

height analyser reduced this whole count rate to 14 per cent, and the addition of the purification procedure reduced this to 3 per cent for the standard; that is, with the standard the iodine-128 contributed 3 per cent of the induced radioactivity at 40 min after the pile. Therefore, in the samples which usually contained about 10 per cent of the iodine of this standard, the iodine-128-radioactivity induced contributed at this time about 0.3 per cent of the total radioactivity induced in the paper or about 0.03 per cent of that at 120 min when most of our counting was done. Clearly the purification was needed, and Fig. 1a indicates that the purity achieved was usually very satisfactory.

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¹ Dimitriadou, A., Turner, P. C. R., and Fraser, R., *Nature*, **197**, 446 (1963)

Rapid Determination of Rubidium in Cæsium Nitrate by Neutron Activation

DETECTION and determination of rubidium in cæsium nitrate by use of neutron irradiation followed by γ -scintillation spectrometry have been attempted. It is known that when natural rubidium is irradiated with neutrons, rubidium-86m (61 sec), rubidium-86 (18.7 days), and rubidium-88 (18 min) are formed. When any one of them is used for detecting rubidium, it is preferable that irradiation is continued for a period comparable with the half-life. Therefore, it was thought that the use of rubidium-86m offered a method for the rapid analysis for rubidium: this method has so far not been reported.

In this work, a sample of cæsium nitrate and a rubidium standard (rubidium nitrate) were irradiated at the same time at a neutron flux of 3×10^{11} n/cm²/sec. After 9.5-sec irradiation they were counted by turns repeatedly at the bottom of the well of a 2-in.-thick, well-type sodium iodide crystal which was connected to a 256-channel pulse-height analyser. In every counting operation, counting was continued for 15 sec. The resultant γ -spectra shown on the monitor (Braun tube) were photographed every two counting operations. A typical spectrogram and decay curves obtained are shown in Figs. 1 and 2, respectively. Rubidium was identified from both γ -ray energy and half-life. Its amount can be determined by the comparative method using decay curves as usual.

If rubidium content in a cæsium nitrate sample is small, 1-min irradiation would be preferable, as well as a large sample-amount, to increase sensitivity.

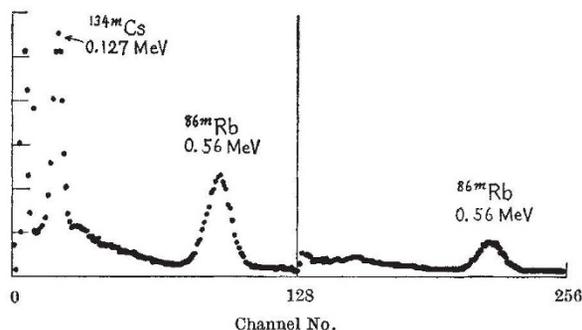


Fig. 1. Typical spectrogram. Count-scale on the vertical axis is 800 counts/division. The left half of this spectrogram is the γ -ray spectrum obtained from an activated sample (8.80 mg cæsium nitrate) and the right half is that from an activated standard (0.64 mg rubidium nitrate). The counting operation for the sample was begun 12 sec after irradiation, and that for the standard was begun 35 sec after irradiation. Counting times used were 15 sec each

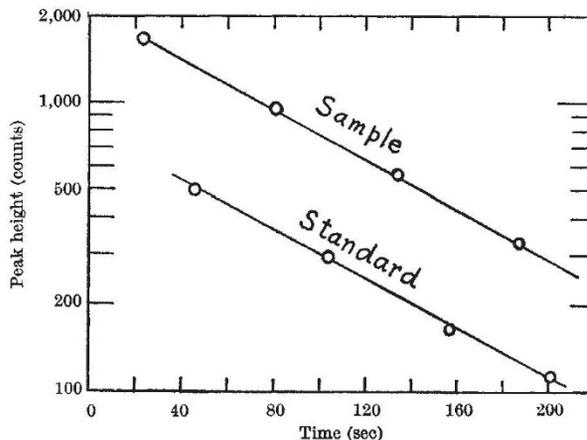


Fig. 2. Decay curves for the sample and the standard which were used to get γ -ray spectra in Fig. 1. From these curves the rubidium concentration of the sample was found to be 10.9 per cent

I thank Prof. Shoji Makishima for advice, Dr. Fumio Aoki for his interest, and Dr. Toshio Nakai, Dr. Yuichiro Kamemoto and Mr. Shigeru Yamagishi for help with γ -ray spectrometry.

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Stabilities of Some Alkaline Earth Chelates of Tetracycline

SEVERAL authors^{1,2} have reported that the antibiotic tetracycline enhances the removal of radiostromium from mice. Theoretical work^{3,4} has indicated that a suitable reagent for the removal of radiostromium from the mammalian skeleton should have a greater affinity for stromium than for calcium. We have, therefore, examined the chelation with tetracycline of calcium and stromium and also, for comparison, magnesium. The only reported stability constants for tetracycline chelates are those determined by Albert⁵ for the chelates of aluminium and some transition metals. The acid dissociation constants for the hydrochloride derivative have, however, been determined by Albert⁵ and by Stephens *et al.*⁶

A potentiometric titration method was used to determine the acid dissociation constants of tetracycline and the stability constants of its magnesium, calcium and stromium chelates in an aqueous system at an ionic strength of 0.11 (potassium chloride) and temperature 30°. All titrations were carried out at $30 \pm 0.1^\circ$ in an inert atmosphere using carbonate-free potassium hydroxide. Measurements of pH were made to ± 0.005 pH unit with a 'Vibron' pH meter (Electronic Instruments, Ltd., model 39A) and were corrected to give hydrogen ion concentrations by a Debye-Hückel approximation⁷. The following titration curves were plotted: (a) ligand alone; (b) ligand and excess metal ion (1 : 10); (c) ligand and equivalent metal ion; (d) excess ligand and metal ion (2 : 1). Precipitation was observed at pH ~ 7.5 in all the titrations with magnesium ion present, and also, at about the same pH, with excess stromium and with the excess ligand : calcium system. Since precipitation affects the equilibria on which the calculations are based, constants were deter-

Acid dissociation constants	pK_1	pK_2	pK_3
	3.39	7.45	9.09
Chelate stability constants	$\log K_{ML}^M$	$\log K_{ML}^M$	$\log K_{ML_2}^M$
Magnesium	3.53	4.85	Not obtainable
Calcium	3.06	5.52	3.3-3.9
Stromium	~ 2.2	4.85	3.5-3.8