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Generator of Highly Concentrated Pure ^{99m}Tc from Low Specific Activity ^{99}Mo Produced by Reactor and/or Electron Linear Accelerator

K. Tatenuma, A. Tsuguchi, Y. Suzuki, K. Ishikawa
Kaken Inc.
1044 Hori, Mito, Ibaraki 310-0903 – Japan

S. Sekimoto, T. Ohtsuki
Kyoto University, Research Reactor Institute
2-1010 Asashiro-nishi, Kumatori, Sen-nan, Osaka 590-0494 – Japan

ABSTRACT

Extraction technique of ^{99m}Tc extraction from ^{99}Mo was examined by the newly developed Technetium Master Milker (TcMM) method. For the production of ^{99}Mo here, the ^{98}Mo(n,γ) reaction using neutrons generated by a nuclear reactor and/or the ^{100}Mo(γ,n) reaction using bremsstrahlung photons generated by an electron linear accelerator were utilized respectively.

By this study, it has been proved that a highly concentrated pure pertechnetate ($^{99m}TcO_4^-$) in saline can be separated and collected through the TcMM method.

Procedurally, the TcMM method utilizes combined activated carbon (AC) and alumina (AL), with or without ion exchange resin (IER). The AC-AL process has used a highly concentrated Mo with low specific and large activity ^{99}Mo of 3.0×10^{12} Bq generated by the irradiation of neutrons in the nuclear reactor, JRR-3 in Japan Atomic Energy Agency.

It was found that a chemical yield and purity of the produced ^{99m}Tc are 90-95% and 6N (99.9999 %), respectively. Therefore, the TcMM method is able to generate a high quality $^{99m}TcO_4^-$ that is eligible to obtain the permission of pharmaceutical affairs law.

It was revealed that the TcMM method has the practical capability of the efficient ^{99m}Tc generator with a wide range from small amount level (kBq) to large level (TBq) per batch, furthermore, the main parts consisted of the AC-AL or AC-IER-AL columns system are simple and are able to collect pure ^{99m}Tc within 30 min automatically.

Conclusively, ^{99m}Tc can be produced domestically and further locally on demand by the combination of the TcMM method and ^{99}Mo with a low specific activity (produced from the ^{98}Mo(n,γ) and/or ^{100}Mo(γ,n) reaction, using a neighboring reactor and/or an electron linear accelerator without enriched uranium (HEU and LEU)), and furthermore, the advanced use for diagnosis can be available everywhere in the world.