INTRODUCTION TO TECHNETIUM NUCLEAR CHEMISTRY AND RELATED TOPICS

Kenji YOSHIHARA
Department of Chemistry, Faculty of Science,
Tohoku University, Sendai 980-77, Japan

Chemistry of technetium has various aspects. Because of great utility of this element in nuclear medicine, designing of chemical forms with better affinity to human (or biological) organs is an important subject to be studied. From this point of view many researchers are piling up their data, and the nuclear chemistry of technetium useful in radiopharmaceutical production of technetium isotopes has been studied to date.

On the other hand, technetium is one of the troublesome nuclear wastes as its main nuclide ^{99}Tc has very long half-life (210,000 y). Effective separation of technetium from the FP and TRU is actively studied in reprocessing of nuclear fuels. The study is also meaningful when the separated material (*e.g.* metal) is readily available as a target for transformation of ^{99}Tc into other short-lived nuclides using nuclear reactions.

Although it seems that there are considerable difficulties in the development of utilization of technetium as materials, we still hope that the FP and TRU nuclides should be systematically studied for possible applications in various research fields ; in this sense, we should not give up regarding technetium as a new material. Russian examples of application shown in 1993 encouraged us.

I describe recent development of the nuclear chemistry of technetium in the following subjects.

1.New potential PET nuclides of technetium

The Jülich group including Qaim studied production of ^{94m}Tc (half-life : 52m, β^+ 70 %) which is available for PET. The excitation function of ^{94}Mo(p,n)^{94m}Tc showed a maximum cross section (480 mb) at 12 MeV. The thick target yield was 54 mCi/mA h for highly enriched ^{94}Mo (93.9%). The excitation function is shown in Fig.1. Combination of the knowledge of ^{99m}Tc SPECT and PET applicability of ^{94m}Tc is promising.

The RIKEN group in Japan recently developed a multi-tracer method in which Au, Ag or Cu was bombarded with high energy heavy ions in a ring cyclotron. This led to production of a group of nuclides with a variety of masses and atomic numbers (Fig.2). Technetium (and rhenium) could be separated easily by distillation. They mainly noticed ^{96}Tc (or ^{183}Re) but other positron emitting nuclides could be produced similarly.