

STRUCTURE AND SYNTHESIS OF AMBANOL, THE FIRST NATURAL OCCURRING
ISOFLAVAN-4-OL

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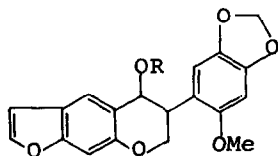
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Although natural products of the isoflavonoid type are well known¹, and have been recognised at several different oxidation levels, the natural occurrence of isoflavan-4-ols in plants has not been reported. This is to be anticipated in view of the acid sensitivity of this class of compound, as well as its relative ease of oxidation to isoflavanones.

Investigation of the light petroleum and benzene extracts of the root of *Neorautanenia amboensis* Schinz gave rotenoid and related compounds^{2,3}. Extensive column and thin layer chromatography of the benzene extract gave the first optically active isoflavan-4-ol, (+)-ambanol (1)^f, as colourless needles, m.p. 213-214°C (acetone:hexane).

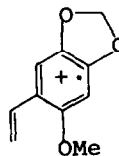
High resolution mass spectrometry established the molecular formula as C₁₉H₁₆O₆, M⁺ 340. RDA fragmentation gave (3) as the base peak, with m/e 340 (M⁺), 322 (M⁺ -18), and 132 as significant ions.

The n.m.r. spectrum revealed the presence of a methylenedioxy group



(1) R=H

(2) R=Ac

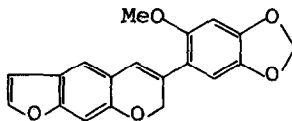


(3) m/e 178

(s, τ 4.07) and furan ring (pair of doublets, τ 2.48 and 3.32, J 2.2 Hz). The H-4 proton, being part of an ABXY system, appeared as a broad multiplet (Varian T60) at τ 5.07. The remaining signals (τ 5.30-6.20) of complex nature were assigned to the ABX portion (2-CH₂ and H-3) in agreement with known data^{4,5}.

Formation of a mono-acetate (2), M^+ 382, τ 8.13 (s, 1 x OAc) confirmed the presence of a benzylic hydroxy group (τ 8.03, exchangeable with D₂O). The n.m.r. spectrum of (2) showed the typical deshielding of H-4 on acetylation ($\Delta\tau$ 1.36 Hz).

Acid catalyzed dehydration of (1) gave the isoflav-3-ene (4), M^+ 322, τ (CDCl₃) 4.97 (s, 2-CH₂), 3.17 (br s, H-4) as colourless needles, m.p. 121-122°C.

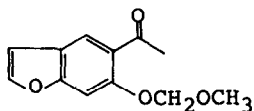


(4)

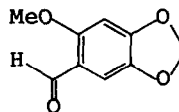
A purple colour is observed when (1) and (4) are sprayed with conc. H₂SO₄, and heated under optimum conditions.

Proof of structure was provided by synthesis.⁷ Condensation⁶ of (5)

and (6) gave a chalcone, m.p. 119-121°C, which on treatment with thallium(III)=nitrate undergoes oxidative rearrangement⁷ to the isoflavone, dehydroneotenone⁸.



(5)



(6)

Potassium borohydride reduction⁹ gave a mixture of two racemates. Separation of these by preparative t.l.c. gave (±)-ambanol (1), m.p. 243-244°C, which was indistinguishable from natural optically active ambanol by n.m.r. and m.s. data.

The characterization of ambanol is of particular interest as regards the possible key role of isoflavan-4-ols both in pterocarpan (neodulin) biosynthesis^{10,11}, and in an oxidative sequence leading to rotenoids [isoflavan-4-ol (ambanol) → isoflavanone (neotenone) → isoflavone (dehydroneotenone) → rotenoid (dolineone)]. The pathway to the respective tetracyclic compounds is conceivably predetermined by the initial availability of either 2'-hydroxyl (pterocarpan) or 2'-methoxyl function (rotenoids) in the isoflavan-4-ol. The analogues of ambanol cited above are all represented in *Neorautanenia amboensis*

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† Satisfactory analytical, spectroscopic (¹H n.m.r. and i.r.), and mass spectrometric data have been obtained for all intermediates and the natural product.

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