Automated synthesis of [^{18}F]fluoromethylcholine using GE TRACERlab® Mx FDG: Preliminary results

In Brazil, prostate cancer is the second most common among men (behind skin cancer non-melanoma). In absolute terms, it is the sixth most common type in the world and more prevalent in men, accounting for about 10% of all cancers. Its incidence rate is about six times higher in developed countries compared to developing countries. The increase in incidence rates in Brazil can be partially explained by the evolution of diagnostic methods, improving the quality of information systems in the country and the increase in life expectancy. One of the methods used for the diagnosis of prostate cancer is the nuclear medicine technique using PET emitters. The most commonly used PET radiopharmaceutical is ^{18}F-FDG. However, in this case ^{18}F-FDG PET was useless in the imaging of prostate cancer and metastases because of the very high radioactivity in the urinary bladder. Many efforts have been made to develop a new ^{18}F-labeled PET tracer that complements some well-known limitations to use ^{18}F-FDG in PET oncologic imaging. A technique for PET imaging of the prostate is using choline derivatives. Choline is needed for the synthesis of phospholipids in cell membranes, methyl metabolism, cholinergic neurotransmission, transmembrane signaling, and lipid-cholesterol transport and metabolism. The uptake mechanism of choline and fluorocholine in tumor cells is of great interest. Tumor cells appear to be destined to incorporate choline rapidly to meet the need of rapid synthesis of the cell membranes. The levels of choline and phosphorylcholine are increased in a variety of tumor cells, probably representing the activation of choline uptake and phosphorylation in tumor cells. The [^{18}F]fluoromethylcholine is a marker of proliferation that can be used for the detection and (re)staging of prostate cancer. The aim of this work is the development of the [^{18}F]fluoromethylcholine synthesis using the automatic module GE TRACERlab MX FDG (adapted) at IPEN/CNEN-SP with ABX kit product No PECH-0008. The validation of the production and quality control methods are necessary in order to achieve this objective. The quality control of radiopharmaceuticals is carried out in accordance with the U.S. Pharmacopoeia. Fully automatic synthesis of [^{18}F]fluoromethylcholine were carried out on GE TracerLab MX FDG modules resulting in a stable non-decay-corrected radiochemical yield of 11–19% for a synthesis time less than 60 minutes. Quality control tests performed at t_0+1h showed the following results: radiochemical purity, 97.7%; radionuclidic purity, 100%; radionuclidic identity, 110 minutes. All mandatory quality control tests will be realized in the next experiments together with the study of stability up to t_0+10h.