

OPTICALLY ACTIVE PERFLUORO-2-PROPOXYPROPIONIC ACID

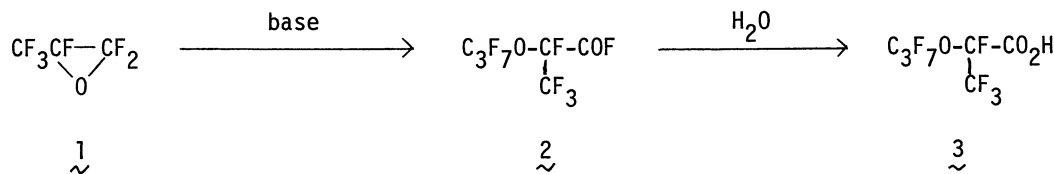
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The diastereomeric amides prepared from (\pm)-perfluoro-2-propoxypropionyl fluoride and (-)-1-phenylethylamine were separated chromatographically, and subsequent hydrolysis of each amide gave (+) and (-)-perfluoro-2-propoxypropionic acids, the first example of optically active and enantiomeric perfluorocarboxylic acids.

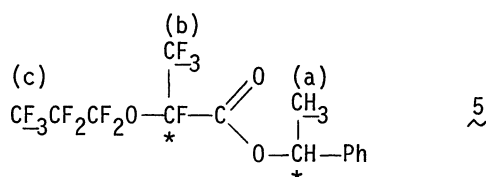
Partially fluorinated optically active compounds such as α -trifluoromethyl benzyl alcohol¹⁾ and α -methoxy- α -trifluoromethylphenylacetic acid²⁾ are known to be a useful compound for spectroscopic studies and they are used for the determination of optical purity of absolute configuration of several asymmetric compounds.³⁻⁵⁾ While some derivatives of perfluorocarboxylic acids are demonstrated to be a volatile and sensitive reagent for chromatographic analysis,^{6,7)} none of perfluorinated optically active compounds have been reported so far. This prompted us to prepare an optically active perfluorocarboxylic acid or its derivative which is expected to be able to protect amines and alcohols easily.

Perfluoro-2-propoxypropionic acid (3) was considered to be suitable for our purpose, since this perfluorocarboxylic acid containing a chiral center was easily prepared from hexafluoro-1,2-epoxypropane and was thought to afford its derivatives having adequate molecular weights for chromatographic analysis.



Perfluoro-2-propoxypropionyl fluoride (2), which was prepared by the anionic dimerization of perfluoro-1,2-epoxypropane (1) using tetramethylurea in diglyme,⁸⁾ was allowed to react with (-)-1-phenylethylamine, $[\alpha]^{20} -40.0^\circ$ (neat), and an oily mixture of the diastereomeric amides (4a + 4b)

The optically active perfluorocarboxylic acid is a useful reagent for analysis of enantiomers. For example, the (+)- and (-)- α -phenethyl alcohol esters prepared from the alcohols and 3b fluoride reflected in their differences in the nmr chemical shifts due to CH_3 , and $\text{CF}_3\overset{*}{\text{C}}\text{F}$ and $\text{CF}_3\text{CF}_2\text{CF}_2$ as follows.



Phenethyl alcohol	Chemical shifts (δ) for <u>5</u>		
	^1H (a)	^{19}F (b)**	^{19}F (c)**
(+)	1.67	5.43	6.10
(-)	1.69	5.53	6.17

** δ ppm from external $\text{CF}_3\text{CO}_2\text{H}$.

Utilizing the above data, the optical purity of an enantiomeric mixture of phenethyl alcohols could be determined based on their signal intensities of both ^1H and ^{19}F nmr.

Since the perfluorocarboxylic acid 3 contains no hydrogen atom, it is also expected to be a useful solvent for ^1H nmr analysis of chiral molecules. Further, since the $\overset{*}{\text{C}}\text{-F}$ bond at the chiral center is very stable, no inversion was observed during reactions of 3 even under vigorous conditions. Extensive work on the utilization of this unique perfluoro compounds is now under way.

References and Note

- 1) D. M. Feigl and H. S. Mosher, *J. Org. Chem.*, **33**, 4242 (1968).
- 2) D. L. Dull and H. S. Mosher, *J. Am. Chem. Soc.*, **89**, 4230 (1967).
- 3) J. A. Dale and H. S. Mosher, *ibid.*, **90**, 3732 (1968).
- 4) W. H. Pirkle, T. G. Burlingame and S. D. Beare, *Tetrahedron Lett.*, **1968**, 5849.
- 5) J. A. Dale, D. L. Dull and H. S. Mosher, *J. Org. Chem.*, **34**, 2543 (1969).
- 6) J. A. Corbin and L. B. Rogers, *Anal. Chem.*, **42**, 974 (1970).
- 7) W. Parr, C. Yang, J. Pleterski and E. Bayer, *J. Chromatogr.*, **50**, 510 (1970).
- 8) Japan Kokai 52-156801 (1977).

- 9) G.l.c. analysis was carried out on a Shimazu GC-3BT apparatus equipped with a TCD. The $4\phi \times 3$ steel column was packed with 15% Thermol-3 on Shimalite. Helium gas was flowed at the rate of 23 ml/min, while the column was kept at 150 °C.

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