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A NEW SYNTHESIS OF (±) LINALOOL

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Linalool I (3:7-dimethyl-1:6-octadien-3-ol) is one of the most interesting acyclic monoterpene alcohols occurring in nature in both d and l forms. Natural linalool is obtained from Brazilian Bois de Rose oil, Mexican linaloe oil, Japanese shiu oil and coriander oil. The structure of linalool was established by Tiemann and Semmler[1]. The absolute configuration of linalool itself was established recently by Ohloff and Klein[2].

Linalool and its esters are used extensively in perfume compositions. Because of the high cost and inadequate supplies of natural linalool, synthetic linalool has largely replaced the natural material in perfumery. Several synthetic procedures for preparation of linalool have been reported. Of these two are particularly important. The first[3] uses pinene readily available from turpentine oil as the starting material. The second[4] is based on the use of acetylene and acetone as the starting materials.

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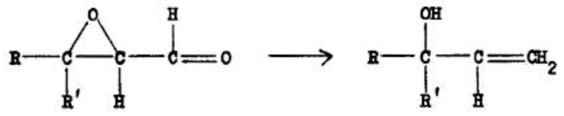
Our approach was based on the fact that α,β-epoxy ketones and aldehydes can be subjected to a reductive elimination process with hydrazine hydrate to form the corresponding allylic alcohols[5].



Recently this reaction has been applied to similar cyclic monoterpene compounds[6]. Mechanistic considerations led us to believe that the open chain aldehydes should undergo similar instantaneous reductive elimination under milder conditions without undergoing much polymerizations in presence of alkali.

We have applied this reaction for the first time to an open chain α,β-epoxy aldehyde. Citral II (a mixture of neral and geranial by GLC[@]) from Indian lemongrass oil was initially converted to its α,β epoxide III (neral epoxide 43% and geranial epoxide 57% by GLC) in excellent yield (80%) through a well established process[7] of treating α,β unsaturated aldehyde with alkaline hydrogen peroxide at low temperatures (0-10°C). The distilled citral epoxide b.p. 84-86°/5 mm., n_D^{20} 1.4672, d_{15}^{15} 0.9779, showed no UV and IR absorption indicative of α,β-unsaturated aldehyde. NMR spectrum[&] $\delta\ ^{CCl_4}_{TMS}$ of (±) citral epoxide (a mixture of neral and geranial epoxides, retention time 16.25 mins. and 16.5 mins. respectively) showed singlets at 1.35 and 1.4 for the β-methyl, signals

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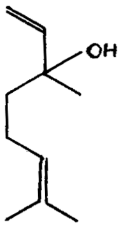
@ GLC analyses were carried out on Pye-Argon (β-ray ionisation) apparatus on a four feet carbowax-1000 column, at 110° and gas flow 40 ml./minute.

& NMR recorded on a Varian A-60 instrument. We are indebted to Dr F. van Voorst Vader of Unilever Research Laboratory, Vlaardingen, Holland for the NMR spectra.

at 1.6 and 1.65 due to the methyls on the isopropylidine group, two doublets at 2.95 and 3.05 due to the proton α to the aldehyde group, multiplets at 5.05 due to the olefinic proton and two doublets centered at 9.4 due to proton of the aldehyde group.



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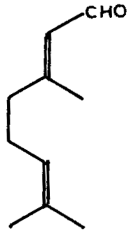

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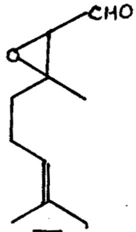

III

The citral α,β-epoxide thus obtained was further reacted with hydrazine hydrate (90-50%) according to Wharton and Bohlen[5] in methanol at 0°C to form the hydrazone which instantaneously rearranged to (±) linalool with the evolution of nitrogen in presence of catalytic amounts (0.2 equiv.) of acetic acid. The linalool was isolated by dilution, extraction and fractional distillation (yield 30-35% based on epoxide), retention time 9.7 mins., b.p. 71-72°/6 mm., n_D^{20} 1.4637, $[\alpha]_D^{20}$ -0.7 (c. 6.88; $CHCl_3$). Infrared (smear; 3350, 1110, 1380, 3090, 1640, 915, and 830 cm^{-1}) and NMR (CCl_4, TMS) spectra were identical with those obtained using an authentic sample of linalool.

All compounds gave the required analytical values.

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