Technetium-99m
(^{99m}Tc)

July 2002
Fact Sheet 320-083

Division of Environmental Health
Office of Radiation Protection

WHO DISCOVERED TECHNETIUM?

Technetium was the first artificially produced element. It was isolated by Carlo Perrier and Emilio Segrè in 1937. Technetium was created by bombarding molybdenum atoms with deuterons that had been accelerated by a device called a cyclotron.

Today, technetium is produced by bombarding molybdenum-98 with neutrons. Molybdenum-98 becomes molybdenum-99 when it captures a neutron. Molybdenum-99, with a half-life of 65.94 hours, decays into technetium-99 through beta decay. While technetium has never been found to occur naturally on earth, its spectral lines have been observed in S-, M- and N-type stars.

WHAT IS TECHNETIUM-99m USED FOR?

The radioisotope most widely used in medicine is technetium-99m, employed in over half of all nuclear medicine procedures. It is an isotope of the artificially produced element technetium and it has almost ideal characteristics for a nuclear medicine scan.

These characteristics are:

- Technetium-99m decays by a process called isomeric transition, a process in which ^{99m}Tc decays to ^{99}Tc via the release of gamma rays and low energy electrons. Since there is no high energy beta emission the radiation dose to the patient is low.
- The low energy gamma rays emitted easily escape the human body and are accurately detected by a gamma camera. Once again the radiation dose to the patient is minimized.

- It has a half-life of six hours which is long enough to examine metabolic processes yet short enough to minimize the radiation dose to the patient.
- The chemistry of technetium is so versatile it can form tracers by being incorporated into a range of biologically-active substances to ensure that it concentrates in the tissue or organ of interest.

Technetium-99m is used to image the skeleton and heart muscle in particular, but also for brain, thyroid, lungs, liver, spleen, kidney, gall bladder, bone marrow, salivary and lachrymal glands, heart blood pool, infection and numerous specialized medical studies.

Small amounts of technetium can retard the corrosion of steel, although this protection can only be applied to closed systems due to technetium's radioactivity. Technetium can also be used to calibrate particle detectors.

WHERE DOES TECHNETIUM-99m COME FROM?

Technetium-99m is artificially produced by the neutron activation of molybdenum-99.

IS TECHNETIUM-99m HAZARDOUS?

Technetium can concentrate in several organs depe nding on its chemical form, so there is no primary organ of concern. This is one reason why the short-lived isotope technetium-99m has such wide usage in nuclear medicine as a diagnostic tool. The low energy of the beta particle, the lack of significant gamma or X-rays, and the rapid excretion of technetium-99m from the body limit the potential for health effects.

PROPERTIES OF TECHNETIUM-99m (^{99m}Tc)

Half-Life:

Physical: 6.02 hours

Principal Modes of Decay (MeV):

Gamma 0.140 (89%)

Sources

Jefferson Lab, http://education.jlab.org/itselemental/ele043.html
Environmental Radioactivity, Eisenbud, Merril & Gesell, Thomas, 1997

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