

Preparation of Cyclic Phosphates of Uranium(VI)

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Cyclic phosphates of uranium(VI) have not been prepared so far. When sodium trimetaphosphate reacts with uranyl nitrate in an aqueous solution, a precipitate of uranyl triphosphate is formed.¹⁾ This shows that a hydrolytic ring-opening reaction of trimetaphosphate ion is remarkably accelerated by uranyl ion.

The present investigation was undertaken to know whether uranyl trimeta- or tetrametaphosphate can be prepared by the precipitation reaction in an alcoholic aqueous solution. The results indicate that uranyl trimetaphosphate cannot be prepared by this method, but disodium uranyl tetrametaphosphate trihydrate, $\text{Na}_2\text{UO}_2\text{P}_4\text{O}_{12} \cdot 3\text{H}_2\text{O}$ can be precipitated from an ethanol-water solution of sodium tetrametaphosphate and uranyl nitrate.

Preparation of disodium uranyl tetrametaphosphate trihydrate was carried out as follows. To 25 ml of a 0.1M aqueous solution of sodium tetrametaphosphate 25 ml of a 0.1M aqueous solution of

uranyl nitrate was added with stirring. After 5 min 45 ml of ethanol was added with stirring to the mixture. The precipitate was filtered, washed with 100 ml of 50% (v/v) ethanol in water and dried for about 24 hr in a vacuum desiccator over calcium chloride.

It was revealed by paper chromatography that the product was tetrametaphosphate containing a very small amount of its hydrolytic products. The analytical results of the product are as follows.

Found: UO_3 , 41.8%; P_2O_5 , 41.4%; Na_2O , 8.9%; H_2O , 7.9% (by difference). Calcd for $\text{Na}_2\text{UO}_2\text{P}_4\text{O}_{12} \cdot 3\text{H}_2\text{O}$: UO_3 , 41.58%; P_2O_5 , 41.27%; Na_2O , 9.30%; H_2O , 7.85%.

The infrared spectrum of the product was similar to that of sodium tetrametaphosphate except for the peaks due to uranyl ion. This indicates that the major component of the precipitate is disodium uranyl tetrametaphosphate trihydrate.

From a comparison of the reaction of trimetaphosphate with that of tetrametaphosphate, it can be concluded that tetrametaphosphate ion is more stable than trimetaphosphate ion against hydrolysis in the presence of uranyl ion.

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1) A. Indelli and G. Saglietto, *J. Inorg. Nucl. Chem.*, **25**, 1259 (1963).