DEVELOPMENT OF TARGET DELIVERY AND RECOVERY SYSTEM FOR COMMERCIAL PRODUCTION OF HIGH PURITY IODINE-124

R.J. Ylimaki[1], M.Y. Kiselev[1], J.J. Čomor[2], G.-J. Beyer[3]

[1]IBA Molecular Imaging, Richmond, Virginia, USA;
[2]Vinča Institute of Nuclear Sciences, Laboratory of Physics, Belgrade, Serbia and Montenegro;
[3]University Hospital of Geneva, Dept of Radiology, Cyclotron Unit, Geneva, Switzerland;

AIMS: Development of integrated target irradiation, handling and recovery system for production of high quality I-124 solution suitable for medical research use in a cost effective and safe manner.
METHODS: Compact Solid Target Irradiation System (COSTIS) [1] was installed on a 17 MeV negative ion cyclotron. The enriched Te-124 oxide was loaded on the platinum disk by preheating. Remotely controlled target recovery device and a control system were designed and installed, with near full automation of the target loading and unloading cycle, terminating with the platinum disk sealed in a pig for transport for safe target removal and recovery of the radio iodine. Recovery was achieved in a quartz furnace installed in a shielded glove box using air suction. Temperature regimes were established according to prior work [2]. An intermediate trap of Al_2O_3 and quartz cotton was used to minimize any metallic tellurium reaching the trap. Radiochemical purity was verified using ion chromatography HPLC system equipped with UV and radio detector. Radionuclidic purity was determined by high-resolution gamma-ray spectrometry, using a hyperpure germanium (HPGe) spectrometer. Bacterial endotoxin concentration in I-124 solution was quantitatively assessed by an end point turbidimetric LAL assay using a plate reader. I-124 solution was filtered through 0.2-micron filter and sterility was verified by sterility test according to USP.
RESULTS: A series of irradiation and recovery cycles were performed using the same target initially loaded with 200 mg of Te-124 oxide. No significant target degradation or target material loss was observed. Target yields of 0.45 mCi/uA-h at EOB and recovery yields of >90% were achieved. Using 99.8% enriched Te-124 resulted in less than 0.1% I-123 impurity at end-of-separation, typically 48 hours after EOB, with no detectable I-125 impurity. Radiochemical purity was consistently greater than 95% when 0.02M NaOH was used. Iodide was stable for 7-10 days after production. I-124 solution contained less than 0.05 Eu/ml of bacterial endotoxins and was sterile.
CONCLUSION: COSTIS target and target handling and recovery system described above are suitable for commercial production of high purity I-124 suitable for medical research applications.

[1] J.J. Čomor, Ž. Stevanović, M. Rajčević, Đ. Košutić: "Modeling of thermal properties of a TeO_2 target for radioiodine production" in Nucl. Instrum. Meth. A 521, 2004, pp. 161-170
[2] G.J. Beyer and G. Pimental-Gonzales: "Physicochemical and radiochemical aspects of separation of radioiodine from TeO_2-targets" in Radiochim. Acta 88, 2000, pp. 175-178