

method gives still lower results, unless nucleic acid is removed from the protein. The lower results are probably due to the formation of much humin, for when cystine is added before hydrolysis it is incompletely recovered by the latter methods. Removal of nucleic acid from the protein by treatment with 5% sodium hydroxide for one minute at 0° does not eliminate humin formation and does not alter the cystine plus cysteine values obtained by the Baernstein and Sullivan procedures. Removal of nucleic acid results in a partial loss of methionine and complete elimination of sulfate sulfur. Virus nucleic acid gives only negligible or no volatile iodide, homocysteine, cysteine or sulfate titrations. In the methionine determinations on protein the volatile iodide and homocysteine titrations agree, yet the results following treatment with alkali make further work necessary to establish definitely the presence or absence of methionine as a part of the intact virus protein molecule.

Virus activity is unaffected following treatment of the protein with reducing agents,⁶ hence labile disulfide groups either are not present or their reduction does not affect virus activity. Although free sulfhydryl groups have not been demonstrated in active protein, they appear following denaturation by even mild means. Furthermore, activity is lost following mild oxidation.⁶ The possibility that sulfhydryl groups may be correlated with activity is being investigated.

(6) Stanley, *Phytopathology*, **25**, 899 (1935).

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A VOLATILE COMPOUND OF ALUMINUM, BORON AND HYDROGEN

Sir:

As a result of successive treatments of aluminum methyl with excess of diborane at temperatures up to 80°, we have obtained a new compound AlB_3H_{12} . Vapor density measurements using 33.5, 94.6, and 55.5 mg. gave molecular weights of 71.5, 71.6, and 71.1, respectively; calculated, 71.5. Hydrolysis of two samples (4.50 and 4.35 cc. at S. C.) gave quantities of hydrogen corresponding, respectively, to 11.9 and 12.2 times the volumes of the samples; theory, 12.0 times. After hydrolysis, aluminum was precipitated as 8-hydroxyquinolate, giving, respectively, 91.5 and 91.0 mg. of the

salt (theory, 92.3 and 89.2 mg.). Another sample (3.17 cc.) was hydrolyzed; boron was removed from the residue as methyl borate and then titrated as boric acid: found, 27.9mg., calcd., 26.3.

For further confirmation of the composition, 5.30 cc. of the compound was treated with hydrogen chloride at -80°, yielding 17.2 cc. of hydrogen, aluminum chloride and a volatile mixture of diborane and chlorodiborane. This mixture was hydrolyzed, giving 43.6 mg. of boric acid (theory, 43.9 mg.) and 46.7 cc. of hydrogen. Total hydrogen thus is 63.9 cc.; calculated, 63.6 (12 volumes).

Physical properties determined are: m. p. -64.5 ± 0.5°; vapor tension at 0°, 119 mm.; b. p. (extrapolated) 44°. The gaseous substance undergoes little change within a relatively long time and is not rapidly affected even at 100°; in the liquid phase, slow polymerization seems to occur at room temperature.

With an equimolecular quantity of methyl ether the substance gives a liquid of low vapor tension, having the composition $AlB_3H_{12} \cdot (CH_3)_2O$. From this, methane is evolved without formation of diborane. With ammonia, a series of products containing up to four moles of ammonia is obtained, but the individuals have not yet been isolated.

The reaction of AlB_3H_{12} with trimethylamine has been studied in more detail. At room temperature, four moles of trimethylamine are taken up, but the resulting product seems to be a mixture of solids which, though moderately volatile, are difficult to separate. That one of the products is borine trimethylamine, $BH_3 \cdot N(CH_3)_3$, is indicated by the fact that this substance could be isolated when the reaction was carried out under somewhat different conditions. Furthermore, it seems probable that at lower temperatures trimethylamine removes borine groups stepwise from AlB_3H_{12} . We are continuing the study of the reaction of trimethylamine to determine whether an addition compound of the amine and aluminum hydride is present in the final product.

We have found that diborane reacts with alkyls of metals other than aluminum, giving in some cases alkyldiboranes and other as yet unidentified products. The investigation is being carried on along the lines herein indicated.

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