춘계한국원자력학회, Virtual, 2021.5.13~14.

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Study on hydrous tin(IV) oxide adsorbent for a $^{82}Sr/^{82}Rb$ generator system

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Introduction

- Despite remarkable medical advances in recent decades, cardiovascular disease remains as one of the most common causes of high morbidity and mortality worldwide
  - an early diagnosis is of paramount importance
    → various imaging modalities have been developed & are increasingly used
    ➔ to improve the diagnosis and prognostic classification of patients at risk of cardiovascular diseases including positron emission tomography
- Rubidium (Rb), an alkali metal ion
  - acts biologically like potassium & accumulates in cardiac muscle tissue
  - a rapid blood clearance profile
    → allows the use of ^{82}Rb (β+ emitter) with an ultra-short physical half-life of 75 sec for non-invasive evaluation of regional cardiac blood flow
    ➔ ^{82}Rb can be produced from a generator system by the decay of its 25.5-day half-life parent ^{82}Sr
- Since no history of the use of ^{82}Rb radioisotope for research or medical purpose in Korea
  - Korea multi-purpose accelerator complex (KOMAC) has plan to produce ^{82}Sr with certain purity & develop $^{82}Sr/^{82}Rb$ generator system

➢ Here, we report the results on characteristic studies of adsorbent in the generator system.

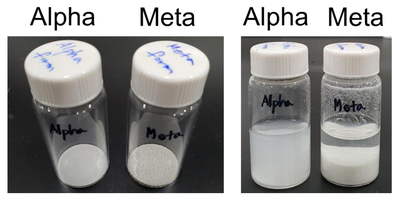
Previous work

● **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)

● **Comparison between meta- & alpha-form adsorbent**

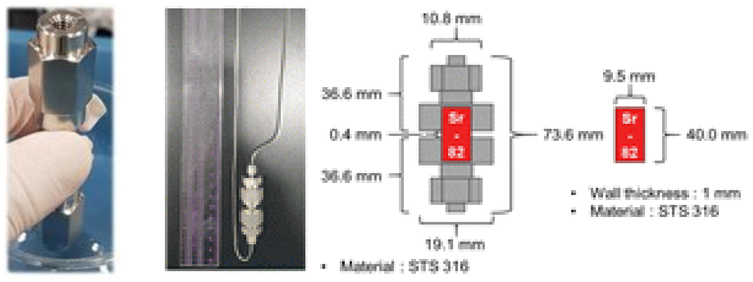


- The meta-form is more crystalline
- The alpha-form is acid soluble

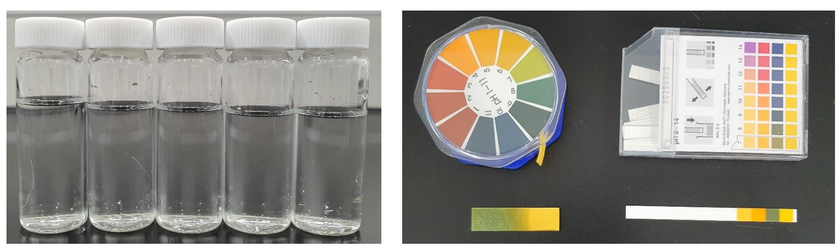
→ higher ion-exchange yield of Sr (96.4%) in the pure alpha-form adsorbent
- Total 9 times test was conducted : adsorption yield of Sr was **97.62±1.57%**

Experiments and Results (Cold Model)

● **Picture & size of $^{82}Sr/^{82}Rb$ generator column**



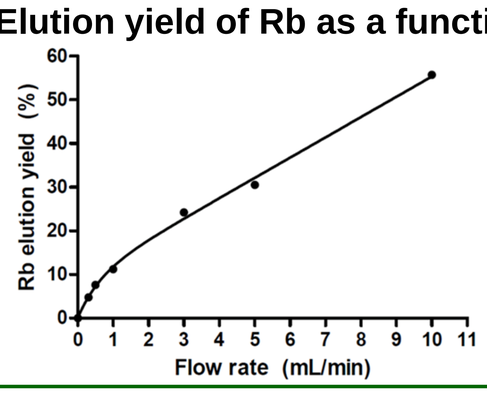
● **Visual inspection & pH measurement of eluate**



- Clear solution - pH : 7.49 (neutral)

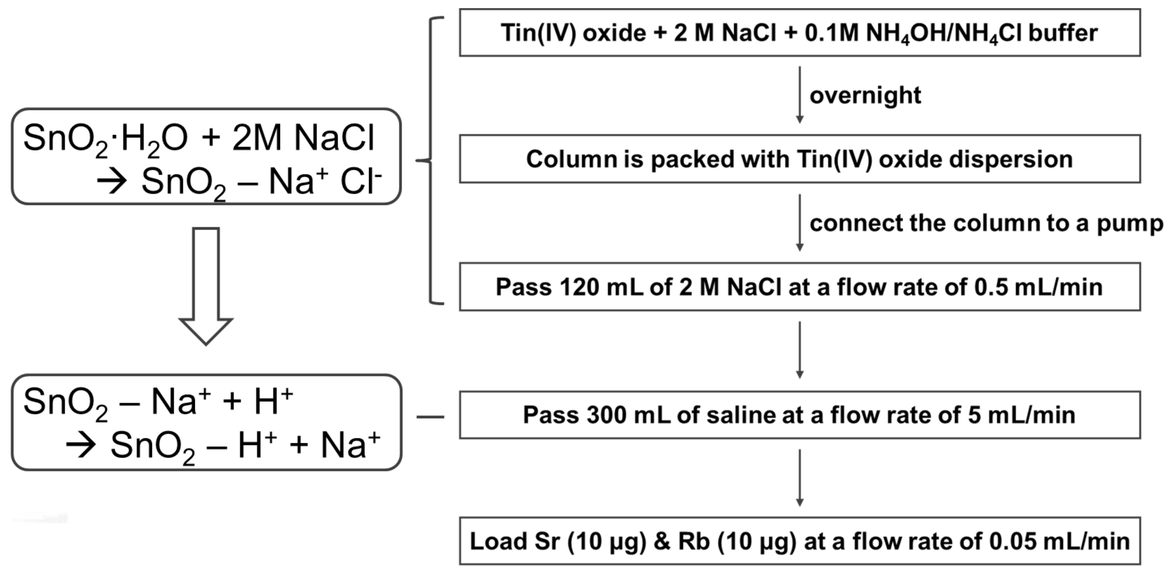
→ direct administration of ^{82}Rb into animal models or patients for medical purposes

● **Elution yield of Rb as a function of flow rate**



- the Rb elution yield varies between 4.79 and 55.74% for a flow rate between 3 and 10 mL/min

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



- the adsorption of Sr into the generator column was **98.36 ± 0.61%** (n = 7)
- no significant Sr breakthrough was observed by ICP-MS analysis of the elution solution from the generator column
- distribution coefficients (K_D) for the equilibration of Sr(II) and Rb(I) between hydrous tin oxide and 0.15 M NaCl solutions (pH 7.2)
  → the K_D value of Sr(II) : 47,000 ~ 58,000
  → the corresponding K_D value of Rb(I) : 2.5 ± 1

Conclusion & Future plan

- **Hydrous tin(IV) oxide in sodium cation form shows promise as a cation exchange adsorbent for a $^{82}Sr/^{82}Rb$ generator**
- **The prepared hydrous tin oxide adsorbent could be used for development of a $^{82}Sr/^{82}Rb$ generator**

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)