ABSTRACT

Theranostic pairs have brought about a groundbreaking transformation in the realm of nuclear medicine by offering both diagnostic and therapeutic outcomes simultaneously. Among these pairs, the duo of arsenic isotopes, namely ^{72}As and ^{77}As, stands out as particularly advantageous. ^{72}As serves as a positron emitter, enabling it to function as a diagnostic radionuclide, while ^{77}As, serves as a β-emitter, providing therapeutic effects. The primary objective of this study is to elucidate the production of 72As through charged particle-induced nuclear reactions involving ^{nat}Ge and ^{72}Ge. The favorable attributes of ^{72}As position it as a promising candidate for positron emission tomography (PET) due to its high β+ emission intensity, low electron capture rate, robust decay intensity, and a half-life of 26 hours suitable for PET applications. To achieve this goal, we have gathered and standardized all available experimental data, incorporating decay information and monitor reactions as needed. Additionally, we have compared the experimental data with theoretical nuclear model calculations, utilizing nuclear model codes like TALYS 1.9, ALICE IPPE, EMPIRE 3.2 and TENDL library. Moreover, we have computed the ratio between the experimental and model-derived data to ensure that the data points fall within the 3σ boundary of the polynomial fitting. We have also presented recommended data for these specific reactions, including their associated 95% upper and lower limits. Finally, we have conducted an analysis to assess the presence of unintended radionuclide impurities in the production of arsenic-72 through these reactions.