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STUDY OF RADIONUCLIDE IMPURITIES IN ^{18}F-METIL-CHOLINE: SETUP OF THE MEASUREMENT GEOMETRY FOR HIGH-PURITY GERMANIUM GAMMA-RAY SPECTROMETER

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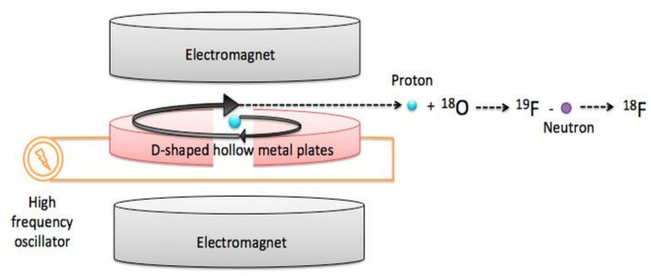
✓Gamma-spectrometry
✓Quality Control
✓Radiopharmacy

BACKGROUND

The Positron Emission Tomografy (PET) use radiopharmaceuticals labeling with β⁺ emetting isotopes.
^{18}F is the most commonly used radioisotope in PET and is producted in medical cyclotron.
During the bombardment of target of with [^{18}O]water to produce the radiopharmaceutical ^{18}F-Metil-Choline, are generated radionuclidic impurities.
For the European Pharmacopoeia these impurities have to be checked before application for human use.

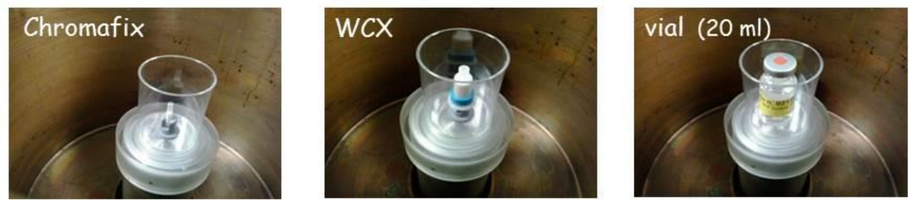
PURPOSE

In this work we have setup the accurate geometry for measurements with HpGe spectrometer to assess radionuclidic impurities generated during the production of ^{18}F-Metil-Choline.

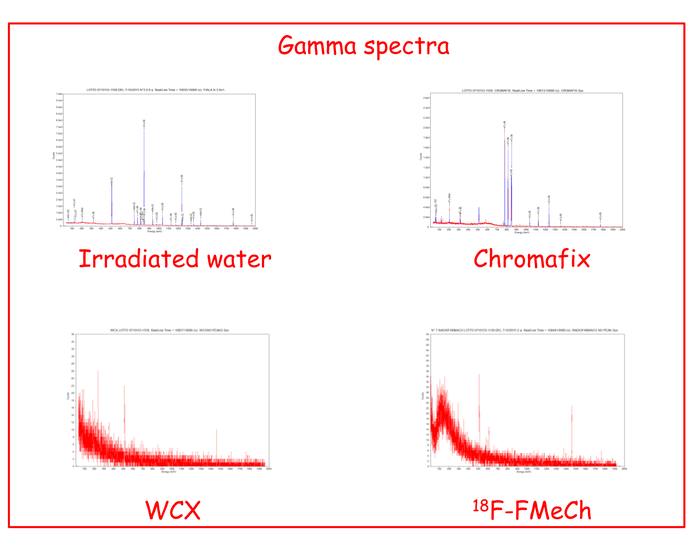


MATERIALS AND METHODS

High-resolution gamma spectrometry is the most appropriate method to determine gamma-emitting radionuclides, but it needs a correct geometry for the measurement.
Samples from the different steps of production process were collected: [^{18}O] irradiated water, waste target water, Chromafix cartridge, waste Chromafix water, WCX cartridge, final waste water and ^{18}F-FMeCh.
The counting of samples was carried out after an appropriate period to allow for the complete decay of ^{18}F. Liquid samples were analysed by volumetrically diluting an appropriate quantity of each solution (2 ml) with distilled water to a volume of 15 ml.
The cartridges Chromafix and WCX were measured by placing the samples directly over the detector, through a support.
The counting efficiency was established using a certificated standard Amersham, containing ^{241}Am, ^{133}Ba and ^{152}Eu (beaker Bertocchi 100 ml).
We used Gespecor software to transfer the efficiency calibration from the geometry of standard to the geometry of the samples and the analysis was performed using the GammaVision analysis software

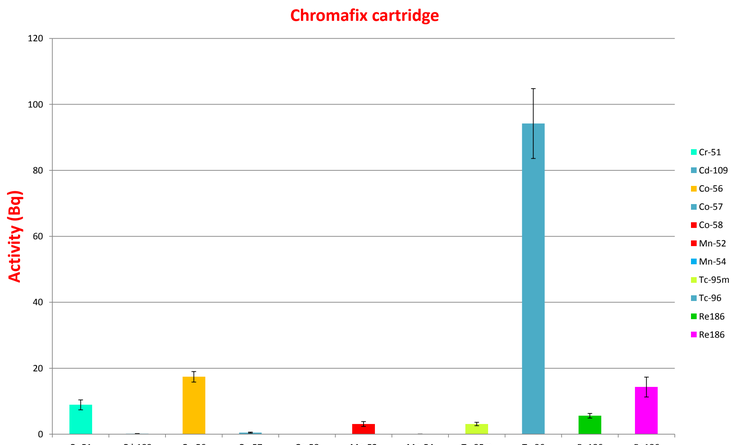


Sample geometry



RESULTS

The data showed the presence of gamma-emitting: **^{51}Cr, ^{52}Mn,^{54}Mn, ^{56}Co, ^{57}Co, ^{58}Co, ^{95m}Tc, ^{96}Tc, ^{109}Cd, ^{184}Re and ^{186}Re in the [^{18}O] irradiated water.**
In final ^{18}F-FMeCh solution, the activity of impurities was lower of the minimum detectable activity of the spectrometer



CONCLUSIONS

- ✓ The software Gespecor has enabled to determine the radionuclides impurity with a single calibration source and to confirm the radiochemichal purity of ^{18}F-Metil-Choline
- ✓ Contaminants have been identified in all stage of the synthesis process but they were absent in the final product.
- ✓ The purification methods adopted are effective as requested by patient's radiation protection standards and European Pharmacopoeia.

sample	Cr-51 (Bq/g)	Cd-109 (Bq/g)	Co-56 (Bq/g)	Co-57 (Bq/g)	Co-58 (Bq/g)	Mn-52 (Bq/g)	Mn-54 (Bq/g)	Tc-95m (Bq/g)	Tc-96 (Bq/g)	Re-184 (Bq/g)	Re-186 (Bq/g)
^{18}O irradiated water	2,03±0,85	7,5±1,8	354±23	10,3±1,3	3,23±0,97	93±15	38±12	1,18±0,32	40,2±4,4	1,1±0,35	2,2±1,5
target's waste water	<MDA	4,9±1,7	265±19	7,3±0,8	3±0,3	39,4±4,5	1,1±0,3	<MDA	2,5±0,6	0,06±0,04	<MDA
Chromafix waste water	<MDA	7,3±7,6	275±19	6,25±0,63	2,58±0,39	20,6±6,4	1,07±0,34	<MDA	<MDA	<MDA	<MDA
Final waste water	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
^{18}F-FMeCh solution	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA

sample	Cr-51 (Bq)	Cd-109 (Bq)	Co-56 (Bq)	Co-57 (Bq)	Co-58 (Bq)	Mn-52 (Bq)	Mn-54 (Bq)	Tc-95m (Bq)	Tc-96 (Bq)	Re-184 (Bq)	Re-186 (Bq)
Chromafix cartridge	8,9±1,5	0,16±0,04	17,4±0,18	0,48±0,15	<MDA	3,1±0,75	0,04±0,02	3,1±0,5	94,2±10,6	5,6±0,7	14,3±3
WCX cartridge	<MDA	<MDA	0,47±0,18	<MDA	<MDA	<MDA	<MDA	<MDA	0,26±0,07	<MDA	<MDA

MDA= minimum detectable activity

There is no potential conflict of interest to disclose