tionation during the sublimation process, as fractional sublimation of the volatile products leads only to separation into $AlBr_3$ and AlI_3.

We have also observed exchange of halogen in the system $AlBr_3$–KCl. These substances appear to form a complex which is more difficult to decompose thermally. Upon heating an equimolar mixture of $AlBr_3$ and KCl at 400°, a volatile product was obtained in which the Br:Cl ratio was found to be 5:3. Potassium was not present in the sublimate. Fractionation of this material resulted in separation into $AlBr_3$ and $AlCl_3$ with no evidence observed to indicate the presence of aluminum chlorobromides. Plotnikov and Shvartsman[1] report that exchange does not occur when the complex is heated to 250°. Appreciable vaporization does not occur below 400°.

Experimental

Samples of known composition were prepared by mixing together weighed quantities of the pure anhydrous components. The pyrex sample tubes were evacuated and sealed, leaving the smallest volume practical. Freezing points were determined by observing the temperature at which crystals first appeared when the fused samples were cooled slowly in an aluminum block. Repeated measurements were made with a given sample, shaking to minimize any tendency to supercool. The freezing temperatures are considered to be accurate within 2°. The melts were characterized by a red coloration. It seems likely that this may have been due to the presence of a small amount of moisture with subsequent liberation of halogen on heating. However, considerable care was taken in an effort to prevent appreciable contamination of the samples by water vapor or oxygen.

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SEATTLE 5, WASHINGTON RECEIVED JANUARY 3, 1950

Photography of Antibiotic Papergrams

BY N. A. DRAKE

There has been considerable demand in our laboratories for photographic records of antibiotic papergrams of the type described by D. H. Peterson elsewhere in THIS JOURNAL. The following simple method for making clear pictures of high contrast has been made standard with us.

The bacterial agar plates are prepared according to the procedure described by Peterson. After paper contact and incubation have been completed, the surface of the agar has a layer of milky growth with clearly defined zones of inhibition reflecting the presence of antibiotic substances in the paper chromatogram. Since the contrast between the growth and the clear agar is very low, photographs made with ordinary lighting fail to give good detail.

We have found that if plane polarized light is used to illuminate the tray, with a dead black surface beneath it and a polarizer at the camera lens crossed with the polarizer at the light source, a satisfactorily high contrast is attained. Two 200-watt lamps in reflectors, or a fluorescent strip lamp serves as a light source when fitted with a sheet of Polaroid. In order to obtain precise crossing of the polarizers, a view camera is used and the exposure is made on high contrast negative material such as Contrast Process Ortho or Kodalith. With such a low level of illumination, the exposure is necessarily a time exposure. One must, of course, use care to avoid burning the sheet Polaroid at the light source.

For identification and necessary notes, a sheet of tracing paper lettered with India ink is placed on the agar plate. A one inch square of paper is also placed on the plate before photography in order to form a size scale for measurement of the areas of zones of inhibition and distance traveled by the zones.

Metal pans coated with Black Heresite[1] can be substituted for the Pyrex trays. In this case, the necessary black background is already incorporated within the tray.

This method has also proved satisfactory in photographing agents of growth as well as inhibition.

(1) Heresite coating is done by Heresite and Chemical Co., Manitowoc, Wisconsin.

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KALAMAZOO 99, MICH. RECEIVED JANUARY 7, 1950

Some Quaternary Ammonium Salts of Quinoxalines

BY WILLIAM K. EASLEY AND CARL T. BAHNER

The biological results obtained by Shear and associates[1] at the National Cancer Institute using quaternary salts containing a pyridine or quinoline ring have led us to prepare similar quaternary salts containing other rings. Previous reports from this Laboratory have discussed salts of thiazoles,[2] of hexamethylenetetramine,[3] and of pyrazine.[4] This paper deals with the preparation of quaternary salts of quinoxaline, 6-methylquinoxaline and 6-chloroquinoxaline with alkyl sulfates, alkyl halides, phenylethyl halides and aryl halomethyl ketones.

The difficulties encountered in the preparation of quaternary salts of 2,3-dimethylquinoxaline have been discussed by Bennett and Willis[5] and by Cook, Garner and Perry.[6] Fritts,[7] working in this Laboratory, found that 2,3-dimethylquinoxaline heated two to three hours at 100° with phenacyl bromide, *p*-methylphenacyl bromide and *m*-nitrophenacyl bromide, respectively, formed green

(1) Shear, *et al.*, in "Approaches to Cancer Chemotherapy," American Association for the Advancement of Science, F. R. Moulton, Editor, Washington, D. C., 1947, p. 236 ff.; Hartwell and Kornberg, THIS JOURNAL, **68**, 1131 (1946).
(2) Bahner, Pickens and Bales, *ibid.*, **70**, 1652 (1948).
(3) Bahner, Pickens and Easley, *ibid.*, **72**, 2266 (1950).
(4) Bahner and Norton, *ibid.*, **72**, 2881 (1950).
(5) Bennett and Willis, *J. Chem. Soc.*, 1960 (1928).
(6) Cook, Garner and Perry, *ibid.*, 710 (1943).
(7) Fritts, unpublished communication.