

## Isolation of At-211 by dry-distillation under oxidative conditions for targeted alpha therapy in Osaka University

Astatine (At)-211 is one of the most promising radionuclides for the targeted alpha therapy (TAT). In Osaka University, we have recently started the collaborative project for the TAT using  $^{211}\text{At}$  which can be produced in nuclear reactions using an accelerator. At present, cyclotron production, chemical separation, radiopharmaceuticals preparation, and pre-clinical trials of  $^{211}\text{At}$  are under study. In this contribution, our cyclotron production and chemical purification of  $^{211}\text{At}$  are presented.

Astatine-211 was produced in the  $^{209}\text{Bi}(\alpha, 2n)^{211}\text{At}$  reaction at Research Center of Nuclear Physics (RCNP), Osaka University. A thin metallic Bi target was bombarded by 28.2-MeV  $^4\text{He}^{2+}$  beam with 0.5-1 particle  $\mu\text{A}$  for a few hours. The Bi target was set at  $45^\circ$  to the beam axis in an irradiation chamber. Beam energy was adjusted to avoid simultaneous synthesis of  $^{210}\text{At}$  decaying into highly toxic  $^{210}\text{Po}$ . After the irradiation, dry distillation was carried out with a simplified distillation apparatus to isolate  $^{211}\text{At}$  from the target materials. We used mixed helium and oxygen gas and also added a moisture content in the distillation system to yield oxidized At species which are easily transported, trapped, and dissolved in a small volume of distilled water. The irradiated Bi target was heated at  $840^\circ\text{C}$ . Vapored At species were transported to a Teflon tube cooled with ice water. During accumulation of  $^{211}\text{At}$  in the trap, a trapped amount of  $^{211}\text{At}$  was monitored with a CdTeZn detector. After a few tens of minutes, trapped  $^{211}\text{At}$  was stripped with 100  $\mu\text{L}$  of distilled water at a flow rate of 250  $\mu\text{L}/\text{min}$ . The radioactivity of  $^{211}\text{At}$  was determined by  $\gamma$ -ray spectrometry using a Ge detector. The  $^{211}\text{At}$  solution was supplied to pharmaceutical preparations, pre-clinical tests, and/or our chemical analysis. Recovery yield of  $^{211}\text{At}$  was 70-80% under optimum conditions. The separation time was typically within 30 min. In the symposium, results on our chemical analysis will be also presented.

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