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Base-catalysed Isomerisation of Epoxy-esters: The Partial Synthesis of Methyl Coriolate from Methyl Vernolate and of Racemic Methyl Helenynolate from Methyl Crepenynate

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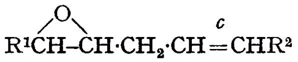
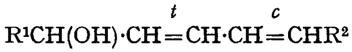
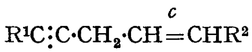
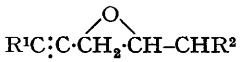
We have previously speculated on the biological relationship between linoleic acid, the epoxy-acids, vernolic and coronaric, the hydroxy-dienoic acids, coriolic and dimorphecolic, and the several conjugated octadecatrienoic acids.[1] We now report the successful base-catalysed conversion of two epoxy-esters into isomeric unsaturated hydroxy-esters.

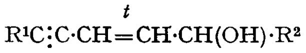
Methyl vernolate (I) was treated with lithium diethylamide in anhydrous ether for 1 hr. at 0°.[2] The major product, recovered in about 60% yield by preparative t.l.c., was a hydroxy-ester accompanied by other products including a diethylamide (~20%) with the same u.v. spectrum as the major ester.


$R^1\overset{O}{\overbrace{CH-CH}}{\cdot}CH_2{\cdot}CH\overset{c}{=}CHR^2$ (I)


$R^1CH(OH){\cdot}CH\overset{t}{=}CH{\cdot}CH\overset{c}{=}CHR^2$ (II)


$R^1C{\vdots}C{\cdot}CH_2{\cdot}CH\overset{c}{=}CHR^2$ (III)


$R^1C{\vdots}C{\cdot}CH_2{\cdot}\overset{O}{\overbrace{CH-CH}}R^2$ (IV)


$R^1C{\vdots}C{\cdot}CH\overset{t}{=}CH{\cdot}CH(OH){\cdot}R^2$ (V)

$R^1 = CH_3{\cdot}[CH_2]_4$ $R^2 = [CH_2]_7{\cdot}CO_2Me$

The hydroxy-ester had a u.v. absorption band at 233 mμ ($E^{1\%}_{1\,\text{cm.}}$ 850 MeOH) and i.r. bands at 3595, 945, and 980 cm.$^{-1}$, indicative of a hydroxy-ester with a conjugated (*cis*, *trans*) diene system. The n.m.r. spectrum contained a complex series of peaks in the region τ 3·3—4·9 (four olefinic protons) and a peak at τ 5·9 [C(OH)·*H*]. In all these respects the spectrum resembles that reported for methyl coriolate.[3]

Identity of structure was confirmed by the following: (*a*) The hydrogenated product gave dodecanedioic and tridecanedioic acids when oxidised with chromic acid.[4] (*b*) von Rudloff oxidation[5] of the unsaturated hydroxy-acid gave azelaic acid as the only dibasic acid. (*c*) The ester was readily dehydrated (1,2 and 1,6) by heating with 0·1N-methanolic hydrogen chloride;[6] the product was a mixture of conjugated trienes (8,10,12- and 9,11,13-) from its u.v. spectrum and its oxidation to suberic and azelaic acids. (*d*) Partial reduction with potassium azodicarboxylate[7] gave two hydroxy-monoene acids; the *cis*-isomer gave azelaic acid as the only dibasic acid when oxidised and the *trans*-isomer gave undecanedioic acid along with a small amount of the C_9-acid (probably from a little unchanged dienoic ester remaining in this fraction). This evidence is consistent with the product being methyl 13-hydroxyoctadeca-*cis*-9,*trans*-11-dienoate (methyl coriolate). Since vernolic acid[8] and coriolic acid[3] have the same absolute configuration at C(13) we expect our product to be identical with the natural product.

Methyl crepenynate (III), isolated from *Afzelia cuanzensis* seed oil by preparative t.l.c. on silica impregnated with silver nitrate,[9] was converted into its mono-epoxide (IV) by reaction with a 2M solution of monoperphthalic acid in ether (12 hr.). This was isolated on thin layers of silica and isomerised with lithium diethylamide. The major product, isolated in 50% yield, was a hydroxy-ester with a *trans*-enyne chromophore ($\lambda_{\max}$ 228 mμ [$E^{1\%}_{1\,\text{cm.}}$ 600] and 238 mμ [$E^{1\%}_{1\,\text{cm.}}$ 510], i.r. absorption bands at 3590 and 950 cm.$^{-1}$). A second product with similar spectroscopic properties is probably the diethylamide of the same ester which we consider to be racemic methyl helenynolate (V).[10]

Other natural products such as the prostaglandins and several short chain poly-ynes contain the group *trans*-CH(OH)·CH=CH– which might arise, biologically, from the *cis*-olefin –CH=CH·CH$_2$– by expoxidation and rearrangement.

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[1] F. D. Gunstone, *Chem. and Ind.*, 1966, 1551; H. B. S. Conacher and F. D. Gunstone, *Chem. Comm.*, 1967, 984.

[2] J. K. Crandall and Luan-Ho Chang, *J. Org. Chem.*, 1967, **32**, 435.

[3] W. H. Tallent, J. Harris, and I. A. Wolff, *Tetrahedron Letters*, 1966, 4329; K. Serck-Hanssen, *Acta Chem. Scand.*, 1967, **21**, 301.

[4] C. R. Smith, T. L. Wilson, R. B. Bates, and C. R. Scholfield, *J. Org. Chem.*, 1962, **27**, 3112.

[5] E. von Rudloff, *J. Amer. Oil Chemists' Soc.*, 1956, **33**, 126.

[6] R. G. Powell, C. R. Smith, and I. A. Wolff, *J. Amer. Oil Chemists' Soc.*, 1965, **42**, 165.

[7] R. G. Powell, C. R. Smith, and I. A. Wolff, *J. Org. Chem.*, 1967, **32**, 1442.

[8] L. J. Morris and D. M. Wharry, *Lipids*, 1966, **1**, 41.

[9] F. D. Gunstone, D. Kilcast, R. G. Powell, and G. M. Taylor, *Chem. Comm.*, 1967, 295.

[10] R. G. Powell, C. R. Smith, C. A. Glass, and I. A. Wolff, *J. Org. Chem.*, 1965, **30**, 610.