Molybdenum-converter based electron linear accelerator and method for producing radioisotopes

The invention

A method for the production of radioisotope molybdenum-99 (Mo-99/Tc-99m) and other radioisotopes for nuclear medicine by using molybdenum metal as the converter in an electron linear accelerator. This way, the natural occurring heaviest stable isotope Mo-100 can be used as the target for accelerated electrons functioning simultaneously both as the bremsstrahlung converter and the radioisotope Mo-99 producing target. Converting the electrons into the bremsstrahlung photons within the Mo-target/converter results in the production of the Mo-99 within the same target via the photonuclear reaction: Mo-100(γ, n)Mo-99. In the process, the photons escaping the Mo-target can be used on other external targets for production different very important radioisotopes. For example, short-lived radioisotopes like F-18, O-15, N-13, and C-11 for use in Positron Emission Tomography (PET) can be produced by placing an external appropriate stable isotope target. This occurs simultaneously with and independently of the production and accumulation of the primary radioisotope Mo-99.

The need

Nuclear medicine uses technetium-99 as the isotope for imaging and its use is so far growing. As this is an unstable isotope (half-life of 6 hours), it needs to be produced on the spot and cannot be stockpiled. The oldest methods used Weapons Grade (highly enriched) uranium as the source for creating through nuclear fission molybdenum-99, which decays into technetium-99m with a half-life of 66 hours. This old methodology requires a source of highly enriched uranium and a nuclear reactor to create the molybdenum-99. The Mo99 has a market potential of over 3 B$, making Mo 100 important as raw material in view of the security problems of the Uranium.

Potential applications

An isotope production electron linear accelerator used both in situ and as a regional one to provide radioisotopes for nuclear medicine, without the need for weapons-grade uranium and the need for transportation of those materials. The potential applicants are companies that produce radioisotopes for nuclear medicine and biology, the companies that produce electron linear accelerators for medical purposes, and producers of the high-tech medical equipment for the nuclear medicine functional imaging techniques such as PET, CT, and similar.

Patent

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