schuda, and K. Kato, *J. Org. Chem.*, 41, 1081 (1976).
8. J.A. Berson, J.S. Walia, A. Remanick, S. Suzuki, P. Reynolds-Warnhoff, and D. Willner, *J. Amer. Chem. Soc.*, 83, 3986 (1961).
9. A colorless crystalline solid prepared as L-proline perchlorate.
10. Satisfactory analytical and spectral data were obtained for all new compounds.

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