

## Introduction

Tritium is a representative low-energy beta emitter, mostly generated by atmospheric radiation by cosmic rays, or distributed in the atmosphere by conventional artificial nuclear experiments, and in modern times, it is also generated during operation of nuclear utilization facilities. Tritium has little effect in terms of external exposure because it emits beta radiation which has a short range that could not penetrate the stratum corneum of the skin. However, in the case of HTO form, which is the chemical molecular structure of water that is easy to be absorbed into the body, it cause internal exposure. Tritium could be homogeneously distributed in body organs and cells when it was inhaled or absorbed in the body, binding to specific molecules or tissues, and cause internal exposure. Therefore, when contamination air is discharged from the facility, we must continuously monitor the exhaust air to manage below the exhaust standard. For the analysis of low level tritium, it is sampled in exhaust air using molecular sieves or silica gel as absorbents. However, depending on the environment, season, and characteristics of the absorbent, the collection efficiency is different or the mechanical strength of the absorbent material is weak, so care should be taken when handling. In this paper, the analysis method that can efficiently measure low-level tritium was improved by supplementing the disadvantages of the absorbent used for the analysis of tritium in the exhaust air of facilities

## Method

### Method 1. Air Bubbling

- Bubbles air in deionized water
- Handling of the sample easy
- No pretreated required
- Measured by LSC (Bubbling sample)
- Suitable for high level utilization facilities (Not Suitable for low level utilization facilities)

&lt; Air Bubbler &gt;



&lt; LSC &gt;



### Method 2. Air Collection

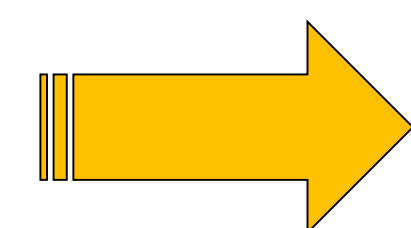
- Trapping air in the absorbent
- Silica gel or Molecular sieve is required as absorbent
- Different of absorption and mechanical strength by impact or friction depending on the porpirtise of the absorbent(Silica gel, Molecular sieve)
- Pretreated is required
- Extracts tritium from the silica gel or molecular sieve through an electric furnace and measured by LSC (Water type sample cannot be pretreated)
- Suitable for Low level utilization facilities (Adoptable for low level tritium)

&lt; Eelectric Furnace &gt;



### Method 3. New Air Bubbling

- Bubbles air in deionized water by Air Sampler
- Using a Natural pulp as absorbent
- It has excellent hygroscopic porterty, strong resistance and processed in various forms
- Pretreated is required
- Extracts tritium from the natural pulp through an electric furnace and measured by LSC (Water type sample can be pretreated)
- Suitable for Low level utilization facilities (Adoptable for low level tritium)



- ▶ 1 Step
  - Air exhausted form the stack is collected using air sampler
  - Tritium in the air is bubbled into deionized water
- ▶ 2 Step
  - Quantified the bubbling sample and absorbed by the natural pulp
- ▶ 3 Step
  - The pulp contained the water is put into a container of the electric furnace and burn it to extract tritium in 0.1M nitric acid solution
- ▶ 4 Step
  - The extracted solution is quantified and mixed with a scintillation cocktail
- ▶ 5 Step
  - Measured the level of tritium by LSC

※ This method can be extracted once more in the form of vapor by burning the bubbling sample before LSC measurement. So, tritium can be concentrated in the sample and lower MDA can be expected when masured by LSC

## Conclusion

In order to use this method as a low-level tritium analysis method, it is first necessary to study whether natural pulp is adoptable as an absorbent for the sample water. So, we will be to analyze the molecular structure, chemical properties and the degree of recovery from the natural pulp. It will compare between the methods using a natural pulp absorbent with using a silica gel or molecular sieve. If the effectiveness of this analysis method is proven, it is expected that it can be introduced as a low level tritium analysis method at nuclear facilities and related institutions.