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P2.213 Analysis of radionuclidic purity of medical isotope production with d-Li neutron in A-FNS

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We are carrying on design activities of an advanced fusion neutron source (A-FNS) in Japan. A large amount of neutrons are produced by Li(d,n) reaction bombarding a 40 MeV deuteron beam of 125 mA with a liquid Li target at the A-FNS. In the Li(d,n) reaction, there are reaction processes with strong angular dependence such as proton stripping and ones with weak dependence such as evaporation. Neutron spectrum depends on locations in the test cell of the A-FNS, especially in high energy region. We are studying the production of medical radioisotope Mo-99 which is the parent nuclide of Tc-99m. There are two reactions in production of Mo-99: Mo-100(n,2n)Mo-99 and Mo-98(n,g)Mo-99 reactions. Mo-100(n,2n)Mo-99 reaction is induced by neutrons above about 8.4 MeV. Mo-98(n,g)Mo-99 reaction is mainly induced by lower energy neutrons. We install the Mo-100 and Mo-98 samples at different locations in the test cell for the suitable production of Mo-99. We calculated neutron spectra in the test cell by using a Monte Carlo transport code MCNP5 with an extension McDeLicious-11 and nuclear data library FENDL-3.1d. Amounts of radioisotopes produced in Mo samples were calculated by using the spectra and an activation code FISPACT-2010. In these radioisotopes, only Tc-99m can be applied for medical use. Radionuclidic purity of Tc-99m is severely required. Tc isotopes other than Tc-99m out of these radioisotopes become a problem in enhance of the purity after chemical separation. From the calculation results, it was found that we could control the amounts of the Tc isotopes by using the isotopically enriched Mo-98 and Mo-100 or natural Mo samples with the right selection of location in test cell which is to say neutron spectrum and cooling time to become the purity higher. From this study, we clarified that the purity of Tc-99m met the medical demand.

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