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“Separation of Tc radioisotopes from proton irradiated Ru targets by thermochromatography – preliminary results”

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Among neutron deficient Tc isotopes, ^{95m}Tc is a useful radiotracer due to a relatively long half-life ($t_{1/2}=61$ d), and high abundance of its gamma-rays. It can be used for studying of a behavior of ^{99}Tc in the environment and waste disposal, as well as in the development of new radiopharmaceuticals of 94m , ^{99m}Tc . Radioisotope ^{95m}Tc can be obtained by a bombardment of Mo-enriched and Nb targets with protons or alpha particles^[1].

In the present work ^{95m}Tc was obtained by proton irradiation of ^{nat}Ru targets. Ru or RuCl_3 powder with a natural isotopic composition was irradiated. The irradiation condition was 20 nA as proton of energy 60 MeV for 2-3 h at the Cracow AIC-144 cyclotron.

At first stage an investigation of volatilization of Tc, Rh and Ru as oxides by heating the target material RuCl_2 powder in an O_2 stream was carried out. At second stage, the investigation with Ru powder as target material was done in the same experimental conditions as for studies of RuCl_3 as target. The similar thermochromatograms were obtained for carrier-free Rh and macroscopic amount of Ru. One oxide of Rh was detected. Thermochromatogram of macroscopic amounts of Ru oxides showed wide peak in temperature range from 1340K to 300K. This peak corresponds to the oxides: RuO_2 and RuO_3 ^[2-4]. Two peaks of carrier-free Tc have been observed at 620 K and 320 K for RuCl_3 target and one peak at 850 K with right-sided tail for Ru target. Thermochromatograms characteristics of Tc i Ru indicate a continuous migration of Ru and Tc oxides into lower temperature^[2-4]. In the case of RuCl_3 target, the additional formation of volatile Tc and Ru oxychlorides can not be excluded. Taking into account obtained results for isolation Tc from RuCl_3 target, high-temperature part of temperature gradient was extended. Tc carrier-free radionuclides were trapped in scrubber with 6 Mol/l HCl. In these experimental conditions about 1% of total amount of Ru was caught in scrubber, too.

The performed studies made it possible to obtain the following conditions for the separation Tc process: mass of RuCl_3 target about 35 mg, starting temperature 1373 K, exposure time 100 minutes, O_2 flow rate 60 cm^3/min . In all experiments one peak of Rh was detected, probably as RhO_2 , at this same adsorption temperature independently of gradient temperature, exposure time and irradiated target material Ru or RuCl_3 powder. The stable position of Rh peak during experiment indicates the possibility of separation Rh from target material. Further investigation is planned.

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