NAT2020 & RMSP-VI, Daejeon, 2020.11.12~13.

* ysha19840704@kaeri.re.kr

Preliminary study on ion exchange adsorber for the development of $^{82}Sr/^{82}Rb$ generator

Yeong Su Ha*, Kye-Ryung Kim

Korea Multi-purpose Accelerator Complex, Korea Atomic Energy Research Institute

Introduction

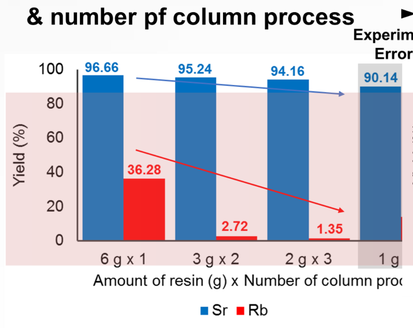
- Nuclear imaging: one of the most powerful means available for non-invasive diagnosis of myocardial disease
- Several radionuclides are available for myocardial perfusion imaging
  - ^{13}N, ^{15}O, ^{201}Tl: Cyclotron and ^{82}Rb, ^{99m}Tc: Generator
- Advantages of ^{82}Rb-PET compared with ^{99m}Tc-SPECT in the diagnosis of myocardial disease
  - ^{82}Rb as a positron emitter allows the full advantages of PET such as image quantification with superior sensitivity, diagnostic performances
- A medical radioisotope ^{82}Rb is generator-produced from its parent radioisotope ^{82}Sr
  - KOMAC already reported that high purity Sr to meet appropriate specifications was prepared by an optimized purification method

➢ Here, to select the appropriate ion exchange absorber in generator system, various studies on absorber were conducted as a follow-up study

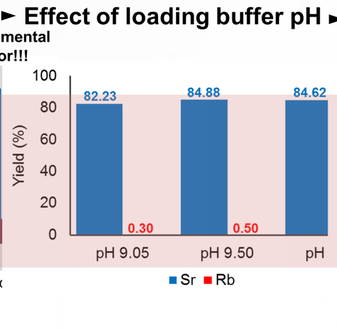
** PET : positron emission tomography*
** SPECT : single photon emission computed tomography*
** KOMAC : Korea Multi-purpose Accelerator Complex*

Previous work

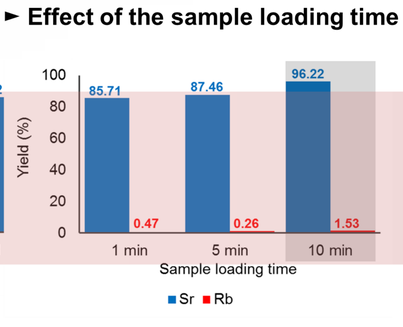
► Effect of amount of Chelex-100 & number pf column process



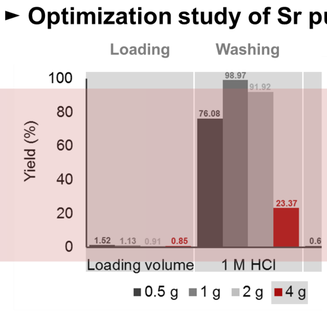
► Effect of loading buffer pH

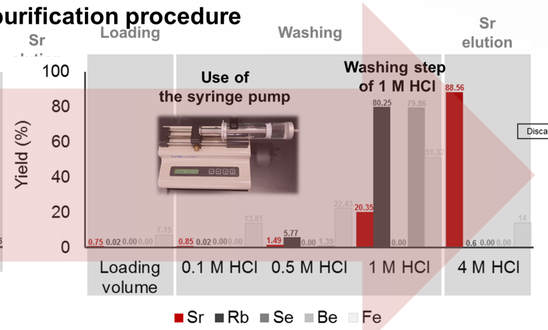


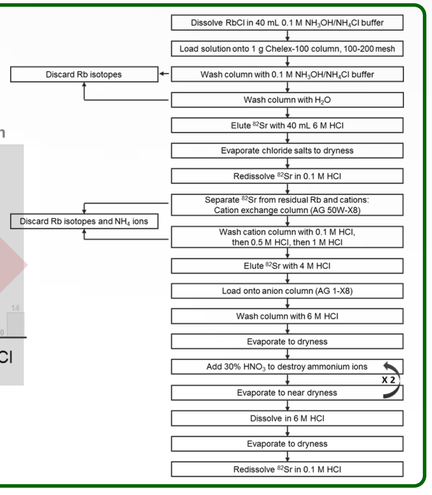
► Effect of the sample loading time



► Optimization study of Sr purification procedure

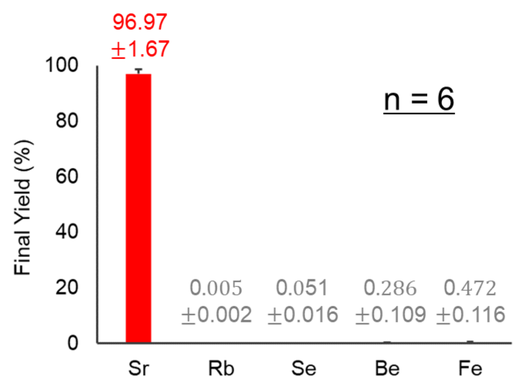




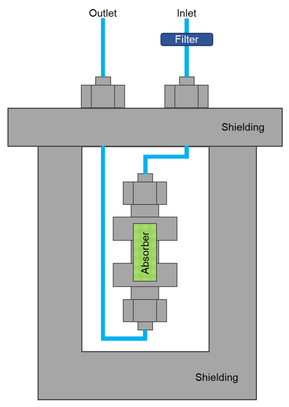


Experiments and Results (Cold Model)

● Validation of ^{82}Sr purification procedure



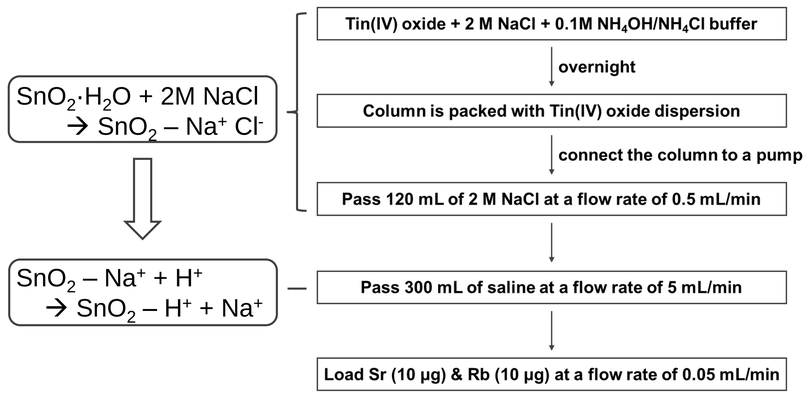
● Schematic diagram of $^{82}Sr/^{82}Rb$ generator



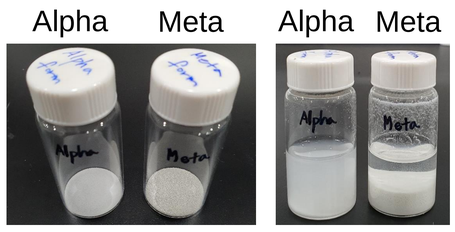
- Five components

① Injection line
② Filter
③ Column (Sr adsorbent)
④ Elution line
⑤ Lead shielding

● Procedure for the adsorption of ^{82}Sr into column



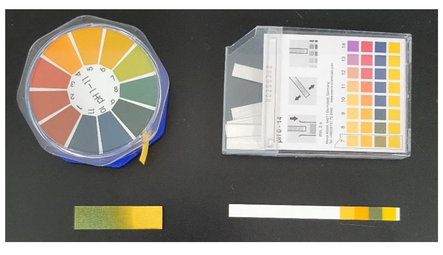
● Comparison between meta- & alpha-form adsorbent



- The meta-form is more crystalline (plan to add XRD data)
- The alpha-form is acid soluble

● Visual inspection & pH measurement of eluate

- Clear solution



- pH : 7.49 (neutral)

● Study on the adsorption of Sr into the generator column (cold model)

Tin(IV) oxide size (μm)	pH	Temperature (°C)	Adsorption yield of Sr (%)
250 ~ 500 (alpha + meta)	7	50	76.7 (6.92 μg/9.02 μg)
250 ~ 500 (alpha + meta)	8	50	76.6 (6.85 μg/8.94 μg)
125 ~ 250 (alpha + meta)	10	room temperature	74.5 (6.56 μg/8.81 μg)
250 ~ 500 (alpha + meta)	10	room temperature	64.2 (5.83 μg/9.08 μg)
no filtration (alpha + meta)	10	room temperature	58.6 (5.20 μg/8.87 μg)
75 ~ 150 (alpha)	10	room temperature	**96.4** (7.23 μg/7.50 μg)

*Custom order (Keeling & Walkers)

- Low ion-exchange yield or Sr was observed in the mixture of alpha- and meta-form adsorbent
  → higher ion-exchange yield of Sr (96.4%) in the pure alpha-form adsorbent
- Total 9 times test was conducted : adsorption yield of Sr was **97.62±1.57%**

Conclusion & Future plan

- **Our research group is trying to apply the optimized purification procedure to radioactive ^{82}Sr for reliable ^{82}Sr production**
- **We drew a schematic diagram of $^{82}Sr/^{82}Rb$ generator system**
- **We performed comparison studies on characteristics of ion exchange absorber**
- **We found that alpha-form absorber for the generator column showed higher ion-exchange ability than those of meta-form absorber**
- **Finally, enough adsorption yield of Sr (97.62±1.57%) was shown in alpha-form absorber**

Acknowledgement: This work has been supported through KOMAC (Korea of Multi-purpose Accelerator Complex) operation fund of KAERI by MSIP (Ministry of Science, ICT and Future Planning)