

pared sodium acetylide in liquid ammonia the calculated amount of 2-bromothiophene was added by drops. The reaction mixture was stirred for four hours and hydrolysed with water. When sodium acetylide was prepared without using a catalyst (hydrated iron nitrate), the reaction mixture turned from colourless to light brown and finally, after hydrolysis of the mixture, to black. There was also present a large amount of free carbon. Under analogous conditions, when employing 2-chlorothiophene, no free carbon was noticed. After isolation of the reaction product with ether, there resulted a crystalline substance and we regained some starting material. From 50 gm. (0.32 mole) of 2-bromothiophene we obtained 10–14 gm. of the crystalline substance, 13 gm. (0.08 mole) of recovered 2-bromothiophene, and 2 gm. of a high-boiling oil, probably a mixture of di- and tri-bromothiophene. The yield of the crystalline substance was 35–45 per cent, depending on the method of preparation of the sodium acetylide. The yield was greater when the sodium acetylide was prepared via sodium amide using an iron nitrate catalyst.

The substance, recrystallized from dilute ethanol, gave white needles melting at 114° C. The analysis gave the following results: calculated for C_4Br_4S : C, 12.02; Br, 80.00; S, 8.04; found: C, 12.31; Br, 80.25; S, 8.44. The molecular weight determined by the Rast method was 380 ± 12 . The product was identified as tetrabromothiophene, in that it did not depress the melting point on admixture with an authentic specimen prepared according to the method of Volhard and Erdmann⁴.

Further investigations on this type of reaction are being carried out.

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¹ Keskin, H., Miller, R. E., and Nord, F. F., *J. Org. Chem.*, **16**, 199 (1951)

² (a) Vaughn, T. H., Hennon, G. H., Vogt, R. R., and Nieuwland, J. A., *J. Org. Chem.*, **2**, 1 (1937). (b) Jacobs, Thomas J., "Organic Reactions", **5** (John Wiley and Sons, Inc., New York, 1949).

³ Krause and Rennwanz, *Ber.*, **62**, 1710 (1934).

⁴ Volhard and Erdmann, *Ber.*, **18**, 454 (1890).

Urea as a Solvent

ALTHOUGH urea is an inexpensive laboratory chemical, its solvent properties do not appear to have been fully appreciated by chemists. Nevertheless, it may well prove to be one of the most versatile solvents known. Maintained at its melting point of 132° (conveniently done, if so desired, by refluxing with xylene with which it is immiscible) its decomposition is very slow. It then combines the solvent properties of water with that of alcohols.

Of approximately a hundred and twenty common inorganic chemicals, the only water-soluble compound which could not be dissolved in urea was sodium silicate. On the other hand, iodine proved to be very soluble.

In general, ions in urea solution possess their familiar colours, save that cobalt solutions are blue. Powerful oxidizing and reducing agents are, of course, decomposed; nevertheless, alkali metal chromates, dichromates and ferricyanides are surprisingly stable, the last-named much more so than in formamide solution.

Common inorganic precipitation reactions can be carried out in urea solution; precipitates of sulphur, copper, mercury, silver, mercurous chloride, mercuric iodide, barium sulphate, thallium iodide, silver chloride, bromide and iodide, silver chromate, magnesium and barium carbonates, copper ferrocyanide, heavy-metal sulphides, nickel dimethylglyoxime, etc., were readily obtained.

Urea dissolves methyl orange, phenolphthalein and litmus readily—the colouring matter is rapidly dissolved from litmus paper, giving a blue or red solution depending upon the acidity. Sodium carbonate is easily soluble and can be titrated with such acids as sulphuric, sulphamic or oxalic. With phenolphthalein, sodium carbonate gives a deep red solution below 140°; at 150° the colour is discharged but returns reversibly on cooling. Ammonium salts of strong acids give strongly acid solutions when hot which reversibly become alkaline on cooling. Alkali hydroxides are soluble but produce carbonate fairly rapidly. Acid solutions attack metals, evolving hydrogen.

Urea proved an excellent solvent for all save a small number of common organic chemicals. Among those with low molecular weights only hydrocarbons were insoluble. Nitro, amino and carboxy groups confer increasing solubility in the order given. Hydroxy compounds, ketones, esters, anilides, amino-acids, substituted hydrazines, etc., are readily soluble and decomposition is rare. Often the organic compound is miscible with molten urea in all proportions. Gluten, dextrin, sodium alginate, gum arabic, soap, etc., dissolve readily.

In the laboratory, urea is a valuable tool for dissolving sparingly soluble compounds. (1) A 5 per cent solution of N-phenylanthranilic acid in molten urea is cooled and powdered. For use as an oxidation-reduction indicator, 0.5 gm. of the solid is added to a solution, when the urea instantly dissolves, leaving the indicator as a finely divided suspension in the liquid. (2) So-called 'soluble' starch dissolves in urea to give a highly viscous clear solution. If a 5 per cent solution is cooled and powdered, the product is ideal for use in titrations involving iodine. It dissolves almost instantly to give a clear colourless solution which is still highly sensitive to iodine, giving the familiar blue colour.

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A Rapid Method for the Determination of Nucleic Acid Components by Paper Partition Chromatography

METHODS for the analysis of small amounts of nucleic acids and their components by paper partition chromatography have been described by Vischer and Chargaff¹ and Chargaff *et al.*². Photographic methods for their identification on paper have also been used^{3,4}, based on the specific absorption in the ultra-violet range of the spectrum of the nucleic acid components. The present communication describes a simple and sensitive method for rapid analysis in routine work.

Hydrolysis. The purines, adenine and guanine, and the pyrimidine nucleotides, cytidylic acids and uridylic