

$^{82}\text{Sr}/^{82}\text{Rb}$ production: characterization and quantification by mass spectrometry of various 18-crown-6 crow-ethers release induced by radiation of Sr resin®

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Introduction

- ^{82}Rb ($T_{1/2}=75$ s) used in cardiology
 - ✓ β^+ emitter used in PET imaging
 - ✓ Obtained from ^{82}Sr ($T_{1/2}=25.35$ d) generator
- ^{82}Sr produced in high energy accelerators via the $^{85}\text{Rb}(p,4n)^{82}\text{Sr}$ reaction from RbCl targets or Rb metal targets
 - ✓ Nowadays purified by ion exchange chromatographic process using three different columns (Biorad Chelex-100, DOWEX1x8, DOWEX50x8)
 - Potential contaminations of Ba or Ca (Sr competitors) in the final solutions that can imply release of Sr during the use of the generator

An alternative way for ^{82}Sr purification is proposed using a Sr-spec resin from Triskem.

- Discarding of Ba and Ca
- The authorities require that no component of the resin is released in the ^{82}Sr final solution

Context

The resin is an impregnated resin

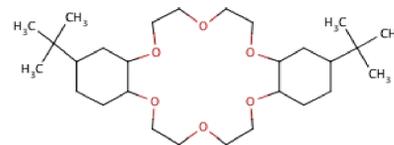


Few Ci of ^{82}Sr

Up to 1 kGy

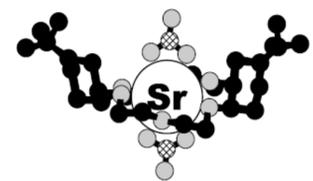
1. sorption of Sr in HNO_3 4M and elution of impurities
2. Elution in HNO_3 0.01M

Extracting agent



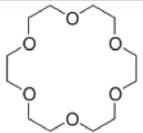
4',4''(5'')-Di-tert-butylidicyclohexano-18-crown-6

Extracted complex

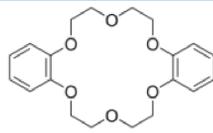


To validate the use of this resin, we have to determine the different species leaching during purification

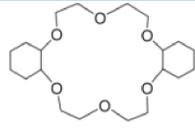
Qualitative analysis



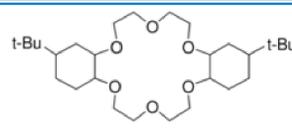
M = 264,32 g/mol



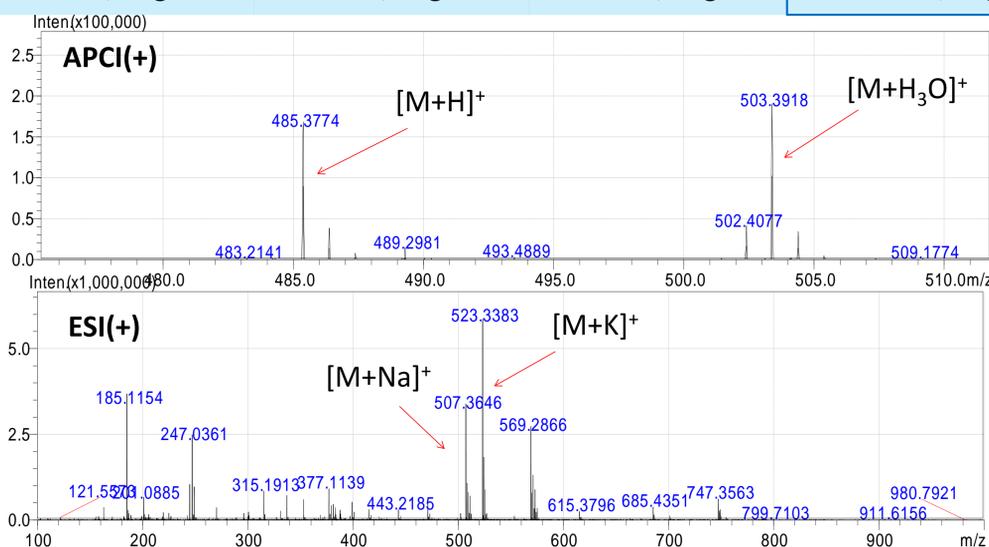
M = 360,40 g/mol



M = 373,25 g/mol



M = 484,71 g/mol

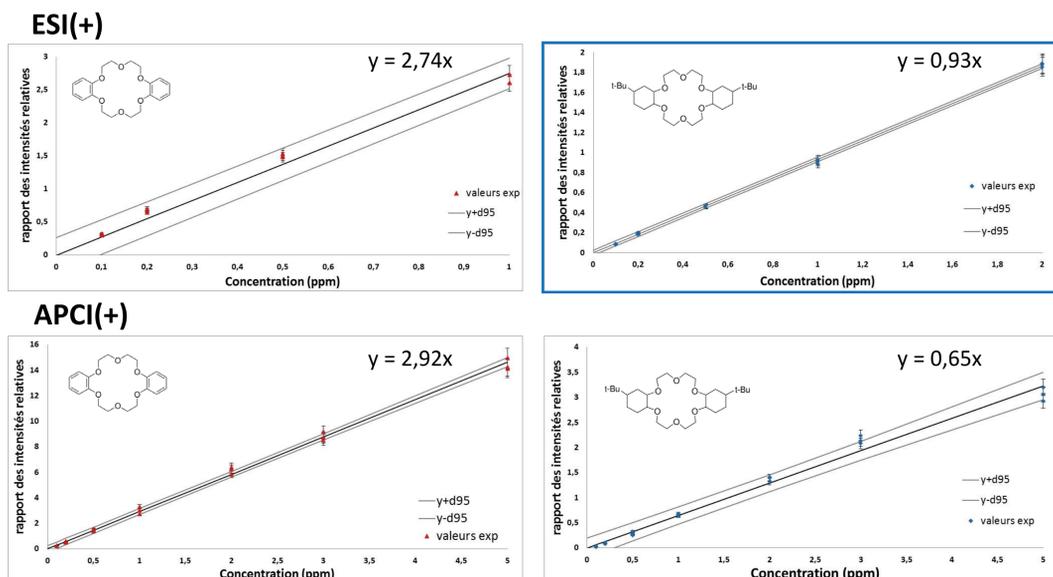


- Injection by infusion in aqueous solutions
- APCI and ESI
 - ✓ are soft ionization modes (minimizing fragmentations)
 - ✓ have been tested and optimized for crown ethers
- Sheathing solvent
 - ✓ 50% ultra pure water 50% methanol

Results

The study established that the APCI (+) mode is most favorable for the analysis of Crown ethers. This last reduces significantly the interference due to the analytical environment.

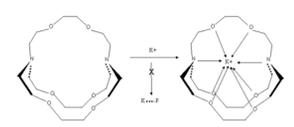
Quantitative analysis



- Linear results of different crown ethers as a function in concentration
 - ✓ Quantification of degradations products
- Higher sensitivity via ESI(+) method
 - ✓ **LD = 28.32 ppb**
(4',4''(5'')-Di-tert-butylidicyclohexano-18-crown-6)
- To improve the limit of detection, we developed a liquid-liquid extraction process by octanol to pre-concentrate the crown-ether
 - ✓ **LD can be divided by ten : LD=2.832 ppb**

First results

In the Sr solution, crown-ether quantity is less than 68.4 μg for more than 2 Ci. The maximum quantity is also 3.42 $\mu\text{g/generator}$ which corresponds to the maximal injectable to human*



* The only existing reference in Eur. Pharmacopeia : 50 μg of kryptofix 222 / day (crown ether used for purification of F-18)

Conclusion and Further Works

The determination of crown ether released by leaching from the non-irradiated resin is possible. Mass spectrometry techniques are suitable tools to achieve this aim qualitatively and quantitatively. A step forward is to move on irradiated resin.