Abstract

Charged particle induced nuclear reactions for the production of ^{52}Fe and ^{72}As were studied. A critical analysis led to consider proton induced nuclear reaction sections on ^{72}Ge, ^{73}Ge, ^{74}Ge and ^{76}Se to investigate for the production of ^{72}As while for the production of ^{52}Fe, the proton induced reactions on ^{58}Ni, ^{55}Mn and alpha induced reaction on ^{50}Cr were chosen. The experimental results obtained via ^{72}Ge(p, n)^{72}As, ^{73}Ge(p, 2n)^{72}As, ^{74}Ge(p, 3n)^{72}As, ^{76}Se (p, x)^{72}As and ^{58}Ni (p, x) ^{52}Fe, ^{50}Cr (^{4}He, 2n) ^{52}Fe and ^{55}Mn(p,4n)^{52}Fe reactions were compared with the results of nuclear model calculations using the codes ALICE-IPPE, EMPIRE 3.2 and TALYS 1.9 to check the reliability and discrepancy in the experimental data. Polynomial fittings were applied using Origin-Lab Pro 2017 to maintain the consistency of experimental and calculated data. Recommended data were generated using the well-established evaluation methodology. The thick target yields (TTY) of ^{52}Fe and ^{72}As is calculated from the recommended excitation functions. Analysis of radionuclidic impurities was also discussed for both radionuclides. Comparison of the various radionuclidic impurities

is done. On the basis of TTY and radio-nuclidic impurity analysis; the production routes and optimum energy ranges for the production of ^{52}Fe and ^{72}As are proposed. Our evaluation scheme showed that for the production of ^{52}Fe via ^{55}Mn(p,4n)^{52}Fe reaction, energy ranges from 70→45 MeV could be the method of choice, which gives high yield with minimum impurities to make it as a potential candidate for theranostic applications in nuclear medicine and in particular, Positron Emission Tomography (PET). For the ^{72}As; ^{72}Ge(p, n)^{72}As reaction in the energy ranges 10-→20 MeV is the optimized nuclear reaction with a negligible impurity ratio and maximum production yield. Being in the low energy range, a small cyclotron can be engaged for the production of ^{72}As to be used it in the medical applications.