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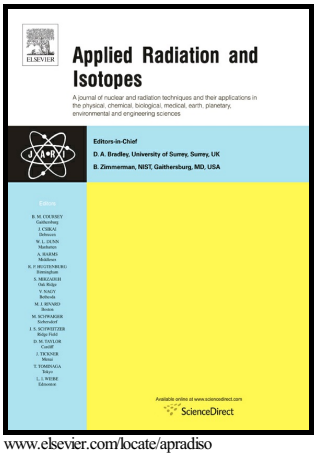

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In-house Cyclotron Production of High-purity Tc-99m and Tc-99m Radiopharmaceuticals

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ABSTRACT

In the last years, the technology for producing the important medical radionuclide technetium-99m by cyclotrons has become sufficiently mature to justify its introduction as an alternative source of the starting precursor $[^{99m}Tc][TcO_4]^-$ ubiquitously employed for the production of ^{99m}Tc-radiopharmaceuticals in hospitals. These technologies make use almost exclusively of the nuclear reaction $^{100}Mo(p,2n)^{99m}Tc$ that allows direct production of Tc-99m.

In this study, it is conjectured that this alternative production route will not replace the current supply chain based on the distribution of $^{99}Mo/^{99m}Tc$ generators, but could become a convenient emergency source of Tc-99m only for in-house hospitals equipped with a conventional, low-energy, medical cyclotron. On this ground, an outline of the essential steps that should be implemented for setting up a hospital radiopharmacy aimed at the occasional production of Tc-99m by a small cyclotron is discussed. These include (1) target production, (2) irradiation conditions, (3) separation/purification procedures, (4) terminal sterilization, (5) quality control, and (6) Mo-100 recovery. To address these issues, a comprehensive technology for cyclotron-production of Tc-99m, developed at the Legnaro National Laboratories of the Italian National Institute of Nuclear Physics (LNL-INFN), will be used as a reference example.

[1] Author Contributions: These authors contributed equally.