

## S-(+)- and R-(-)-Carvone as Starting Material in the Enantioselective Synthesis of Natural Products

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Conjugate addition of nucleophiles followed by annulation is investigated for R-(-) and S-(+)-carvone to obtain highly functionalised chiral decalins. The isopropenyl group in carvone first serves as a chiral handle. After the addition and annulation, it can be transformed into an alcohol, a double bond, or a carbonyl group, and thus it can be considered as a protecting group for these functionalities. Following these lines, the total syntheses of a number of sesqui- and diterpenes has been realised.

One new approach starts with the conjugate addition of cyanide to the enone in S-(+)-carvone (**1**), followed by an annulation reaction. In this way a functionalised chiral decalone with a nitrile group at C9 and a potential functional group at C7 is obtained in an easy way and in high yield. This decalone will be applied in the synthesis of Ambrox® (**2**), drimanes **3** and other flavour compounds. Conjugate addition to S-(+)-carvone followed by annulation also provides an easy access to progesteron receptor ligand eremophilane sesquiterpenes **4**.

Mukaiyama or double Mukaiyama reactions can be applied to obtain cadinanes **5**, and (homo)steroids from carvone. The application of conjugate addition followed by Mukaiyama-aldol reactions gives excellent intermediates for the enantioselective synthesis of insect antifeedant clerodanes like dihydroclerodin (**6**).

