added. The removal of ^{47}Ca was tested but it essentially followed the Sr with a decontamination factor of only 1.4.

DISCUSSION

The time required for separation of the strontium from a fission product sample is 15 min. The insoluble basic hydroxide and chromates are precipitated followed by precipitation of strontium from the supernate that contains the soluble basic radioactivities. The decontamination factors for the fission products tested are greater than 1000. At present this method is being used to separate strontium from fission products solutions. It may be used for other types of samples where calcium does not interfere.

REFERENCE

1. D.N.Sunderman, C.W.Townley, The Radiochemistry of Barium, Calcium, and Strontium, NAS - NS - 3010, Jan. 1960.

RADIOCHEM.RADIOANAL.LETTERS 4 /6/ 391-395 /1970/

SEPARATION OF CARRIER-FREE ^{64}Cu AND/OR ^{67}Cu FROM REACTOR IRRADIATED ZINC BY MEANS OF THE SPONTANEOUS DEPOSITION OF COPPER ON PLATINUM BLACK

G.Tóth, É.Füssy

Institute of Isotopes of the Hungarian Academy of Sciences, Budapest, Hungary

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Separation of carrier-free ^{64}Cu and/or ^{67}Cu was performed by making use of the selective spontaneous deposition of copper on platinum black previously reduced with CH_2O. Assay of the decay curve and γ-ray spectra of separated radiocoppers showed that radioimpurities do not exceed 0.1%.

There are two radioactive copper isotopes of appropriate half-life for tracer investigations which can be produced in a carrier-free state in a reactor. These are ^{64}Cu and ^{67}Cu, formed by /n,p/ processes from ^{64}Zn and ^{67}Zn, respectively.

It is due to the low isotopic abundance of ^{67}Zn, as well as the low cross-section values of the /n,p/ reactions, that production of mCi quantities either of the two radiocopper isotopes requires irradiation of relatively large amounts of zinc as target material. As can be seen from Table 1, the activities of radiozinc isotopes produced by simultaneous /n,γ/ reactions are by orders of magnitude higher than those of ^{64}Cu and ^{67}Cu.

An ion exchange method for separation of ^{64}Cu and ^{67}Cu was reported by Szirtes and Zsinka.[1] This separation method makes use of the higher selectivity of Dowex-1 resin for the negatively charged chloro-complexes of zinc than for those of copper.

TABLE 1

Abundance of stable zinc isotopes, %		Half-life of the product of reaction /n,γ/		/n,p/	Cross-section of the reaction /n,γ/	/n,p/	Saturation activity*, mCi/g /n,γ/	/n,p/
^{64}Zn	48.89	^{65}Zn	245 d	^{64}Cu	12.8 h	0.47 barn	29 mbarn	572	03.5
^{66}Zn	27.81	^{67}Zn	stable	^{66}Cu	5.1 min	$2x10^{-5}$ barn	2.1 mbarn	-	0.140
^{67}Zn	4.11	^{68}Zn	stable	^{67}Cu	59 h	-	4.6 mbarn	-	0.041
^{68}Zn	18.57	^{69m}Zn	13.9 h	^{68}Cu	32 sec	$9.7x10^{-2}$ barn	0.09 mbarn	44.9	-
		^{69}Zn	55 min		-	1.0		462	-
^{70}Zn	0.62	^{71m}Zn	4.1 h		-			13.1	-
		^{71}Zn	2.2 min		-	$8.5x10^{-2}$ barn	0.005	4.0	-

*The saturation activity values were calculated taking into account a thermal neutron flux of 10^{13} $ncm^{-2}sec^{-1}$ for /n,γ/ reactions, and 10^{12} $ncm^{-2}sec^{-1}$ for /n,p/ reactions.

It has been observed by several authors that copper ions can be deposited on hydrogen saturated platinum plate as a consequence of the exchange between adsorbed hydrogen atoms and copper ions resulting in the formation of a copper monolayer.[2-4] When using platinum plate, however, to separate ^{64}Cu or ^{67}Cu from irradiated zinc, the separated copper activity is limited by the geometrical size of the platinum plate. However, 1 cm^2 of copper monolayer corresponds to 0.138 µg copper, i.e. 522 mCi ^{64}Cu or 106 mCi ^{67}Cu, the inactive copper impurity almost inevitably present in the target material reduces the radiocopper activity deposited on 1 cm^2 of platinum plate.

To increase the surface and, thus, the separated radiocopper activity as well, platinum black [spec. surface area 10-16 m^2/g] was used instead of platinum plate.

The method reported here and based upon the spontaneous deposition of copper on platinum black makes it possible to separate of mg-quantities of copper from the zinc target amounting several grams. The separation can be carried out as follows.

1 g platinum black was filled into a small column /diameter and length 10 and 40 mm, respectively/ supplied with fritted glass on the bottom. The surface of the packing was previously reduced by passing 20 ml 1:1 water-formaldehyde mixture through the column at a flow rate of about 1 ml/min. The zinc irradiated for 116-200 hrs in a fast neutron flux of $2-3x10^{12}$ $ncm^{-2}sec^{-1}$ was dissolved in 10 ml sulphuric acid containing 2% formaldehyde.

This solution was passed through the column at a flow rate of 0.1 - 0.2 ml/min, as a result of which 95-98% of ^{64}Cu and ^{67}Cu was deposited on the platinum black while zinc remained in

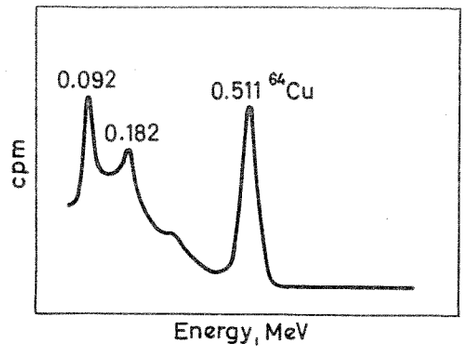

Fig.1. γ-Ray spectrum of ^{64}Cu and ^{67}Cu four hours after separation

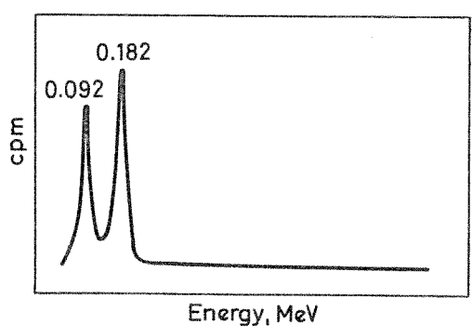

Fig.2. γ-Ray spectrum of ^{67}Cu five days after separation

solution. To remove traces of zinc the column was thoroughly washed with 5N sulphuric acid followed by the desorption of copper performed by the use of a few ml of concentrated nitric acid.

The γ-ray spectra of the separated ^{64}Cu and ^{67}Cu taken by the use of NaI/Tl/ crystal and a 256-channel pulse height analyser 4 hrs and five days after the separation was performed, are shown in Figs 1 and 2. Assay of the decay curve of ^{67}Cu proved that the ^{65}Zn impurity did not exceed 0.1%.

The main difference between ion exchange separation and the method reported here is that in the latter case the loading of platinum black is due only to the copper while zinc passes through the column without being deposited on the packing thus making possible the use of very small columns and eluent volumes.

REFERENCES

1. L.Szirtes, L.Zsinka: Radiokhimiya, 9 /1967/ 389.
2. O.Erbacher, Angew.Chem., 54 /1941/ 485.
3. G.Tóth, Magy.Kém.Folyóirat, 70 /1964/ 361.
4. J.Miller, J.Radioanal.Chem., 4 /1970/ 35.