Evolution of Production of Astatine-211 in Orléans Cyclotron

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Introduction

Since 2005, we produce, at academic scale in Orleans, ^{211}At for needs of chemistry and physicians teams of Nantes in research project of alpha immunotherapy. Between 2005 and 2014, several modifications were been made on preparation of target, targetry and radiation to protect personnel.

Material and Methods

The first target was a molten Bi metal onto a Cu support pre-treated with acid attack. The wished thickness (up to 100 µm) was obtained by mechanical treatment of target. The target is irradiated at 32MeV alpha particle beam for around 2 hours and then delivered by road transport to users. Only a measure of radiation dose was made to evaluate target activity. The second target we have used since 2010 is a electrodeposition of Bi (thickness of around 30 µm) onto AlN backing. We used a beam of 30.5 MeV for reaction ^{207}Bi(α,n)^{211}At (2 h with a current intensity of 2µA). Activity has measured with a detector Ge at 687 keV (γ-branching fraction = 0.26 %) before to be delivered. For all targets, beam energy on target was around 28.7 Mev in order not to produce too much ^{210}At.

Results and Conclusion

138 productions with the first target were delivered with an estimated activity of less than 100 MBq. Difficulties with wet extraction[1], low yield of radiolabelling (metallic impurities and activation of copper resulting in ^{66}Ga and ^{67}Ga) made necessary to change process of extraction. With support of AlN, dry extraction was used with good yield (75–80 %) and without activation of support. Until today, 46 batchs were delivered with activity of 44 ± 12 MBq/µAh. Yield activity of ^{211}At has been almost doubled compared to first target (25MBq/µAh). The dose burden to personnel was decreased with modification of targetry (outside of blockhouse of cyclotron, in a specific line beam to radionuclide production, cf. FIG. 1).

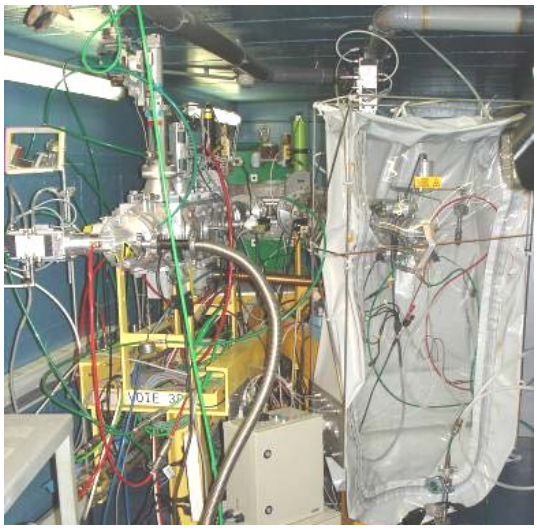

FIGURE 1. Targetry of Radionuclides production (^{64}Cu/^{211}At on left and ^{11}C on right)

In the case of ^{211}At production, energy of reaction is of major impact. With our versatile accelerator (range of energy in alpha between 10 and 50 MeV) and a low thickness of metal, it's easy to reach the right energy. This radionuclide production will be continued until ARRONAX, Nantes cyclotron, could take over from us for bigger activity of ^{211}At.

Reference:

1. C. Alliot, M. Chérel, J. Barbet, T. Sauvage, G. Montavon: *Radiochim. Acta* **97**, pp. 161–165, 2009.

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