

## Tritium Removal from Tritiated Water Using Mesoporous Silica

A. Taguchi<sup>a,\*</sup>, Y. Torikai<sup>a</sup>, M. Saito<sup>a</sup>, M. Matsuyama<sup>a</sup>, M. Ogura<sup>b</sup>, S. Uchida<sup>c</sup>

<sup>a</sup>Hydrogen Isotope Research Center, University of Toyama, Gofuku 3190, Toyama 930-8555, Japan

<sup>b</sup>Institute of Industrial Science, The University of Tokyo, Komaba 4-6-1, Meguro-ku, Tokyo 153-8505, Japan

<sup>c</sup>Graduate School of Art and Science, The University of Tokyo, Komaba 3-8-1, Meguro-ku, Tokyo 153-8902, Japan

The recovery of tritium from a large volume and low concentration HTO is important for reducing tritium emissions into the environment. Several methods such as gas diffusion, distillation or electrolysis have been proposed for tritium removal, however, these methods are ineffective for managing a large volume of HTO. One desirable method is preconcentration of tritium. Selective removal of tritium from HTO by using certain adsorbents has been proposed. Various kinds of adsorbents such as active carbon, amorphous silica and zeolite have long been investigated, however, there is still controversy on the use of adsorbents. Therefore, development of novel adsorbents for tritium removal is an interesting subject. Mesoporous silica, e.g., MCM-41[1], exhibits several novel properties, as compared to conventional microporous zeolites. In particular, surface of mesoporous silica provides silanol groups which easily interact with various substrates to facilitate desired processes such as catalysis, host-guest interaction, and adsorption. In this study, we investigated the tritium adsorption abilities of MCM-41.

MCM-41 was prepared from a mixed solution of surfactant and colloidal silica according to the procedure given in the literature[1] with a slight modification. High-silica mordenite (HSZ-690HOA), low-silica mordenite (HSZ-640HOA) and Linde-type A (A-4) zeolites were purchased from Tosoh Corporation and used as comparison. Tritium adsorption experiments were carried out using the adsorbent (0.1–0.7 g) and 2.5 mL of HTO (0.5–50 kBq/mL). The mixed solution was continuously shaken in a water bath at 5 °C. After an adequate period, the solution was filtered and the tritium concentration in the filtrate was measured by LSC to evaluate the tritium removability.

The removability, defined as the ratio of the decreased amount of tritium to that of tritium in the mother solution, was of MCM (2.2%), MOR (1.8 %, high silica), MOR (1.7 %, low silica) and LTA (1.1 %) when using 5 kBq/mL of HTO and 0.2 g of adsorbent. This indicates that MCM-41 is promising for tritium removal. The rather high removability in MCM-41 is probably due to the conjugated silanol groups on the mesopore surface.

[1] C. T. Kresge et al., Nature 359 (1992) 710.