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New technique for Producing Therapeutic Radioisotope ^{89}Sr

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1. Introduction

Recently, many therapeutic techniques by using radioisotopes have been developed, and the demands of radioisotopes are increased, in the medical application. The researches for production of radioisotopes are widely performed. In this study, the requirement of neutron generator for producing the therapeutic radio-isotopes ^{89}Sr was studied and the production rate was calculated.

2. Methods and Results

The study for nuclear reaction and cross section data to produce ^{89}Sr has been performed in the previous work [1], and cylinderical neutron generator is being developed in our group [2,3].

The feasibility study has been performed, for producing therapeutic radioisotope ^{89}Sr by using cylindrical neutron generator. The optimized production rate of radioisotope is calculated. The nuclear reaction for radioisotope production is $^{89}Y(n,p)^{89}Sr$ by the 14 MeV neutron of D-T neutron generator, and radio-isotope target is Y_2O_3 compound.

2.1 Source-Target Geometry

The neutron generator is cylindrical shape, and neutron is generated in the surface of center cylinder. The radioisotope targets were positioned in the outer boundary and center core of neutron generator. Figure 1 is schematic diagram of target geometry; (B) is cylinder for neutron generation, (A) and (C) is radioisotope target of center core and outer boundary. The production rate can be enlarged with the expandable diameter and length in the cylindrical neutron generator.

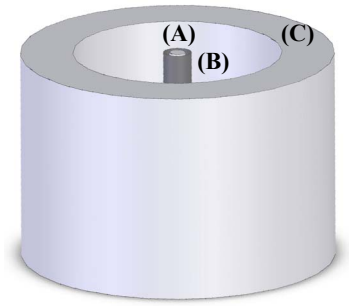

Figure 1. Schematic diagram of neutron source(B) and RI production target(A, C).

2.2 MCNP Simulation

The production rate of radioisotope was calculated by using the MCNP simulation code [4]. Table 1 describes the dimension of neutron generator and radioisotope targets.

Table 1. the dimension of neutron generator and radioisotope targets.

Component		Diameter [mm]	Height [mm]
Neutron Generator	overall	200	200
	Center cylinder	10	200
Radioisotope Target	Center core	5	200
	Outer boundary	200 - 300	200

It is assumed that the neutron generation rate is the 10^{11} n/s, with energy of 14 MeV. As the result of simulation, the neutron flux in the center target is 3×10^9 /cm^2 sec, and for the outer target, about 1.8×10^8 /cm^2 sec. Figure 2 shows the reaction rate in the outer target, layer of diameter 220 ~ 240 mm.

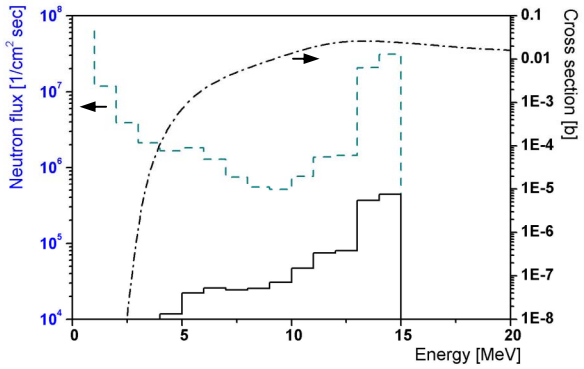

Figure 2. The reaction rate of ^{89}Sr in the outer target(solid line ; layer of diameter 220 ~ 240 mm)

2.3 Radioisotope Production

the optimized target geometry was confirmed in the previous study[1]. The irradiation time of target is about 50 days(1 half-life) . The outer target is about 20 kg of weight, in the boundary of neutron generator. The production rate of ^{89}Sr is about 200 MBq, 0.27 mCi per kg of Y_2O_3 target. The center target is about 50 g of

weight. The production rate of ^{89}Sr is about 10 MBq, 6 mCi per kg of Y_2O_3 target. The efficiency in the center core target is about 20 times than outer target.

3. Conclusion

The feasibility study for producing therapeutic radioisotope ^{89}Sr has been performed. The development of cylindrical neutron generator and research for chemical separation of radioisotopes must be investigated in advance.

REFERENCES

[1] Suk-Kwon Kim, In Jung Kim and H.D. Choi, Requirement for D-T Neutron Generator to use for Producing Therapeutic Radioisotopes, Proceedings of the Korean Nuclear Society Autumn Meeting, Oct. 2004, YongPyong, Korea.

[2] In Jung Kim, Suk-Kwon Kim, Chang Su Park, Nam-Suk Jung, Hwa-Dong Jung, Ji-Young Park, Yong-Seok Hwang and H.D. Choi, Experiment of Neutron Generation by Using Prototype D-D Neutron Generator, Proceedings of the Korean Nuclear Society Spring Meeting, May 2005, Jeju, Korea.

[3] Kyoung-Jae Chung, Min-Joon Park, and Yong-Seok Hwang, A Coaxial Neutron Generators Using RF Plasmas, 7th US-Japan Workshop on Inertial Electrostatic Confinement Fusion, March 2005, LANL, USA.

[4] J.F. Briesmeister, Ed., "MCNP - a general Monte Carlo N-particle transport code, version 4C", LA-13709-M, Los Alamos National Laboratory, 2000.