Chemical Processing of mini-SHINE Targets Solutions for Recovery and Purification of Mo-99

D.A. Rotsch, A.J. Youker, P. Tkac, D.C. Stepinski, J.F. Krebs, V. Makarashvili, M. Kalensky, Z. Sun, T.A. Heltemes, J.F. Schneider, A.S. Hebden, J.P. Byrnes, L. Hafenrichter, K.A. Wesolowski, S.D. Chemerisov, G.F. Vandegrift

Chemical Science and Engineering
Argonne National Laboratory, 9700 Cass Avenue, Argonne IL. 60439 – USA

ABSTRACT

Despite recent shortages and the increased availability of positron imaging tomography systems and radionuclides (e.g. ^{18}F), Technetium-99m remains the workhorse of diagnostic nuclear medicine. ^{99m}Tc is produced from ^{99}Mo which is currently created by fission of U-235 in targets irradiated in research and test reactors. Argonne National Laboratory is assisting SHINE Medical Technologies to provide domestically produced ^{99}Mo from an accelerated driven non-critical aqueous solution of low enriched uranium, uranyl sulfate. Argonne is performing "pilot-scale" experiments using a linac-driven mini-SHINE facility to assist in this development. In phase-1, 5 L of uranyl sulfate solution is being irradiated to produce up to 2 Ci of ^{99}Mo. The irradiated target solution is processed using all unit operations envisioned in the SHINE facility to recovery and purify ^{99}Mo. ^{99}Mo is isolated on a titania column and the target solution recycled for future production runs. The column is washed to remove residual uranium and purify ^{99}Mo. Molybdenum-99 is then eluted from the column in basic solution and transferred to a hot cell for further processing. This 1 L solution is acidified and concentrated to 36 mL by another far smaller titania column, the Mo-product solution is evaporated and acidified for final purification using the LEU-Modified Cintichem Process. The purified Mo-99 will be ready for shipment 24 hours after the end of irradiation.