Synthesis, Absolute Configuration, and Photocyclisation of the Sesquiterpene (−)-Cryptomerion

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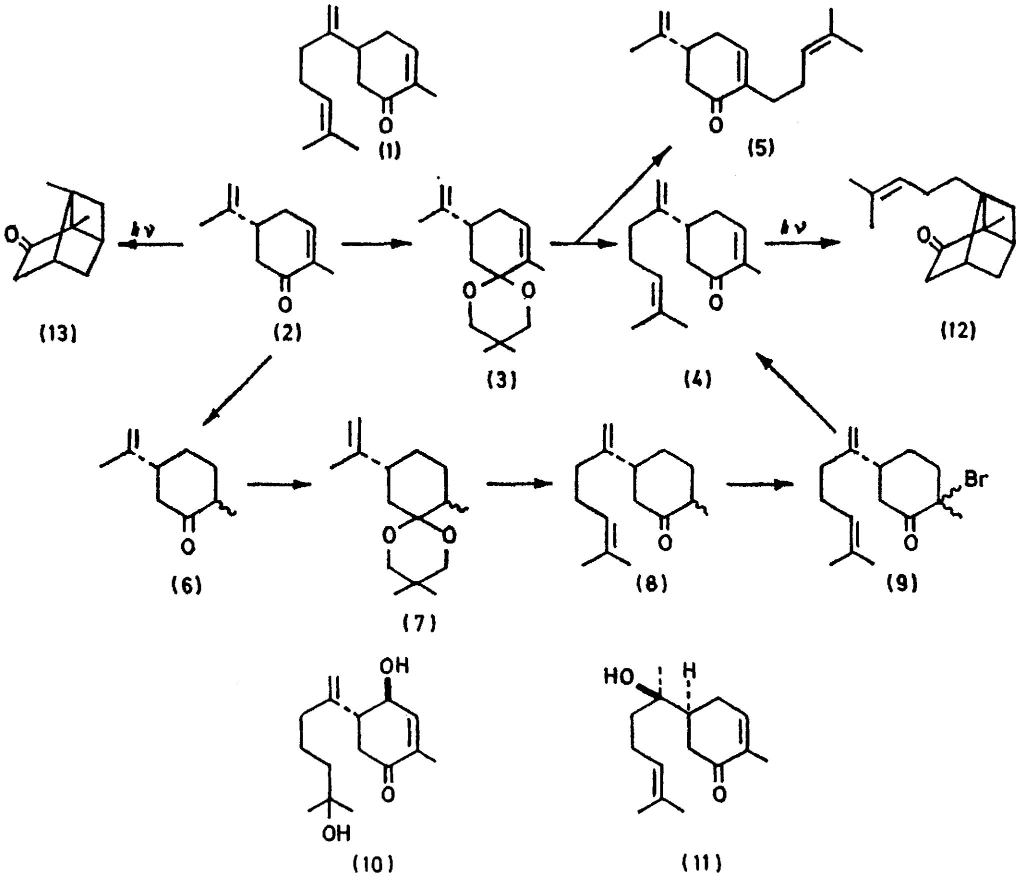
Summary The absolute configuration of cryptomerion has been established by synthesis from (−)-carvone and the conversion of cryptomerion into photocryptomerion is reported.

CRYPTOMERION, a sesquiterpene isolated from *Cryptomeria japonica* D. Don, has been assigned[1] structure (**1**) and this assignment has subsequently been confirmed by synthesis.[2] In connection with our recent biosynthetic suggestions[3] for a group of structurally related mono- and sesqui-terpenes we needed to determine the absolute configuration of cryptomerion. Accordingly, we have completed a synthesis of (−)-cryptomerion using an alkylation procedure developed by Crawford, Erman, and Broaddus.[4] In preliminary studies, the acetal (**3**), derived from (−)-carvone (**2**), was alkylated[4] in the appropriate allylic position by treatment with butyl-lithium[5] and *NNN'N'*-tetramethylethylenediamine followed by addition of 1-chloro-3-methylbut-2-ene. After hydrolysis the major reaction product (**4**) was isolated by preparative g.l.c. and had spectral characteristics and specific rotation, $[\alpha]_{D}^{28}$ −39·3° (c 1·43, $CHCl_3$) lit.[1] $[\alpha]_D$ −38° (c 1·45, $CHCl_3$), in close agreement with those reported[1] for cryptomerion. Later studies provided a more efficient synthetic route to cryptomerion. Reduction[6] of (−)-carvone (**2**) yielded (+)-dihydrocarvone (**6**) which was converted into the acetal (**7**). Subsequent alkylation of (**7**) provided dihydrocryptomerion (**8**) in 70% overall yield. Treatment of (**8**) with phenyltrimethylammonium tribromide[2,7] gave the bromoketone (**9**)[2] which, after heating in pyridine under reflux, was converted into (−)-cryptomerion (**4**), $[\alpha]_D^{29}$ − 37° (*c* 2·65, $CHCl_3$), in 77% yield. The synthetic studies described above establish the absolute configuration[8] of (−)-cryptomerion (**1**). It is interesting that cryptomerone (**10**),[9] which co-occurs with cryptomerion, belongs to the same absolute configurational series.



The i.r. spectrum of cryptomerion changed significantly after a period of two days' exposure to light. In particular, a new band at 1735 cm^{-1} appeared and a suspected photochemical reaction was conclusively established. Irradiation (Westinghouse 275 W lamp and 20 mm Corning filter No. 7380) of a solution of cryptomerion in ethanol for three days resulted in efficient conversion (73% yield) into photocryptomerion (**12**), $[\alpha]_D^{28}$ −41°(*c* 1·5, $CHCl_3$), which was separated from starting material (27%) by column chromatography (alumina). The structure of photocryptomerion was assigned on the basis of spectral characteristics [ν_{max} (neat) 1735, 1410, 835 cm^{-1}; τ (CCl_4) 4·96 (1H, m), 8·33 (3H, s), 8·40 (3H, s), 8·93 (3H, s); M^+ *m/e* 218·1662, $C_{15}H_{22}O$ requires 218·1670]. Its formation is analogous to the conversion of carvone (**2**) into (**13**).[10]

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