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ALICYCLIC TERPENOIDS FROM CYCLOCITRYL PHENYL SULFIDES. IV. [1)]

A SYNTHESIS OF METHYL ESTERS OF VITAMIN A_1 AND A_2 ACIDS AND THEIR GEOMETRIC ISOMERS

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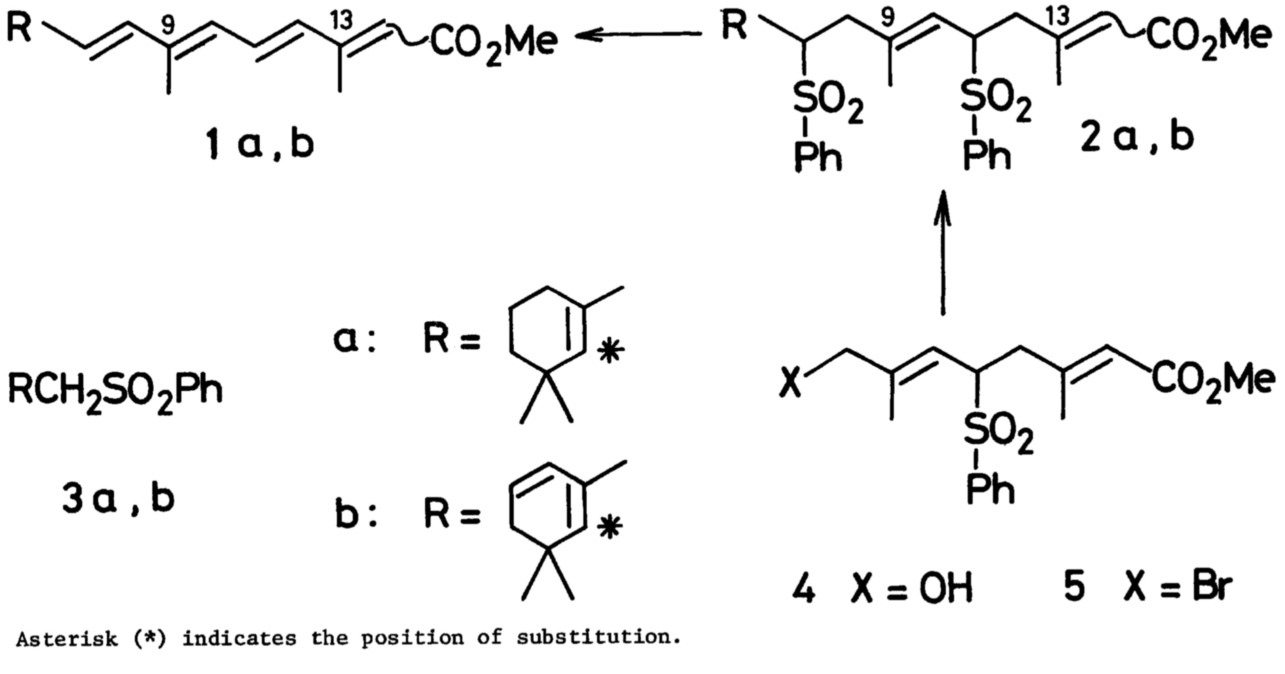
Methyl esters of vitamin A_1 and A_2 acids were synthesized by the base-catalyzed desulfination of the C_{20} skeletons 2a and 2b derived from the coupling reaction between 3a or 3b and the bromo compound 5.

A number of efforts to discover the practical synthetic routes to vitamin A comprise a stepwise construction of the polyene systems from β-ionone and its related compounds.[2)] However, because of the unstable nature of polyenes for heat and light, coupling of the two kinds of the non-conjugated C_{10} systems must be favorable for the current synthetic purpose.

As an extension of our study on the syntheses of terpenoids from cyclocitryl phenyl sulfone 3a [3)] and its related sulfone 3b [4)], we describe here a novel synthesis of methyl esters of vitamin A_1 and A_2 acids 1a and 1b, involving the formation of the C_{20} skeletons 2a and 2b derived from the coupling reaction [5),6)] between 3a or 3b and the bromo compound 5.



Asterisk (*) indicates the position of substitution.

The reaction of (2E)-2-methyl-4-phenylsulfonyl-2-buten-1-ol (6)[7] with 2 eq of $(i\text{-Pr})_2NLi$ followed with methyl (2E)-3-methyl-4-bromo-2-butenoate (7) in THF at -78°C for 30 min provided methyl (2E, 6E)-3,7-dimethyl-5-phenylsulfonyl-8-hydroxy-octadienoate (4) as crystals in 92% yield.

The alcohol 4 was converted into the corresponding bromo compound 5 with PBr_3 in dry benzene in 65% yield. The reaction of 3a with 1 eq of $(i\text{-Pr})_2NLi$ followed by the action of 5 in glyme-THF (1:1) at -78°C for 2 hr afforded 2a as a colorless liquid in 94% yield. The product 2a was a mixture (1:1) of the geometric isomers on C_{13}. Finally, the base-catalyzed desulfination of the isomeric mixture 2a took place by heating with t-BuOK in t-BuOH-THF (2:1) at 70-80°C for 7 hr, affording 1a in 94% yield. The PMR and CMR of the product 1a revealed that the product was a mixture (trans:cis=5:1) of the geometric isomers on C_{13}.[8]

Similarily, methyl ester of vitamin A_2 acid was obtained as geometric isomers (trans:cis= 5:1) on C_{13} in overall yield 50% from the combination of 3b and 5 followed by desulfination.

REFERENCES AND NOTES

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7) The alcohol 6 was prepared in 55% yield from prenyl phenyl sulfone by oxidation with SeO_2 followed by reduction of the corresponding aldehyde with $NaBH_4$.

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