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Determination of conditions for optimum labeling of DOTA-Y3-Octreotate with terbium-161

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DOTA-Y3-Octreotate (DOTA-TATE) and other somatostatin analogs can be labeled with radionuclides for cancer-fighting applications. Specifically, the radiolanthanides are of great interest to the radiopharmaceutical industry because of their similar chemistries and assortment of radioactive properties. Terbium-161 (^{161}Tb) is considered ideal for both radiotherapy and imaging because of its half-life (6.91 days), beta (0.59 MeV) and gamma (46-48 and 74 keV) emissions. In addition, carrier-free ^{161}Tb will have a high specific activity, meaning less drug mass is necessary to deliver the required dose to the neuroendocrine tumor. Radioactive terbium was obtained at the University of Missouri Research Reactor (MURR) via neutron capture on gadolinium-160 (^{160}Gd) to form gadolinium-161 (^{161}Gd), which beta decays to ^{161}Tb. To obtain carrier-free ^{161}Tb, ^{160}Gd contaminant was isolated from ^{161}Tb using ion-exchange liquid chromatography. Various parameters were tested to optimize conditions for labeling DOTA-TATE with ^{161}Tb: pH, buffer concentration, sample volume, incubation time using a water bath, and amount of activity. ^{161}Tb-DOTA-TATE solution was reacted in 0.4 M, pH 7 ammonium acetate (NH_4OAc) under 80˚C for 1 h. However, an experiment using lutetium-177 showed that only 5 minutes in the water bath was necessary for labeling. We determined the concentration of the NH_4OAc buffer solution was insignificant as long as pH was maintained above 5. We observed a maximum labeling level of 65 μ Ci of ^{161}Tb per microgram of DOTA-TATE. Future work will include a stability study of the labeled DOTA-TATE and modifications to the preparation of the terbium sample in order to achieve more activity per microgram of the chelate as required by animal studies.