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

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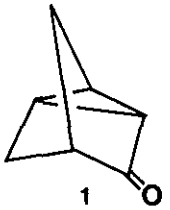
Asymmetric synthesis of (-)-norcamphor(5) from a nonchiral nortricyclanone(1) and L-proline perchlorate *via* the iminium perchlorate(2) has been described.

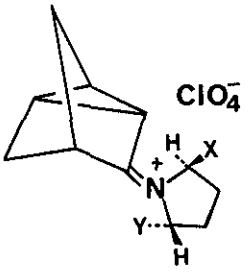
Successful asymmetric induction using proline has been reported by Hajos and Parrish[1], however, extensive studies using proline itself have not been made. We report here another example of convenient use of L-proline as a chiral controlling agent in a synthesis of (-)-norcamphor(5) from a symmetrical 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 perchlorates[3], 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 perchlorate[4] 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 acid[5] at refluxing temperature for 24h, gave exo-5-bromonorcamphor[6](4),

mp 26.5-27.5°, bp 120-122°(17 mm Hg)[lit.[6] mp 31-32°], $[\alpha]_D$-6.25° ($CHCl_3$), in 88% overall yield from 1. Reductive debromination was carried out by using tri-*n*-butyltin hydride[7] to form (-)-norcamphor(5), $[\alpha]_D$-4.7°($CHCl_3$), in 69% yield. Comparison of the optical rotation of the product(5) with that of the reported value[8]($[\alpha]_D$-29.2°($CHCl_3$)) indicated a 16.1% of optical purity.

Similar treatment of nortricyclanone(1) with pyrrolidine perchlorate[9] furnished the tricyclic iminium perchlorate(3) in a crystalline form[10], 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.



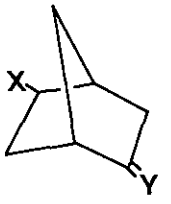


2 : X=CO_2H, Y=H

or

X=H, Y=CO_2H

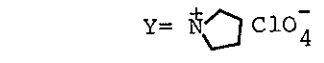
3 : X=Y=H



4 : X=Br, Y=O

5 : X=H, Y=O

6 : X=Br

Y= 

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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 azeotropical removal of water using benzene under reduced pressure(aspirator) below 60°.
5. Cf. R. Peel and J.K. Sutherland, Chem. Comm., 151 (1974).
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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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