DISTRIBUTION OF TECHNETIUM-99 IN THE PACIFIC OCEAN

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INTRODUCTION

Studies on the behavior of ^{99}Tc in the environment have gained growing interest because our knowledge of the distribution and radioecology of the element is not so much. From an environmental point of view ^{99}Tc is a potential radionuclide that would give radiation dose to public people along with an increase of peaceful use of nuclear energy in future. The long half-life and the high fission yield in the nuclear fission of ^{235}U make it one of the remarkable radionuclides in nuclear waste. Most of ^{99}Tc produced by the peaceful use of nuclear energy have been under the controls, but a part of them has been already released to the environment, mostly during nuclear fuel reprocessing processes; the estimated amount of ^{99}Tc released from nuclear reprocessing facilities to the environment has exceeded that released from nuclear explosion tests conducted in 1950s-60s [1].

Beta ray counting system has been widely used for ^{99}Tc measurement in combination with radiochemical analysis [2,3]. However, few data have been reported on its distribution in the environment because of technical difficulty and low concentration. Recent development of inductively coupled plasma mass spectrometry (ICP-MS) enables us to analyze very low-level ^{99}Tc in the environment. We have developed a new analytical procedure using ICP-MS for measurement of ^{99}Tc [4,5] and the developed technique was applied to determination of ^{99}Tc in coastal and open seawaters.

EXPERIMENTAL

Filtered coastal seawater samples were collected at the Fishery Research Laboratory, Kyushu University, Fukuoka, Japan (33.8° N, 130.2° E). The sampling location is shown in Fig. 1. The coastal seawater was taken in two 500 l plastic containers from one of the utilities supplying fresh seawater to experimental aquariums in the laboratory. The sampling was carried out in winter and in summer in 1993. At the sampling in summer, seawater was also collected into a 50 l plastic container for ^{137}Cs analysis. The sample volume of the seawater and the sampling date are summarized in Tables 1. Technetium-99 in the sample was enriched by the repetitive coprecipitation method [4], and ^{137}Cs in the sample was adsorbed on ammonium molybdophosphate (AMP).

Surface ocean seawaters in the North Pacific Ocean, the South Pacific Ocean, and Tasman Sea were sampled during the oceanographic expedition KH-92-4 cruise of the Hakuhomaru belonging to the Ocean Research Institute, The University of Tokyo. The ship left Harumi wharf, Tokyo in September 16, 1992, and arrived at Cairns, Australia in October 26, 1992. During the cruise 6 ocean seawater samples were collected. Sampling date and volume of the