

Synthesis of Poncimarin, a New Coumarin from *Poncirus trifoliata* L.

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Poncimarin, Natural Coumarin, Synthesis

Poncimarin[7-(2',3'-epoxy-3'-methylbutyl-oxo)-8-(2'',3''-epoxy-3''methylbutyl)coumarin], a coumarinic derivative isolated from unripe fruits of *Poncirus trifoliata* L., was synthesized by isoprenylation and diepoxidation of osthenol. Analytical and spectral properties of synthetic product superimposes with that of natural coumarin.

Recently¹ we suggested the structure (6) for poncimarin, a new coumarinic derivative isolated from unripe fruits of *Poncirus trifoliata* L. (fam. Rutaceae; subfam. Aurantioideae).

Poncimarin is a neutral coumarin, optically active $[\alpha]_D^{25} = -56.2^\circ$ (CHCl₃; c 9.4) m.p. 140 °C, violet-blue fluorescent to UV light and molecular formula C₁₉H₂₂O₅.

The presence of two epoxidate isoprenylic moieties on 7 and 8 positions was principally determined from H¹-NMR absorptions and from isomerization reactions², apart from other analytical evidences.

The occurrence of a diepoxidate natural coumarin is so far not reported to our knowledge; but the occurrence belong the Rutaceae plants of high oxygenated coumarins is frequently described.

We are now reporting the synthesis of poncimarin, we have performed both to furnish a further proof of the suggested structure and to have at our disposal a sufficient amount of this substance to characterize completely the numerous products, which originated both from acidic and basic hydrolysis.

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¹ A. GUIOTTO, P. RODIGHIERO, and U. QUINTILY, Z. Naturforsch. **30c**, 420 [1975].

² A. GUIOTTO, P. RODIGHIERO, and G. PASTORINI, forthcoming paper.

³ R. D. H. MURRAY, M. M. BALLANTYNE, and K. P. MATHAI, Tetrahedron **27**, 1247 [1971].

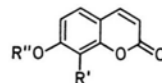
Poncimarin synthesis was achieved by perbenzoic acid epoxidation of isoprenylated osthenol prepared with minor modifications by the convenient three-step synthesis reported by MURRAY *et al.*^{3,4}.

In this way umbelliferon (1) was reacted with 3-chloro-3-methylbut-1-yne in acetonic solution in the presence of K₂CO₃ and KJ. The α,α -dimethyl propargyl ether of umbelliferon (2) was catalytically hydrogenated with Pd-CaCO₃ 10% until one equivalent of hydrogen was uptaken and then the α,α -dimethylallyl ether (3) was submitted to Claisen rearrangement in boiling diethylaniline. The isomeric rearranged products, osthenol (73%) (4) and demethyl suberosine (15%), were separated by silicagel column chromatography eluting with chloroform and eliminating a scarce amount of umbelliferon. The isoprenylation of osthenol was performed with 1-chloro-3-methyl-but-2-ene in acetonic solution in the presence of K₂CO₃ and isoprenylated product (5) was epoxidated with perbenzoic acid in chloroform solution.

Because of the presence in the molecule of two chiral centers, it was expected synthetic poncimarin to be a mixture of four diastereoisomers, constituting two pairs of enantiomers, and this fact account for a depression in m.p. 119 °C of the synthetic product in comparison with that of the natural coumarin.

All attempts, however, to divide the synthetic product by crystallization into two racemates failed as well by TLC on several systems, since synthetic poncimarin showed only a single spot with identical R_f values as natural one.

UV, IR, and NMR spectra of both natural and synthetic poncimarin are practically superimposable, only minor differences being valuable in the fine structure absorption of unresolved multiplet from δ 3.0 to δ 3.40 of H¹-NMR spectrum.



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|---|-----------------------------|--|
| 1 | R' = -H | R'' = -H |
| 2 | R' = -H | R'' = -C(CH ₃) ₂ - C \equiv CH |
| 3 | R' = H | R'' = -C(CH ₃) ₂ - CH = CH ₂ |
| 4 | R' = -CH ₂ | -CH = C(CH ₃) ₂ R'' = H |
| 5 | R' = R'' = -CH ₂ | -CH = C(CH ₃) ₂ |
| 6 | R' = R'' = -CH ₂ | -CH - C(CH ₃) ₂ |

⁴ All intermediates gave satisfactory analytical and spectral data.

⁵ J. HLUBUCEK, E. RITCHIE, and W. C. TAYLOR, Chem. Ind. **1969**, 1780.