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A New Naturally Occurring Racemic Compound from the Marine Red Alga *Laurencia obtusa* (Hudson) Lamouroux[1)]

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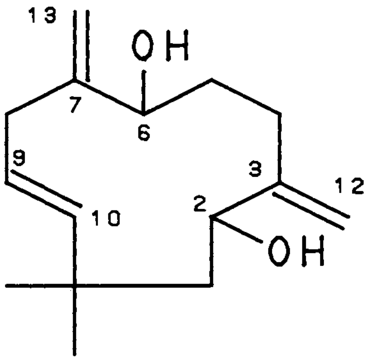
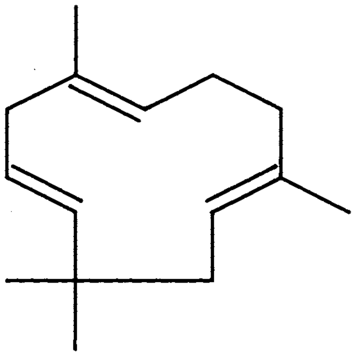
A new sesquiterpene alcohol has been isolated as a racemate from the title alga. The absolute structure of each enantiomer resolved by means of HPLC using chiral supports, was determined by the correlation with the synthetic intermediate, whose absolute structure was established by X-ray crystallographic analysis.

We have isolated a new sesquiterpene alcohol (2R^*, 6S^*)-2,6-dihydroxyhumla-9(E)-3(12),7(13),9-triene (1) as a racemate from the marine red alga *Laurencia obtusa* (Hudson) Lamouroux collected at Teuri Island, Hokkaido, together with humulene (2). In this paper, we wish to describe the structure, including the absolute configuration, of the novel racemic metabolite 1.



1



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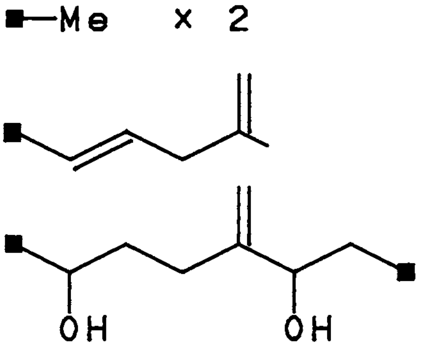


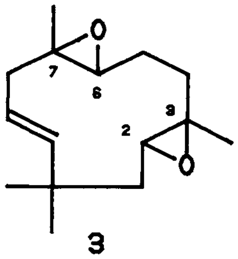
Fig.1. Partial structures of 1.
(■ ; quaternary carbon)

Sesquiterpene diol 1, mp 104.5-107.0 °C, $[\alpha]_D$ 0.0° (c 0.50, CH_3OH) had the molecular formula of $C_{15}H_{24}O_2$ (HR-MS; obsd. 236.1770, calcd. for $C_{15}H_{24}O_2$, 236.1776). ^1H NMR spectrum[2)] of 1 coupled with ^1H-^1H COSY spectrum showed the presence of following partial structures (Fig. 1). In view of co-occurrence of humulene, the planar formula of 1 could be assigned for the compound 1.

The $[\alpha]_D$ value of 1 suggested that the natural diol is a racemate. By HPLC separation with a chiral support [JASCO, Chiral cel OC, hexane/2-propanol (93:7)], the natural diol 1 was resolved into each diol of enantiomers ($[\alpha]_D$ +20.5° and -26.4°).

Treatment of humulene (2) with mCPBA (2 eq) in CH_2Cl_2 gave humulene dioxide (3)$^{3)}$ as a major product. The racemic dioxide 3 was resolved into each of enantiomers ($[\alpha]_D$ +74.3° and -83.5°) by HPLC. On treatment of (-)-3 with 2,2,6,6-tetramethylpiperidine and n-BuLi in THF, an isomerized product ($[\alpha]_D$ -29.3°) was obtained which was found to be identical with the resolved (-)-diol.

Previously, the absolute structures of (+)- and (-)-3 were reported by S. Dev.$^{3b)}$ In its paper, the $[\alpha]_D$ values of each enantiomer were described to be +0.78° and -1.42°, respectively, but these values are extremely small compared with those of our optically resolved 3 (+74.3° and -83.5°). Hence, we have carried out an X-ray crystallographic study of (-)-3. The crystal data of (-)-3 are as follows: $C_{15}H_{24}O_2$, M=236.4 monoclinic, space group $P2_1$, a=8.2930(9), b=15.119(2), c=5.8108(9) Å, β=102.345(8)°, V=711.7(2) Å^3, Z=2, Dc=1.103 g/cm^3. Intensity data for 2θ<140° were collected on an Enraf-Nonius CAD4 diffractometer with Ni filtered CuKα radiation by using a ω-2θ scanning mode. The structure was solved by means of the direct-methods program MULTAN$^{4)}$ and was refined by the full-matrix least-squares method. The final R(Rw) is 0.025(0.031) for 1599 reflections. Unit weight was given to all reflections. The absolute configuration was determined by the Bijvoet method with the technique reported by Engel$^{5)}$. The correct absolute configuration of (-)-3 is shown in Fig. 2, and hence, the absolute configurations at C-2 and C-6 in (+)- and (-)-1 were determined as 2R, 6S and 2S, 6R, respectively.



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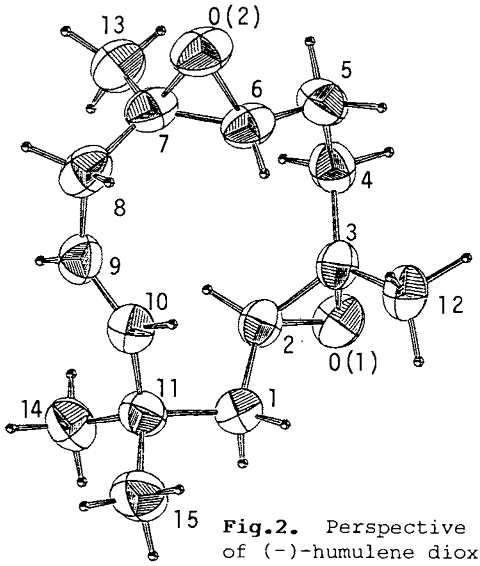

Fig.2. Perspective view of (-)-humulene dioxide.

Consequently, the natural diol exists as a racemate and the $[\alpha]_D$ values of 3 reported by S. Dev$^{3b)}$ should be revised.

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References

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