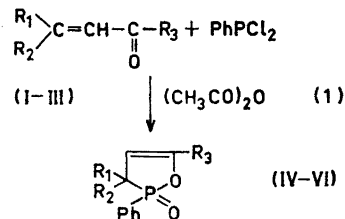


Preparation of Some Oxaphospholine Derivatives

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The trivalent phosphorus compounds PCl_3 and PhPCl_2 , and trialkyl phosphites, $\text{P}(\text{OR})_3$, are known to react smoothly with conjugated dienes¹⁻⁵ and α,β -unsaturated ketones⁶⁻⁹ forming derivatives of phospholine, phosphole, and oxaphospholine, respectively. In a study of the kinetics of hydrolysis of five-membered cyclic phosphinates the two compounds, 2-oxo-2,3,5-triphenyl-1,2-oxaphospholine (IV) and 2-oxo-2-phenyl-3,3,5-trimethyl-1,2-oxa-phospholine (V), were needed. They were prepared according to the above principle from phenylphosphine dichloride, acetic anhydride, and the α,β -unsaturated ketones benzalacetophenone (I) and mesityloxide (II). Attempts with benzalacetone (III) for the preparation of 2-oxo-2,3-diphenyl-5-methyl-1,2-oxaphospholine (VI) resulted only in unchanged starting material. The cyclic compounds were identified by infrared spectra, elementary analysis, equivalent weight, and hydrolysis products.



- I and IV: $\text{R}_1 = \text{H}, \text{R}_2 = \text{R}_3 = \text{Ph}$
 II and V: $\text{R}_1 = \text{R}_2 = \text{R}_3 = \text{CH}_3$
 III and VI: $\text{R}_1 = \text{H}, \text{R}_2 = \text{Ph}, \text{R}_3 = \text{CH}_3$

The infrared spectra of IV and V (Fig. 1) show strong bands at 1630 and 1660 cm^{-1} , respectively, which are assigned to the olefinic double bonds. Upon hydrolysis of IV and V with water the bands at 1630 and 1660 cm^{-1} were replaced by bands at 1690 and 1725 cm^{-1} , respectively. The new bands are assigned to carbonyl groups formed by tautomeric rearrangement of the enols formed by hydrolytic cleavage of the rings at the P—O bond. The presence of the keto groups was confirmed by formation of 2,4-dinitrophenylhydrazones. The structures of the cyclic compounds IV and V thus indicate that reaction (1) occurs by 1,4-addition of phosphorus to the conjugated system in the α,β -unsaturated ketones.

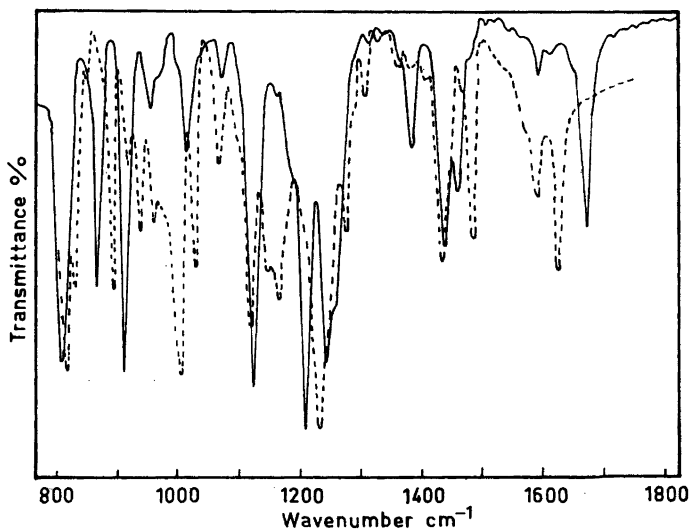
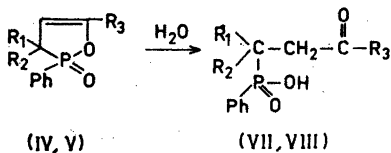


Fig. 1. Infrared spectra of IV (---) and V (—). Solid in KBr.



(IV, V)

(VII, VIII)

IV and VII: $\text{R}_1 = \text{H}$, $\text{R}_2 = \text{R}_3 = \text{Ph}$ V and VIII: $\text{R}_1 = \text{R}_2 = \text{R}_3 = \text{CH}_3$

Experimental. 2-Oxo-2,3,5-triphenyl-1,2-oxaphospholine (IV). Phenylphosphine dichloride (15.9 g), benzalacetophenone (20 g), and acetic anhydride (10.2 g) were stirred for 24 h at room temperature. The white, solid reaction product was filtered off and washed three times with sodium-dried benzene. After four recrystallizations from anhydrous benzene-ether 17.5 g (53 %) of white needles was obtained, m.p. 162–163°C. (Found: C 75.74; H 4.99; E 331.4. Calc. for $\text{C}_{21}\text{H}_{17}\text{O}_3\text{P}$: C 75.8; H 5.10; E 331.4.)

2-Oxo-2-phenyl-3,3,5-trimethyl-1,2-oxaphospholine (V). Mesityloxyde (4.9 g), phenylphosphine dichloride (8.9 g), and acetic anhydride (5.1 g) were refluxed for 24 h, and the product was distilled *in vacuo* to give 2.6 g (24 %), b.p. 170–172°/10 mm, $n_D^{20} = 1.5449$. (Found: C 65.32; H 6.55; E 220.9. Calc. for $\text{C}_{12}\text{H}_{15}\text{O}_2\text{P}$: C 65.0; H 6.75; E 222.0.)

The keto-phosphinic acids VI and VII were obtained after refluxing the cyclic compounds IV and V with water for 20 h, and evaporation of the water.

1-Phenyl-1-(2,4-diphenyl-propanone-4)-phosphinic acid (VII). Recrystallized four times from ethanol-water, m.p. 243–244°C. (Found: C 71.84; H 5.28; E 348.6. Calc. for $\text{C}_{21}\text{H}_{19}\text{O}_3\text{P}$: C 71.90; H 5.42; E 350.)

1-Phenyl-1-(2,2,4-trimethyl-propanone-4)-phosphinic acid (VIII). Recrystallized four times from ethanol-water, m.p. 93.5°C. (Found: C 59.72; H 6.58; E 237.2. Calc. for $\text{C}_{12}\text{H}_{16}\text{O}_2\text{P}$: C 60.00; H 6.70; E 239.0.)

1. Cormack, W. Mc. U.S. Pat. 2,663,737 (1953); *Chem. Abstr.* 49 (1955) 7601.
2. Hunger, K., Hasserodt, U. and Korte, F. *Tetrahedron* 19 (1963) 1563.
3. Hunger, K., Hasserodt, U. and Korte, F. *Tetrahedron* 20 (1964) 1593.
4. Cambell, J.G., Cookson, R.C. and Hocking, M.B. *Chem. Ind. (London)* 1962 360.
5. Brage, E.H., Hübel, W. and Caphlier, I. *J. Am. Chem. Soc.* 83 (1961) 4406.
6. Contant, J.B. and Cook, A.A. *J. Am. Chem. Soc.* 42 (1920) 830.

Acta Chem. Scand. 19 (1965) No. 7

7. Anschütz, L., Klein, E. and Cumak, G. *Chem. Ber.* 77 (1944–45) 726.
8. Ramirez, F., Patwarhan, A.V. and Heller, S.R. *J. Am. Chem. Soc.* 86 (1964) 514.
9. Ramirez, F. and Madan, O.P. *Unpublished work.* Ref. 8, Table 1, footnote (h).

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Isolation of Methylcobalamin from Liver

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It has been established by Toohey and Barker¹ that the major cobamide in mammalian liver is B_{12} coenzyme, 5'-deoxyadenosyl cobamide. Apart from this cobamide the same authors found mainly hydroxocobalamin. There is, however, another cobamide occurring in liver which was mentioned briefly in a report by Lindstrand.² The isolation procedure of others has been modified to permit characterization of this third cobamide with a reasonable degree of certainty of its structure and the procedure is described in detail in this paper.

Material and methods. Frozen calf liver was obtained from a slaughter-house. Methylcobalamin was synthesized as described by Lester Smith *et al.*³ Ionic exchange resins were washed with 0.5 M NaOH or 0.5 M NaCl and 0.5 M HCl and finally converted to the desired form with the appropriate solution.

Absorbance measurements for ultraviolet and visible light were carried out in microcuvettes in a Unicam SP 500 spectrophotometer.

Preliminary studies of B_{12} in liver, were made according to a slightly modified biotographical technique.^{4,5}

Isolation procedure. All operations were carried out in the dark, or in dim light. All glassware was covered with black cloth and metal foil. Because of the large volumes used in this study, 100 kg of calf liver was thawed, minced, and the total amount divided into

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