

Application of thermogravimetric analysis for a high temperature combustion method of tritium analysis

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Content

There are the various forms of tritium in the environment. That can be classified as tissue free water tritium (TFWT), organically bound tritium (OBT) and total tritium with TFWT and OBT. TFWT which exists in the biological tissue is extracted by freeze-drying. After that, OBT can be extracted through combustion process for dry matter that has been washed repeatedly with TFWT. Various laboratories have used a number of different methods to analyze total tritium and OBT. These include oxidizer combustion, oxygen bomb combustion, plasma combustion and a high temperature combustion using tube furnace. In all methods, attention must be paid to two key points: complete combustion and prevention of contamination by ambient atmospheric moisture. One of those, a high temperature combustion using tube furnace is more efficient method for the limited samples and has been used a lot recently. However, there are problem of explosion and incomplete combustion for some environmental samples which include a large amount of organic matter. It cause flowing backward of tritium trapping solution and color quenching. So, this study applied thermogravimetric analysis (TGA) to a high temperature combustion using tube furnace for effective combustion without explosion and incomplete combustion. In this study, ignition points of samples were measured by making use of TGA for some samples which are nuclear waste (activated carbon, oil, resin, etc.) and environmental samples (potato, wheat, sediment, etc.). And, temperature steps of combustion method were determined in consideration of measured ignition points. Finally, we analyzed radioactivity of total tritium and OBT for each samples by combustion method applying the temperature steps. The reported mean values of tritium radioactivity were used to verify this method, and the results were in agreement with assigned radioactivity concentration in reference range. This study shows TGA of some nuclear waste and environmental samples and is aimed to demonstrate the process of stable and rapid combustion method.

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