Optimization of Automated Synthesis of 2-[^{18}F]Fluoro-2-deoxy-*D*-glucose Involving Base Hydrolysis

N. A. Gomzina, D. A. Vasil'ev, and R. N. Krasikova

Institute of Human Brain, Russian Academy of Sciences, St. Petersburg, Russia

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Abstract - Synthesis of 2-[^{18}F]fluoro-2-deoxy-*D*-glucose ([^{18}F]FDG) involving base hydrolysis was optimized. Fluorine-18 was isolated from irradiated water to more than 90% by sorption of [^{18}F]fluoride on QMA anion-exchange resin, which was followed by elution with a 96 : 4 (by volume) acetonitrile–water mixture containing Kryptofix 2.2.2 and potassium carbonate (molar ratio 2 : 1). This composition is the best for preparing the complex [K/K2.2.2]$^{+}$^{18}F^{-} used in nucleophilic fluorinations. No additional azeotropic drying is required. Base hydrolysis under optimized conditions (40 – 45°C), followed by neutralization with HCl, removal of traces of the solvent, and purification of the final product on a combined SCX/Alumina N column, yielded [^{18}F]FDG of high radiochemical (>99%) and chemical purity with minimal product loss. With an RB-86 robotic system (Anatech, Sweden), the synthesis time was 38 min. The procedure is used in the Institute of Human Brain, Russian Academy of Sciences for routine synthesis of FDG; the radiochemical yield of the product by the end of synthesis (EOS) is reproducibly high: 63 ± 3% (n = 40).