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


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ABSTRACT

Despite recent shortages and the increased availability of positron imaging tomography systems and radionuclides (e.g. ¹⁸F), Technetium-99m remains the workhorse of diagnostic nuclear medicine. ⁹⁹mTc is produced from ⁹⁹Mo 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 ⁹⁹Mo 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 ⁹⁹Mo. The irradiated target solution is processed using all unit operations envisioned in the SHINE facility to recovery and purify ⁹⁹Mo. ⁹⁹Mo 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 ⁹⁹Mo. 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.