Automated cassette-based synthesis of [^{18}F]FAPI-74 via [^{18}F]AlF strategy for routine production in a GMP environment

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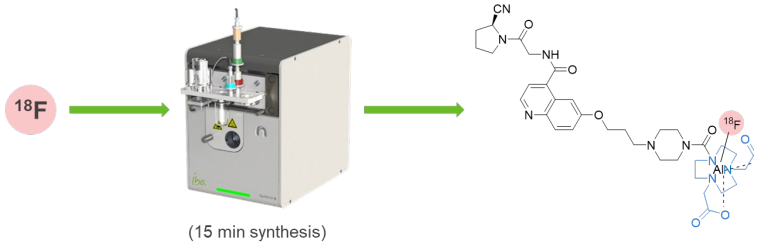
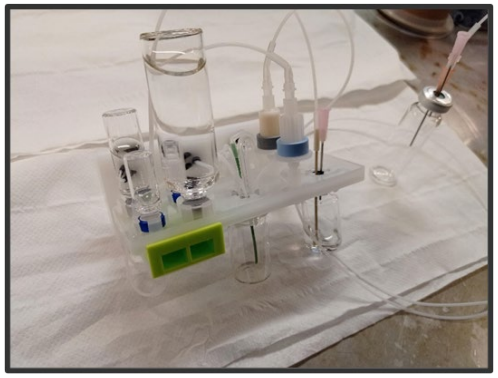
INTRODUCTION

Fibroblast activation protein (FAP) is overexpressed in the stroma of a variety of cancer types in humans[1]. For this reason, such target is considered a very attractive imaging biomarker. Recently, small molecules labelled with PET isotopes, in particular Fluorine-18, targeting FAP have emerged[1,2,3]. Robust automated synthesis in a GMP environment is crucial to ensure a reliable routine production of this radiopharmaceutical. In this abstract, optimized_and fully automated synthesis of [^{18}F]FAPI-74 in a disposable, cassette-based module and its quality control results will be described.

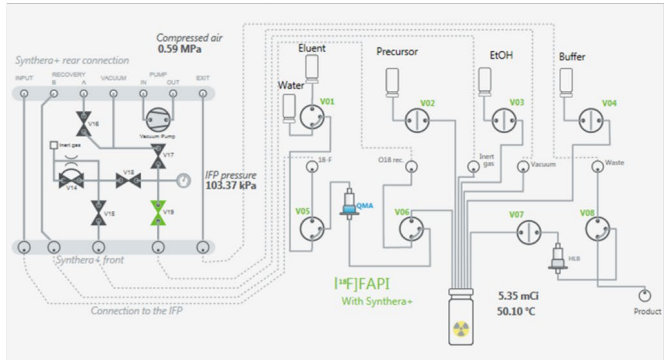


MATERIALS AND METHODS

One-pot automated synthesis has been established on a cassette-based synthesizer. The [^{18}F]fluoride was trapped on a QMA cartridge and eluted with 500 µL of a mixture of EtOH/NaCl 0.9% (2:3) into the reactor. Subsequently, the precursor solution (72 µL of aqueous solution of FAPI-74 precursor (1 mg/mL), 300 µL MeCN, 300 µL of a 20 mM ascorbic acid solution and 10,8 µL of 10 mM $AlCl_3$) is added to the same reactor. The fluorination was performed at 100 °C for 5 minutes. The reaction mixture was then diluted with Ascorbate buffer (pH 4.7) and purified with HLB light cartridge. [^{18}F]FAPI-74 was eluted with 3 mL of ethanol 66%. Final formulation can be adapted by end-user depending on desired shelf-life. The overall synthesis time was 20 minutes. Quality control tests were performed including appearance, pH, radionuclidic purity, radiochemical purity, chemical purity and residual solvents.



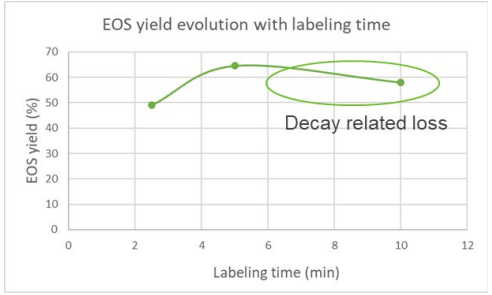
- [^{18}F]F-FAPI-74 visual pathway and sequence



1. ^{18}F trapping on QMA
2. QMA cleaning
3. ^{18}F Elution to reactor
4. Precursor addition
5. Labeling (5 min, 100°C)
6. Dilution
7. Trapping on HLB
8. HLB cleaning (2x)
9. HLB elution

RESULTS

In this present study, automated radiosynthesis of [^{18}F]FAPI-74 has been achieved with radiochemical yields varying from approximately 50% non-decay corrected (n.d.c) for incoming activity up to 74 GBq and >30% n.d.c. at incoming activities as high as 111 Gbq. In all cases, radiochemical purity was >95% and residual solvents below ICH Q3 limits.



CONCLUSION

Fully automated, optimized and simplified synthesis of [^{18}F]FAPI-74 has been obtained on cassette-based module with high radiochemical and chemical purity. Ready-to use consumables will be made available to help streamline routine clinical production in a GMP setting.

REFERENCES

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