Low-temperature Sublimation of Polonium Dithizonate

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The formation of polonium dithizonate was first reported in 1950 by T. Ishimori and H. Sakaguchi(1), and, independently, by G. Boussière and C. Ferradini(2). In the course of study on polonium chemistry using polonium-210, the present authors observed the following phenomenon.

A thin layer of ultra-micro quantities of polonium dithizonate was prepared in a stainless steel dish by evaporating the solution of the compound in carbon tetrachloride. When the dish was heated on a hot plate, the α-activity of the sample in the dish was rapidly diminished.

Since such a phenomenon has never been reported, it was explored in detail.

In order to know the cause of decrease in activity of the sample, a platinum plate was placed 3 cm. above the dish and heating of the sample was carried out in a closed system. The platinum plate was checked for its radioactivity with a Lauritsen electroscope. The presence of α-activity of polonium-210 was detected and approximately 25% of the lost activity was found on the plate.

From this fact it is likely that the decrease in the activity is caused by the sublimation of polonium-210 in some chemical form, although further study is necessary to confirm whether or not this phenomenon is the sublimation in the strict sense.

The heating was carried out in a range of temperatures between 80°C and 200°C, and attempts were made to identify the sublimate by chemical procedures combined with the measurement of radioactivity.

The result of the experiment is summarized as follows:

(1) The sublimation occurs at temperatures above approximately 120°C under atmospheric pressure.

(2) When the sample is treated with hydrogen peroxide before heating, the α-activity of the sample in the dish does not decrease even at temperatures above 120°C.

(3) The sublimate on the platinum plate is very soluble in carbon tetrachloride, but only slightly soluble in water. Moreover, it is remarkable that the partition of polonium α-activity between carbon tetrachloride and water is dependent on the hydrogen ion concentration of the water layer. This is one of characteristic properties of metal chelate compounds.

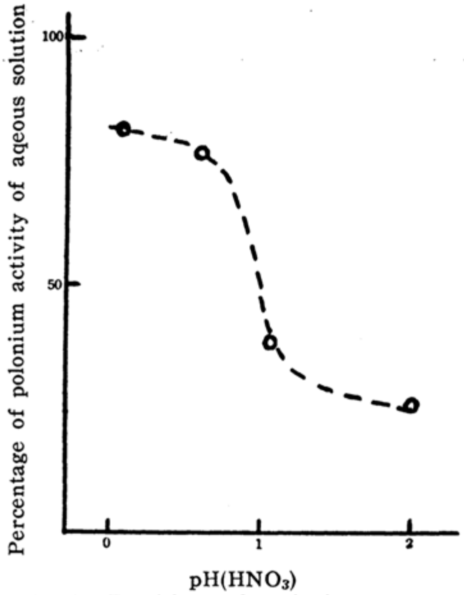

Fig. 1. Partition of polonium activity between carbon tetrachloride (2 cc.) and aqueous solution (20 cc.).

The figure shows the partition of polonium-210 between carbon tetrachloride and aqueous solution as a function of the pH of aqueous solution. In the study of the dithizone extraction of polonium the authors observed a similar change of the partition of polonium between carbon tetrachloride and aqueous solution.

From these results, the authors came to the conclusion that the sublimate is probably polonium dithizonate itself.

This phenomenon may be applied to the carrier-free separation as well as to the purification of polonium.

The detail of this study will be reported in a separate paper.

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1) T. Ishimori and H. Sakaguchi; *J. Chem. Soc. Japan*, 71, 327 (1950).

2) G. Boussière et C. Ferradini; *Anal. Chim. Acta*, 4, 610 (1950).

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