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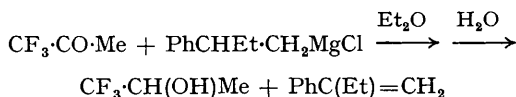
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## Optical Rotation of (–)-1,1,1-Trifluoropropan-2-ol<sup>1</sup>

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WE have evidence that the resolution of 1,1,1-trifluoropropan-2-ol recently reported by Crawford,<sup>2</sup> is not complete. The asymmetric reduction of 1,1,1-trifluoropropan-2-one by the Grignard reagent from (+)-1-chloro-2-phenylbutane gave (–)-1,1,1-trifluoropropan-2-ol (63% yield) which was purified by gas chromatography,  $[\alpha]_D^{26} - 2.20 \pm 0.02$  (neat,  $l = 0.5$ ).



This corresponds to a specific rotation of  $[\alpha]_D^{26} - 3.62 \pm 0.04$  (neat) when corrected for the optical purity (96%) of the Grignard reagent.<sup>3</sup>

We would not anticipate this reduction to proceed with 100% stereoselectivity.<sup>4</sup> In fact we have shown by gas chromatography that optically pure 1,1,1-trifluoropropan-2-ol has  $[\alpha]_D^{26} 5.6$  as compared to the  $[\alpha]_D^{25} 2.63$  reported by Crawford

which in fact represents a carbinol of about 47% optical purity.

After an extensive search<sup>1</sup> it was found that the diastereomers of 1,1,1-trifluoro-2-propyl *O*-methylmandelate were separable by gas chromatography (relative retention times 1.09, Carbowax 20 M, 20ft.  $\times$   $\frac{1}{4}$ in. stainless steel column, 170°, helium flow rate 86 ml./min.). (–)-1,1,1-Trifluoropropan-2-ol,  $[\alpha]_D^{27} - 4.40$  (neat,  $l = 1$ ) was converted into the ester by treating with an excess of *O*-methylmandeloyl chloride, prepared from (–)-*O*-methylmandelic acid, under conditions where neither kinetic nor analytic concentration of one diastereomer should occur. Gas chromatography gave two peaks with relative areas of 81 : 19 after correction for the known 3% ( $\pm$ )-*O*-methylmandeloyl moiety present. Assuming no racemization<sup>5</sup> this represents an isomer composition of 81% (–) and 19% (+), equivalent to a mixture of 38% (+), 62% (+) 1,1,1-trifluoropropan-2-ol. The sample,  $[\alpha]_D^{27} - 4.40$  (neat,  $l = 1$ ) is 62% stereochemically pure

<sup>1</sup> Asymmetric Reductions, Paper XIII.

<sup>2</sup> J. W. Crawford, *J. Chem. Soc.*, 1965, 4280.

<sup>3</sup> The optical purity of the Grignard reagent was confirmed by hydrolysis of an aliquot to give (+)-2-phenylbutane,  $[\alpha]_D^{25} + 23.34^\circ$  which is 96% of the maximum value reported by D. J. Cram, *J. Amer. Chem. Soc.*, 1952, **74**, 2149.

<sup>4</sup> (a) J. S. Birtwistle, K. Lee, J. D. Morrison, W. A. Sanderson, and H. S. Mosher, *J. Org. Chem.*, 1964, **29**, 37. (b) H. S. Mosher, J. E. Stevenot, and D. O. Kimble, *J. Amer. Chem. Soc.*, 1956, **78**, 4374.

<sup>5</sup> (a) J. Casanova and E. J. Corey, *Chem. and Ind.*, 1961, 1664. (b) E. Gil-Av, R. Charles, and G. Fischer, *J. Chromatog.*, 1965, **17**, 408. (c) G. E. Pollock, V. I. Oyama, and R. D. Johnson, *J. Gas Chromatog.*, 1965, **3**, 174. (d) B. Halpern and J. W. Westley, *Chem. Comm.*, 1965, 246. (e) J. P. Guetté and A. Horeau, Collège de France, Laboratoire de chimie organique des Hormones, Paris. Private communication.

<sup>6</sup> That racemization must be minor is shown by the fact that both (+)- and (–)-samples of alcohol gave, within experimental error, the same results except the areas of the DL and DD peaks were reversed. If the (–)-*O*-methyl mandeloyl moiety had undergone racemization the calculated rotation for the pure enantiomorph would not have been the same.

and the rotation of the pure enantiomorph, assuming a linear function between concentration and rotation, must be  $100 \times (-4.40/62) = [\alpha]_{\text{D}}^{27}(\text{max}) - 7.1$  (neat,  $l = 1$ );  $[\alpha]_{\text{D}}^{27} 5.6$  (neat).

Details concerning the percent asymmetric synthesis and relative configurations of this and the related 2,2,2-trifluoro-1-phenyl- and 2,2,2-trifluoro-1-t-butyl-ethanol<sup>1</sup> will be published.

The gas-chromatographic method for separation of diastereomers<sup>5</sup> and hence the determination of optical purity and the calculation of the rotation of the pure enantiomorphs (as well as relative configuration considerations) should prove of wide application and considerable importance in stereochemical investigations.

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