Cyclotron Produced Radioisotopes used in Nuclear Medicine

Francisco Alves (Coimbra)

Several radioisotopes used in either in conventional Nuclear Medicine and PET can be produced in a cyclotron. Some processes are widely used, like routine clinical oriented production of ^{18}F, ^{11}C or ^{13}N.

In recent years an increasing interest in non-conventional emitters, particularly metals, in a response to their expanding use for both molecular imaging and therapeutic applications, has been obseved. Several studies have thus investigated the potential use of a wide range of radiometals discussing their basic physicochemical properties such as half-life, range, decay properties as well as dosimetric considerations. Furthermore, it is fundamental to investigate and optimize the possible production techniques using common commercially available cyclotrons and synthesis modules to insure that all clinical and research applications are fulfilled.

Recently, important achievements regarding cyclotron production of radioisotopes have been reported, in two main fields: cyclotron production of ^{99m}Tc using a solid target; and production of ^{68}Ga by the irradiation of liquid targets, in a whole methodological approach involving fully automated separation and purification systems.

Main aspects involved in the use of the so-called solution ("liquid") targets for radiometal production possess significant benefits when compared to conventional ("solid") production. Processes in terms of reliability, purification and labelling time and significant reduction or even elimination of the pre- and post-irradiation target preparation and handling issues shall be addressed.

A brief review of possible production routes will be presented for these particular radionuclides in order to compare with the new approaches, emphasizing the improvements and gains obtained, including cost-reduction and the opportunity to perform consecutive synthesis.

References:

1. H.A. Williams, S. Robinson, P. Julyan, J. Zweit and D. Hastings, *Eur J Nucl Mol Imaging* 32, 1473-1480 (2005).
2. S.M. Qaim, *J Nucl Mol Imaging* 52, 111-120 (2008).
3. L. Tang, *QJ Nucl Med Mol Imaging* 52, 121-133 (2008).
4. F. Alves, V. H. P. Alves, S. J. C. Do Carmo, A. C. B. Neves, M. Silva, A. J. Abrunhosa; *Mod Phys Letters A* in press doi: 10.1142/S0217732317400132