Short Communications

The Structure of Divinyl Ether

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The study of the diethyl and divinyl ether by Fischer and Ehrenberg [1], [2] has given rise to a discussion of the structure of the gaseous divinyl ether. Usually the structure of this compound is explained by assuming a resonance which gives a certain degree of double bond character to the C—O-bonds [3]. The molecule should accordingly be expected to be planar. On the other hand the short H_2—H_3-distance in the planar model is unfavourable and will counter-act the tendency to coplanarity. The van der Waals distance between two hydrogen atoms is 2.4—2.5 Å, while the H_2—H_3-distance for an undistorted model would be about 2.0 Å.

In order to decide whether one of the two effects predominates or an intermediate equilibrium position might exist, we have carried through an electron diffraction investigation by the aid of the sector method.

In Fig. 1 the $\sigma(r)$-curve of divinyl ether is given. The peaks with Roman numerals are due to the C—C- and C—O-distances. The other maxima are mainly caused by the C—H- and O—H-distances which give a relatively important contribution in this case. These maxima are, however, also somewhat influenced by the diffraction effect.

We are not able to determine separately the C—C- and C—O-bond distances from the $\sigma(r)$-curve. The same difficulty also occurs for the distances C_1—O and C_2—C_3. An accurate determination of the parameters in the molecule can therefore not be expected. The following bond distances
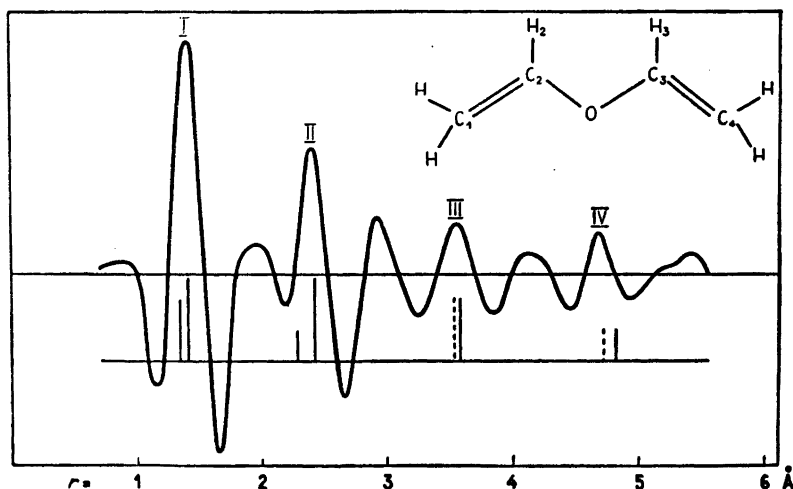

Fig. 1. σ(r)-curve for divinyl ether.

and valency angles seem, however, to give best agreement with the $\sigma(r)$-curve:

C_1C_2	1.35 Å
C_2O	1.42 Å
$\angle\ C_2OC_3$	107°
$\angle\ C_1C_2O$	123°

The C—C and C—O-distances occuring in a planar molecule with these parameters are indicated below the $\sigma(r)$-curve by a line diagram. (Full-drawn lines). The maximum IV does not fit with the C_1—C_4-distance. If we give up the claim of coplanarity, however, and for instance rotate the vinyl groups about the C—O-bonds an angle of 20° in such a way that the C_1- and C_4-atoms move in the same direction, a relatively good agreement may be obtained. (Dotted lines in the line diagram.) Because of the uncertainty in the determination of the bond distances and valency angles an accurate determination of the magnitude and form of the deviation from coplanarity is impossible. By varying the distances and angles within reasonable limits we have, however, not been able to find a planar model which can be brought in accordance with the $\sigma(r)$-curve. We feel therefore justified in concluding that the deviation from coplanarity is real and that this deviation must be ascribed to the short H_2—H_3-distance in the undistorted planar model.

In this connection another question related to our problem may be mentioned. Wheland [3] has drawn attention to the surprising fact that the resonance energy of ethyl vinyl ether seems to be slightly *greater* than that of divinyl ether; it would have been expected to be somewhat *smaller* since only a single unstable structure takes part in the resonance in the ethyl vinyl ether molecule, while *two* such structures take part in the resonance of the divinyl ether molecule. This fact might be brought in relation to the unfavourable H_2—H_3-distance in the planar

On the Identification of α-Aminoadipic Acid by Paper Chromatography

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Recent work has shown that α-aminoadipic acid is an important metabolite. It has been isolated from *Cholera vibrio* [1] and the acid has been found active in transamination [2] in arginine formation [3] and also shown to be an intermediate in the lysine metabolism in mammals [4] and in *Neurospora* [5].

divinyl ether molecule model. If our assumption of a deviation from coplanarity is correct, the π-orbitals will overlap less completely causing a reduction of the resonance energy. But even if the molecule was assumed to be strictly planar the unfavourable H_2—H_3-distance would have decreased the stability of the divinyl ether molecule. In the case of the ethyl vinyl ether, on the other hand, the planar configuration is stabilized by the favourable H_2—H_3-distances. In an ethyl vinyl ether molecule with a planar carbon-oxygen skeleton the H_2—H_3-distances are approximately 2.3 Å. If any of the carbon atoms are brought out of the plane, one of the H_2—H_3-distances will decrease and might therefore oppose the deviation from coplanarity.

1. Ehrenberg, L., and Fischer, I. *Acta Chem. Scand.* **2** (1948) 657.
2. Fischer, I., and Ehrenberg, L. *Acta Chem. Scand.* **2** (1948) 669.
3. Wheland, G. W. *The theory of resonance* (1947) p. 61.