Medical radioisotope Zr-89 production with RFT-30 cyclotron

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^{89}Zr (half-life = 78.4 h) having favourable nuclear decay kinetics with feasible chemical properties is an appealing high-intensity positron emitting radiometal favourable for the development of novel immuno-PET probes using radiolabeled monoclonal antibodies. Rising demand of ultrahigh purity and high-specific activity ^{89}Zr has propelled the scientists involved in nuclear medicine sector to develop an overall efficacious method for its production.
We have optimised the overall production as well as purification methodologies for high radionuclidic purity (99.9%) ^{89}Zr using the indigenous 30 MeV cyclotron. Our cyclotron research team focuses on the optimization of production / purification practices with the possible clinical application of ^{89}Zr. ^{89}Zr was produced by using ^{89}Y (p, n) ^{89}Zr reaction. 30 MeV of initial cyclotron energy was degraded using aluminum degrader to ~12.5 MeV. The irradiated ^{89}Y target was dissolved in the required amount of 6 M HCl and was further processed and purified using hydroxamate based resin with a remarkable yield (>99.99%). The produced and purified ^{89}Zr is presently used to carry out several studies including but not limited to the development of radiochemical separation and purification mechanisms for ^{89}Zr and its coordination with several novel compounds and nanoparticles for possible clinical applications. Using the above mentioned production method we were able to optimize the irradiation conditions for producing ~120 mCi of ^{89}Zr using RFT-30.
The produced ^{89}Zr was further processed and purified in ^{89}Zr-oxalate/chloride (99.99%) form. Further, labelling and small animal study applications are underway. To conclude, we were successful in producing and purifying ^{89}Zr in oxalate as well as chloride form at the acceptable level for research applications. Further efforts for automated ^{89}Zr separation and purification module are under consideration. This will help in the possibility of ^{89}Zr production at large scale while considering its future demand.

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