ALTERNATIVE GENERATORS OF THE ^{99m}Tc

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INTRODUCTION

At present ^{99m}Tc radionuclide is the radionuclide most widely used in nuclear medicine. ^{99m}Tc radionuclide is received from its generator, in which ^{99}Mo is a parent radionuclide. In the generator ^{99m}Tc and ^{99}Mo radionuclides are in genetic balance and within a certain time interval ^{99m}Tc radionuclide is eluted chemically from the system.

Despite many ways of manufacturing the ^{99m}Tc generators, new variants of the ^{99}Mo → ^{99m}Tc generator systems are studied. An example one can take investigations carried out under the aegis of IAEA [1,2]. In these research works, generators based on elution of polymolybdate gels have been developed and evaluated. These generators will serve as alternative technologies to receive ^{99m}Tc radionuclide, using ^{99}Mo produced by non-fission routes. It is known that in Australia and China more than 30% of ^{99m}Tc generators are gel-generators [2]. The works of authors [3-5] are devoted to the search of new perspective materials as a column material that will serve as adsorbent. The main purpose of all researches of alternative technologies is the usage of parent radionuclide ^{99}Mo that is obtained by reaction ^{98}Mo(n, γ)^{99}Mo instead of fission ^{99}Mo (^{99}Mo produced by fission). Our work examines the possibility of reception of generators ^{99}Mo → ^{99m}Tc using non-fission ^{99}Mo that is based on insoluble salts of molybdate.

EXPERIMENTAL

In our experiments Barium, Calcium and phosphorous Cesium molybdates were used as such insoluble salts. Here we present the solubility product of the specified salts:

$BaMoO_4 - 4.10^{-8}$;
$Ca\ MoO_4 - 4{,}7.10^{-9}$;
$Cs_3[P\ (Mo_3O_{10})_4] - 1{,}7.10^{-11}$.

Salts of Barium and Calcium were obtained by adding ^{99}Mo radionuclide into the chemical structure of the salts during their synthesis. Mixing solutions containing ions Ba^{2+}, Ca^{2+} and $^{99}MoO_4^{2-}$ carried out during the synthesis. The precipitation of resoluble salt of molybdate was observed at the bottom of solution:

$$Ba^{2+} + {}^{99}MoO_4^{2-} \rightarrow Ba^{99}MoO_4^{2-} \quad (1)$$

$$Ca^{2+} + {}^{99}MoO_4^{2-} \rightarrow Ca^{99}MoO_4^{2-} \quad (2)$$

Phosphorous Cesium molybdate was obtained by mixing solutions containing Cs^+ions and phosphorous molybdate(^{99}Mo) ions:

$$3Cs^+ + [P(^{99}Mo_3O_{10})_4]^{3-} \rightarrow Cs_3[P(^{99}Mo_3O_{10})_4]^{3-} \quad (3)$$

The generators consisted of glass columns with two layers: first – lower layer Al_2O_3 (0,5 g), second – upper layer insoluble ^{99}Mo salt. Weight of the salt varied from 1 to 2 gramms. Elution of pertechnetate(^{99m}Tc) sodium was conducted with 0,9% solution of NaCl at the elution speed of from 0,5 to 1,5 ml/min.

RESULTS

^{99}Mo is generally produced by the direct (n,γ) nuclear reaction irradiated of natural Molybdenum or enriched ^{98}Mo.

Output of insoluble salts of molybdate (^{99}Mo) on its synthesis was more than 95% for all salts. This means that the loss of ^{99}Mo in the process of obtaining insoluble salts is low.

Quantity of ^{99m}Tc yield from salt generators on elution in 0,9% solution of NaCl are presented in the table.

Table. Yield of ^{99m}Tc from salt generators

Salt	Yield of ^{99m}Tc, %	Content of ^{98}Mo, %	Radiochemical purity, %
$BaMoO_4$	70,8	less than 10^{-3}	99,7
$Ca\ MoO_4$	75,2	0,02	99,5
$Cs_3\ [P\ (Mo_3O_{10})_4]$	77,6	less than 10^{-4}	99,8

A low yield of ^{99m}Tc radionuclide indicated the existence of Technetium-99m adsorption in the molybdate salts. The table also shows radiochemical and radionuclide purity of eluate pertechnetate(^{99m}Tc).

Received results testify to the possibility of usage of salt generators in practice.

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