^{99}Mo production via ^{100}Mo(n,2n)^{99}Mo using accelerator neutrons

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^{99m}Tc, the daughter nuclide of ^{99}Mo with $T_{1/2}$=66 h, is the most common radioisotope used in diagnosis. In fact, more than 25 million medical diagnostic procedures have been performed worldwide every year using ^{99m}Tc-based radiopharmaceuticals. Therefore, a reliable and constant supply of ^{99}Mo is the key issue to ensure the routine application of ^{99m}Tc. About 95% of ^{99}Mo has been produced by the fission reaction of highly enriched ^{235}U in research reactors in the world. However, a number of incidents of the reactors caused the shortage of ^{99}Mo, which has triggered widespread discussions on the medium- and long-term supplies of ^{99}Mo.[1)] In fact, many efforts are being made for the domestic production of ^{99}Mo or ^{99m}Tc worldwide.[1,2)]

We proposed a new route to produce ^{99}Mo via ^{100}Mo(n,2n)^{99}Mo using fast neutrons from an accelerator.[3)] The reaction cross section is large, 1.5 b at a neutron energy E_n≈14MeV, which is ten times larger than that of ^{98}Mo(n,γ)^{99}Mo at the thermal energy. We have performed all important steps necessary to obtain high-quality ^{99m}Tc using ^{99}Mo, which was produced using fast neutrons from ^{3}H(d,n)^{4}He.[4)] The intensity of 14MeV neutrons at a ^{100}Mo sample position is the key issue for sufficiently producing ^{99}Mo. Recently, significant progress has been achieved in accelerator technology, which enables us to obtain high-flux fast neutrons with a most probable energy of 14MeV by C(d,n) using 40 MeV deuterons.[5)]

We showed that other medical isotopes, such as ^{90}Y, ^{64}Cu, and ^{67}Cu, are significantly produced using accelerator neutrons.[6,7)]

[1] T. Ruth, Nature **457**, 536 (2009).
[2] K. Bertsche, Proceedings of IPAC'10, Kyoto, Japan, p.121 (2010).
[3] Y. Nagai and Y. Hatsukawa: J. Phys. Soc. Jpn. 78, 033201 (2009);
F. Minato and Y. Nagai: J. Phys. Soc. Jpn. 79, 093201 (2010).
[4] Y. Nagai et al.: J. Phys. Soc. Jpn. 80, 083201 (2011).
[5] M. Fadil, B. Rannou, and the SPIRAL2 project team: Nucl. Instrum. Methods Phys. Res., Sect. **B 266,** 4318 (2008).
[6] Y. Nagai et al.: J. Phys. Soc. Jpn. 78 (2009) 113201.
[7] T. Kin et al.: J. Phys. Soc. Jpn. (2013) in press.