

## Oral 4.1

### A STUDY ON EVALUATION METHODS FOR $^{210}\text{Pb}$ ACCUMULATION IN ADSORBENTS OF NATURAL GAS TREATMENT PROCESS

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Evaluation methods for  $^{210}\text{Pb}$  accumulation in the adsorbent of natural gas treatment process have been developed. These evaluation methods enable not only to predict the  $^{210}\text{Pb}$  concentration in the spent adsorbent but also to determine exchange period of adsorbent in order to keep the  $^{210}\text{Pb}$  concentration in adsorbent below the exemption level.

Natural gas includes natural radioactive gas  $^{222}\text{Rn}$ , which is a decay product of  $^{226}\text{Ra}$  existing in earth crust. The decay products of  $^{222}\text{Rn}$ , such as  $^{210}\text{Pb}$ ,  $^{210}\text{Bi}$  and  $^{210}\text{Po}$  may accumulate in natural gas plants, especially in adsorbent materials, because the half period of  $^{222}\text{Rn}$  is 3.8 days and that of  $^{210}\text{Pb}$  is 22.3 years. It is reported that the radioactivity concentration of spent adsorbents exceeded the exemption level and the spent adsorbents was disposed as radioactive waste.

It is desired that determine whether the radioactivity concentration of spent adsorbent is over the exemption level. However, it is impossible to measure  $^{210}\text{Pb}$  and its decay products,  $^{210}\text{Bi}$  and  $^{210}\text{Po}$ , in a vessel from the outside during operation because these nuclides do not emit high energy gamma ray. Therefore, the characterization of the spent adsorbent is carried out after exchange using radiochemical analysis.

For prediction of Rn decay products accumulation, evaluation methods for  $^{210}\text{Pb}$  accumulation in the adsorbent of natural gas treatment process have been studied. Two evaluation methods have been developed. One method evaluates  $^{210}\text{Pb}$  accumulation based on Rn absorption equilibrium coefficient of the adsorbent. The coefficient is determined by a break through curve from adsorbent column test using surrogate gas including Rn. The other method evaluates  $^{210}\text{Pb}$  accumulation based on the Rn adsorption amount determined by column test using real process gas. Our laboratory tests indicated that the latter method is an easy and practical evaluation method.