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Cyclotron production and processing of Positron Emission Tomography (PET) radiometals

Abstract

Molecular imaging has been accepted as a promising technique for diagnostic and therapeutic management of patients with cancer. Several PET radiopharmaceuticals are extensively used such as 18F-FDG, 68Ga-DOTATATE, 68Ga-PMSA for staging, re-staging and response evaluation of patients with various malignancies.

These PET based radio-metals hold special place in advancement of radio theranostic due to their long enough matching half-life with various biologics and ability to form coordinate bond with the same chelator like therapeutic isotope making a true theranostic pair. The easy availability of radioisotope with high yield is a primary requirement for development of any radiopharmaceutical. In India, 68Ga-DOTANOC and 68Ga-PMSA are routinely used for management of patients with neuroendocrine tumors and prostate cancer, respectively. However, the demand surpasses the availability of the Ga-68 radio-isotope because the only possible source across the country is 68Ge/68Ga generator. This mode of production is associated with various limitations such limited amount of radioactive Ga-68/elution, Ge-68 breakthrough, bi-yearly replacement of generator etc. This led researchers to explore an alternative mode of production for Ga-68.

Over the years, cyclotron produced radioisotopes have gained considerable interest, due to on site and on demand production of desired amount radio-isotopes. Therefore, cyclotron production of Ga-68 came into view as a possible method of choice. Initially Ga-68 was synthesized via cyclotron using solid target material. But this method was not adopted globally for routine production of Ga-68 because of the cost involved. Recently, Dr. Pandey and his team of researchers have successfully produced Ga-68 using liquid target material which has gained a widespread acknowledgement for being a cost effective and on demand method of production.

However, in India, irrespective of the cyclotron availability, we could not start production of Ga-68 with same technique attributing to lack of knowledge, skills and trained manpower. Therefore, this one month fellowship program can assist me to develop the practical skills and expertise for cyclotron based production of Ga-68. This can be later on practically implemented in India as effective technique to produce the radioisotope, meeting the necessary demand of Ga-68 radiopharmaceuticals on daily basis.