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Automated synthesis of [^{18}F]fluoroacetate using a compact FDG synthesizer

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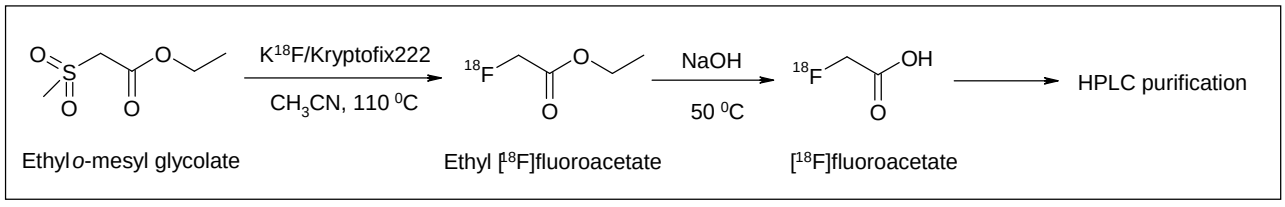
Objectives: F-18 labeled fluoroacetate ([^{18}F]FA) has been developed as a surrogate PET radiopharmaceutical of [^{11}C]acetate [1-2]. A commercially available automatic synthesizer box, Synthera, from IBA is designed to be simple and compact for FDG synthesis. The synthesizer employed disposable cassette type concept including four reagent vials and one reaction pot. In this study, we developed automated [^{18}F]FA synthesis using the Synthera to adapt a routine production.

Methods: The synthesis of [^{18}F]FA was modified from the method of Sun et al.[3] (Scheme 1), and selected four reagent vials as follows: kryptofix2.2.2./K_2CO_3 mixture, ethyl *o*-mesyl-glycolate as a precursor, NaOH, and ethanol. No-carrier-added [^{18}F]fluoride in enriched ^{18}O water was trapped on a Waters Sep-Pak QMA light cartridge and then the [^{18}F]fluoride was eluted with the mixture of kryptofix 2.2.2. (22.6 mg) and K_2CO_3 (4.2mg) in 0.6 ml of 50% acetonitorile/water. The eluate was transferred into the reactor, and then water was azeotropically evaporated three times at 100°C under nitrogen gas flow with anhydrous acetonitrile. After the drying step, 15 mg of ethyl *o*-mesyl-glycolate in 0.5 ml of anhydrous acetonitrile was added to the dried residue in the reactor. The labeling reaction to synthesize ethyl [^{18}F]FA was conducted at 110°C for 5 or 10 min in the sealed condition. Then hydrolysis reaction was performed with 1 ml of 1 M NaOH solution at 50°C or 80°C for 10 min. Finally, the solution was transferred to HPLC purification system.



Scheme 1. Synthesis of [^{18}F]fluoroacetate

Results: In the labeling step, the yield of fluorination was 55% for 5 min and 72% for 10 min, respectively. In the hydrolysis step, the yield of [^{18}F]FA was 50% at 80°C and 93% at 50°C, respectively. Therefore, we chose 10 min for the labeling and 50°C for the hydrolysis step. This automated procedure was achieved with a high and reproducible radiochemical yield exceeding 45% (decay uncorrected) within the synthesis time less than 50 min.

Conclusions: The automated synthesis of [^{18}F]FA using Synthera has been accomplished. This work widens the application of the Synthera and should provide the Synthera users with easy access to [^{18}F]FA for PET imaging.

References: [1] Ponde DE, et al., (2007), *J Nucl Med.*, 48(3), 420-8, [2] Matthies A, et al., (2004), *Eur J Nucl Med Mol Imaging*,, 31(5), 797, [3] Sun LQ, et al., (2006), *Nucl Med Biol.*, 33(1), 153-8.