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Abstract Submission

Title: Optimization of Technetium-94m Production by Cyclotron Proton Irradiation of Phosphomolybdic Acid using an Automated Liquid Target System

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Abstract:

Purpose
Technetium-94m (94mTc) is viewed as a potential candidate for PET imaging due to its positron branching ratio (72%), medium positron end-point energy (2.47 MeV), and half-life (52 minutes) [1]. It is proposed that phosphomolybdic acid (PMA) is a promising material for 94mTc production [2]. The evaluation of production capacity has been the point of interest for this work.

Methods
A 16.5 MeV GE PETtrace cyclotron was used for the irradiations using a standard GE Nb liquid target with a 200 µm Nb target foil. A 25 µm HAVAR vacuum foil was used to degrade the proton energy to 12.9 MeV [2]. Irradiations of 10 minutes at 10 µA to up to 60 minutes at 15 µA were carried out. All activities were measured by gamma

spectroscopy using HPGe detector and trace metal contents analyzed by ICP-OES. A fully automated liquid targeting system controlled by a PLC is currently used, conducting the loading sequence from target loading to post irradiation target emptying.

Results

From initial production setup, end of bombardment activity yield was around 154 MBq 94mTc achieved from 0.16M PMA solution at 15 μA irradiations for 60 minutes, corresponding to 53.9% of the calculated theoretical saturation yield. Recovery in product load was observed to be >98%. From the fully automated system, preliminary data shows end of bombardment activity yield was around 24 MBq 94mTc achieved from 0.16 PMA solution at 10 μA irradiation for 10 minutes, corresponding to 50.9% of calculated theoretical saturation. Recovery in product load was observed to be around 90%. Using both loading systems, no Nb degradation or PMA precipitation was observed.

Conclusions

PMA has shown to be a promising target material for 94mTc. The fully automated system is functional and produces results comparable to literature. Next steps are to continue to investigate maximum irradiation parameters and tracer 94mTc labelling for preclinical evaluation.

References

[1] Qaim, S.M., 2000. Production of high purity 94mTc for positron emission tomography studies. Nucl. Med. Biol. 27, 323–328.

[2] Harper, R., Morim, D. R., Mehta, D., Rosecker, V., Archibald, S. J., Southworth, R., Blower, P. J., Stephenson, K. A., & Nielsen, K. M., 2024. Optimised production of technetium-94m for PET imaging by proton-irradiation of phosphomolybdic acid in cyclotron liquid target. Applied Radiation and Isotopes, 210, Article 111381.