

BRUGIEROL AND ISOBRUGIEROL, TRANS- AND CIS-1,2-DITHIOLANE-1-OXIDE,
FROM BRUGIERA CONJUGATA

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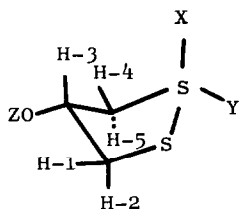
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From Brugiera conjugata (Rhizophoraceae) two new substances, named Brugierol and Isobrugierol, have been isolated for which the structures I and II are proposed respectively on the basis of spectroscopic evidence outlined below.



I; X = O, Y = lone pair, Z = H
Ac-I; X = O, Y = lone pair, Z = Ac
II; X = lone pair, Y = O, Z = H
Ac-II; X = lone pair, Y = O, Z = Ac

The extraction of the chipped stem and bark with CHCl_3 and the repeated silica gel column chromatography of the extract furnished two sulfur containing components in approximately 4:1 and the total yield of 0.05%. Crystallization of the more mobile preponderant isomer from n-hexane- CHCl_3 (5:1) afforded rhombic crystals, mp 84° , of Brugierol (I). Purification of the less mobile minor one with preparative TLC resulted in the isolation of Isobrugierol (II) as an oily substance. Both isomers showed no optical rotation.

An empirical formula $\text{C}_3\text{H}_6\text{O}_2\text{S}_2$ has been deduced for both isomers from the elemental analyses and mass spectra in which they gave parent peak at m/e 138

corresponding to the molecular ion with isotopic ion peaks at $M+1$ and $M+2$ in accord with the formula.

A partial structure $-\text{CH}_2\text{CH}(\text{OH})\text{CH}_2-$ in both isomers is evident from their NMR spectra, determined at 100-MHz and summarized in the Table, in which each isomer showed two sets of AB parts of ABX spectra for a pair of methylenes, a multiplet for a methine and a doublet exchangeable with D_2O for a hydroxyl, I at δ 5.42 ($J=10\text{Hz}$) and II at δ 5.43 ($J=5.3\text{Hz}$). On double irradiation at the methine proton in each isomer, the ABX spectra and the doublet were collapsed to corresponding a pair of AB spectra and a singlet respectively thus confirming the arrangement of protons.

The rest in both molecules, S_2O , being a thiosulfinyl which forms five membered ring with the aforementioned part is substantiated with the UV and IR absorptions characteristic of 1,2-dithiolane-1-oxides¹, I-($\lambda_{\text{max}}^{\text{MeOH}}$ 252 nm, ν_{max} 1040-1060 cm^{-1}) and II-($\lambda_{\text{max}}^{\text{MeOH}}$ 248 nm, ν_{max} 1030, 1090 cm^{-1}).

Thus Brugierol and Isobrugierol are apparent to be either of trans-(I) and cis-(II) isomer of 4-hydroxy-1,2-dithiolane-1-oxide. Moreover the well defined NMR signals clearly indicate that both exist in definite conformations with no interconversion.

Since the hydroxyl group could be reasonably assumed to be quasi-equatorial in a five membered ring, the isomers should differ in the conformation of sulfinyl oxygen. The sulfinyl oxygen has been assigned quasi-axial, i.e. trans to hydroxyl, in I and quasi-equatorial, i.e. cis to hydroxyl, in II with considerations of 1) thermodynamical stability, 2) chromatographic mobility and 3) NMR data of Ac-I and Ac-II with the use of a shift reagent, $\text{Eu}(\text{dpm})_3$.

I is expected to be thermodynamically more stable than II, because an attractive force² between a hydrogen and a sulfinyl oxygen in a 1,3-diaxial relationship and a repulsive force³ between lone pairs of sulfurs and an oxygen, both of which are possible in I, have been reported to exert marked axial preference of sulfinyl oxygen in similar systems. The stability of I over that of II was clearly implicated in the acetylation experiments in which I yielded exclusively Ac-I with retention of configuration⁴, while II

yielded a mixture of Ac-I and Ac-II with the former in major.

Previous studies⁵ have shown that an isomer with sterically more hindered sulfinyl oxygen can move faster on a liquid absorption chromatography. Of the two isomers, I is more mobile on TLC and hence should be assigned endo-sulfoxide.

The additional evidence for the assignment was presented by the NMR measurements of Ac-I and Ac-II with the addition of a shift reagent $\text{Eu}(\text{dpm})_3$.⁶ The shift values of each protons, induced with 0.33 equiv. $\text{Eu}(\text{dpm})_3$ and listed in the Table, are in good accord with the proposed structures when we assume the metal and the substrates make complex near sulfinyl oxygen. Especially the higher downfield shift of H-3 of Ac-I relative to H-3 of Ac-II by 0.23 ppm is a strong support for the assignment.

Table Chemical Shifts (ppm, Downfield from internal TMS) and Coupling Constants (Hz) with or without $\text{Eu}(\text{dpm})_3$

Compounds		H1	H2	H3	H4	H5	J12	J45	J13	J23	J34	J35
I	δ	3.59	4.09	5.42	2.92	4.05	11.0	13.0	4.3	-	3.5	-
		dd	dd	m	dd	dd						
Ac-I	δ	3.99	3.71	5.97	3.79	3.42	12.0	14.0	4.0	5.0	3.0	5.0
		dd	dd	m	dd	dd						
	PS* ¹	2.51	1.52	2.67	3.59	1.82	12.0	14.0	4.0	5.0	3.0	5.0
		dd	dd	m	dd	dd						
II	δ	3.85	3.44	5.33	3.54	3.54	11.0	13	5.0	6.0	5	5
		dd	dd	m	m	m						
Ac-II	δ	3.56	4.07	6.12	3.65	3.65	12.0	-	4.5	5.0	5.0	5.0
		dd	dd	m	d	d						
	PS* ¹	1.68	2.30	2.44	2.18	3.49	12.0	14.0	4.0	4.8	5.0	5.0
		dd	dd	m	dd	dd						

*1 Down field proton shift induced with the addition of 0.33 equiv. $\text{Eu}(\text{dpm})_3$.

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- 4) Apparently indicated by the close resemblance of NMR splitting pattern between I and Ac-I.
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