Purification of Zirconium-89 for the Radiolabeling of Monoclonal Antibodies for Positron Emission Tomography

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Zirconium-89 has gained growing attention in recent in medical imaging by its half-life time (78.4h) which is adapted with the pharmacokinetics of monoclonal antibodies (mAbs). Its high positron yield (22.7%) and positrons with low energy (E_{moy} = 395.5 keV) provide a high resolution in PET imaging. The best chelating agent is deferoxamine (DFO) but this ligand release progressively the metal that will bind on the bones. This release is more important in little living being like rats or mouse than human being. That's why for pre-clinical study the synthesis of a new ligand still relevant.

We aim to develop an automated system for routine production of Zirconium-89 in order to provide this isotope with high radionuclide purity and specific activity. We also investigate a new chelating agent that confront in a stability test with EDTA or DFO. Briefly, I investigated the irradiation of yttrium sputtered niobium coins. The sputtered coins were irradiated with an incident beam energy of <13 MeV with various currents to determine optimal cyclotron conditions for ^{89}Zr production.

This system will automated a separation process from the literature that uses a hydroxamate resin column to purify ^{89}Zr from an ^{89}Y target. We have designed a system allowing control over every step in the process. This system is currently working well; more than five productions were made with high purity yield. The particularity between us and all the latest work on sputtered yttrium is that we want an $^{89}ZrCl_4$ complex. Briefly, the oxalate form gives the majority of commercially available Zirconium where the oxalic acid is highly harmful for the kidneys

After the successful production development, we want to improve our knowledge and our capacity to use this nuclide for *in vivo* studies.