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NATURALLY OCCURRING OPTICALLY ACTIVE FLAVANS

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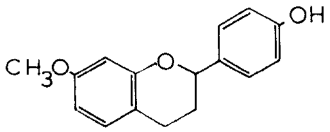
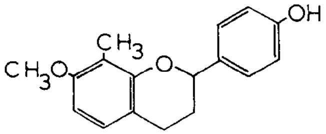
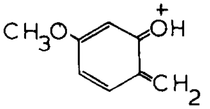
From the benzene extracts of two species of *Dianellinae* have been isolated two optically active flavans. We believe this to be the first report of the isolation of a natural flavan possessing optical activity, and indeed one of the few reports of a natural flavan not containing an oxygen atom attached to the heterocyclic ring. Previous examples are racemic 4',5,7-trimethoxyflavan, isolated from a methylated extract of a *Xanthorrhoea*[1], and 4'-methoxyflavan, isolated from the scent glands of the Canadian beaver (*Castor fiber*)[2]. We wish to report the isolation from *Stypandra grandis* of (-)-4'-hydroxy-7-methoxyflavan (I), and from *Dianella revoluta* of (-)-4'-hydroxy-7-methoxy-8-methylflavan (II).



I



II



III

(-)-4'-hydroxy-7-methoxyflavan : Off-white crystals, m.p. 148.5-9.5°C. (ex acetone/petrol). Ultraviolet : λ_{max} (mμ) 225.5, 281, 287(sh) ; logε 4.25, 3.67 and 3.57 respectively. Infrared : -OH 3400 (strong), no carbonyl bands, benzenoid absorptions 1615 and 1590 cm^{-1}. $[\alpha]_D^{21} = -15.6°$ (c = 0.55, in ethanol). The yield was ca. 100 mg from 7 Kg dried roots.

Proof of structure was by synthesis of the racemic compound via the flavylium salt[3] by catalytic hydrogenation (Pd/C, methanol) and chromatography over silica. The solution infrared spectra of the two samples were superimposable, and ultraviolet and chromatographic characteristics were also identical.

The mass spectrum was in accord with recorded spectra for flavans[1,4,5], except for the base peak in the spectrum, m/e 137, which may be rationalised in terms of structure (III), the

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product of a "retro-Diels-Alder reaction", with hydrogen transfer. The ion is peculiar to the 4'-hydroxyflavan, and is negligible in intensity in the spectrum of the corresponding methyl ether. The n.m.r. spectrum is very similar to recorded spectra for flavans[1,2], and values are tabulated below.

Position of proton(s)	2	3	4	5	6	7	8	2'	3'	4'
Chemical shifts (τ)	5.05	7.7	7.2	3.02	3.53	6.23	3.53	2.71	3.17	5.3
Multiplicities	quart	mult	mult	doub	quart	sing	doub	doub	doub	sing
Relative intensities	1	2	2	1	1	3	1	2	2	1
Coupling constants, cps	8,4	-	-	8.5	8.5,2.5	-	2.5	8	8	-

(-)-4'-hydroxy-7-methoxy-8-methylflavan : Colourless crystals, m.p. 126-7°C. (MeOH/water) Ultraviolet : λ_{max} (mμ) 226, 277, 281(sh), 285(sh) ; log ε 4.26, 3.56, 3.54 and 3.51 resp. Infrared : -OH 3300 (strong), no carbonyl bands, benzenoid absorptions 1613, 1590(sh) cm^{-1}. $[\alpha]^{21}_{D}$ = -22.4° (c = 0.85, in $CHCl_3$). The yield was ca. 20 mg from 5 Kg dried roots.

The natural product showed an identical infrared spectrum (solution or disc) to racemic 4'-hydroxy-7-methoxy-8-methylflavan, prepared by hydrogenation (Pd/C, MeOH) of the corresponding flavylium chloride. The flavylium salt was prepared according to the general method of Freudenberg *et al.*[3] from p-hydroxyacetophenone and 2-hydroxy-4-methoxy-3-methylbenzaldehyde, the latter having been prepared by selective methylation of 2,4-dihydroxy-3-methylbenzaldehyde[6].

This flavan shows mass spectral fissions exactly analogous to the other. All fragments associated with the methoxyaryl moiety are observed at correspondingly higher mass numbers, while ions arising from the phenolic moiety are observed at similar relative intensities as in the spectrum of (I). The n.m.r. spectrum of (II) is almost identical with that of (I), except for a 3-proton singlet at 7.89τ due to the 8-methyl substituent, and a corresponding simplification of aromatic absorption to two overlapping quartets.

The isolation of these optically active flavans has established these compounds as a discrete group within the family of flavonoids, and has resolved ambiguities allowed by previously described racemic compounds, namely that such flavans may have arisen as artefacts during the extraction procedures, formed for example by ring closure of an appropriately hydroxylated 1,3-diarylpropene.

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