

trichlorosilane while the second step involves the addition of a molecule of trichlorosilane to vinyltrichlorosilane to give 1,2-bistrichlorosilylethane. The second step has been discussed in some detail in the previous publication.<sup>1</sup>

Additional evidence in support of the reactions as given in these equations has been obtained. A pentenyltrichlorosilane was isolated from the reaction of 1-pentyne and trichlorosilane in the presence of peroxide. There are two isomeric pentenyltrichlorosilanes which could be obtained in this reaction, however, from a consideration of the boiling point data and previous reactions that have been conducted under similar conditions, it is believed that the isolated compound is 1-pentenyl-1-trichlorosilane,  $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}=\text{CH}-\text{SiCl}_3$ .<sup>2</sup> Isolation of this substituted vinyl addition product indicates that equation (1) is one step of the reaction. Thus, it is reasonable to assume that the reactions as outlined by equations 1 and 2 are indeed the reactions whereby disubstituted products are formed from an alkyne and trichlorosilane in the presence of a peroxide.

This furnishes another method of preparing alkenyltrichlorosilanes. Vinyltrichlorosilane has been prepared by the direct reaction of vinyl chloride and silicon<sup>3</sup> or by dehydrohalogenation of a mixture of  $\alpha$ - and  $\beta$ -chloroethyltrichlorosilanes with anhydrous quinoline.<sup>3</sup>

#### Experimental

**1-Pentenyl-1-trichlorosilane.**—A mixture of 271 g. (2.0 *M*) trichlorosilane and 12.1 g. (0.05 *M*) of finely divided benzoyl peroxide was placed in a glass-lined autoclave. To this was added 34 g. (0.5 *M*) of 1-pentyne (Farchan Research Laboratory) in 50 g. of trichlorosilane. The mixture was heated at 80° for fifty-two hours under its own vapor pressure. Distillation of the reaction mixture gave in addition to the unused trichlorosilane 10.8 g. of 1-pentenyl-1-trichlorosilane, b. p. 85° (80 mm.) and 11.9 g. of less pure 1-pentenyl-1-trichlorosilane. A residue of 18.2 g. was obtained.

*Anal.* Calcd. for  $\text{C}_5\text{H}_9\text{SiCl}_3$ : Si, 52.26; unsaturation, 1 double bond per 205 g. Found: Si, 51.6; unsaturation (reaction with  $\text{Br}_2$ ), 1 double bond per 246 g.<sup>4</sup>

(2) Sommer, Pietrusza and Whitmore [THIS JOURNAL, **69**, 188 (1947); **70**, 484 (1948)] has shown that only 1-octyltrichlorosilane results from the addition of trichlorosilane to 1-octene in the presence of peroxide (99% yield).

(3) Hurd, *ibid.*, **67**, 1813 (1945).

(4) The author acknowledges the aid given by Dr. E. H. Winslow who determined the unsaturation.

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#### Viscosities of 2-Methyl-3-butyn-2-ol and 1,1-Dibutoxyethane

BY PHILIP J. ELVING,<sup>1</sup> NORMAN ALPERT AND PHILIP E. TOBIAS

The kinematic viscosities of 2-methyl-3-butyn-2-ol and 1,1-dibutoxyethane (acetaldehyde dibutyl acetal) were determined over the temperature

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range of 0 to 100°. A Fenske-Cannon-Ostwald viscosimeter (Series 50)<sup>2</sup> was used; distilled water was used to calibrate the viscosimeter. The accuracy of the data was limited by the constancy in temperature of the thermostat used, which was  $\pm 0.1^\circ$ . The compounds were purified by careful rectification, and had these boiling point ranges and refractive indices: methylbutynol, 104 to 105°,  $n_D^{20}$  1.4203; dibutoxyethane, 188 to 189°, 1.4080.

The viscosities were calculated from the equation  $V = Ct$ , where  $V$  is the kinematic viscosity in centistokes,  $C$  is the calibration constant for the viscosimeter, and  $t$  is the efflux time in seconds. The viscosity in centipoises equals the product of the viscosity in centistokes and the density; for methylbutynol,  $d_{20}^{20}$  0.8628 and  $d_{25}^{25}$  0.8588; for the dibutoxyethane,  $d_{20}^{20}$  0.8335 and  $d_{25}^{25}$  0.8300.

Temp., °C.	Viscosity in centistokes	
	Methylbutynol	Dibutoxyethane
0	10.83	1.927
25	3.43	1.239
50	1.54	0.871
75	0.891	0.668
100	0.539	0.492

(2) A. S. T. M. Method D445-46T.

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#### The Alkylation of Decalin with Ethylene<sup>1,2</sup>

BY J. R. DICE AND D. R. MCKINNEY<sup>3</sup>

The alkylation of decalin<sup>4</sup> with ethylene in the presence of aluminum chloride produces a complex mixture of products. From this mixture we have isolated a fraction which apparently contains some 2-ethyldecalin. The evidence for this is based on the isolation of derivatives of 2-ethylnaphthalene from the dehydrogenation products of the given fraction. Since the dehydrogenation procedure employed<sup>5</sup> has been shown not to effect skeletal rearrangement in various similar methyl decalins and octalins, it is reasonable that no skeletal rearrangements occurred in this case. Derivatives of some other compounds were also isolated, but none could be identified. That some of the original products are aromatic in nature is shown by the colors obtained on adding picric acid and trinitrobenzene solutions and by the

(1) Presented at the Fourth Annual Southwest Regional Meeting of the American Chemical Society, Shreveport, Louisiana, December 10, 1948.

(2) Most of the equipment used in this investigation was purchased from funds provided by the Research Institute of the University of Texas, Project 186.

(3) From the M. A. thesis of D. R. McKinney, the University of Texas, 1948.

(4) Pertinent references to the alkylation of cycloalkanes are: (a) Ipatieff, Komarewsky and Grosse, THIS JOURNAL, **57**, 1722 (1935); and (b) Petrov, *Chimijatwerdoga Topliwa*, **5**, 632; *Chem. Zentr.*, **107**, I, 251 (1936).

(5) Linstead, Milledge, Thomas and Walpole, *J. Chem. Soc.*, 1146 (1937).