Transfer of Radionuclides to Marine Organisms

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Abstract

A commercial large-scale nuclear fuel reprocessing plant in Rokkasho, Aomori Prefecture, Japan is now under final safety assessment by the Nuclear Regulation Authority. Radionuclides including tritium and radioiodine are discharged by the normal operation of the plant. In order to assess the realistic impact of those radionuclides, it is important to understand the processes of their accumulation from seawater to marine organisms. In this research, we investigated the transfer of tritium and iodine from seawater and feed to scallop (*Mizuhopecten yessoensis*) and olive flounder (*Paralichthys olivaceus*), a commercially important fish found in the coastal waters of Aomori Prefecture.

Tritium in organisms is composed of two chemical forms: one is free water tritium (FWT) and the other is organically bound tritium (OBT) fixed by the organism metabolic activity. In order to assess realistically the impact of tritium discharged into seawater to the public, it is important to understand the processes of transfer and accumulation of tritium from seawater to marine organisms, especially OBT in them. In the experiment, the stable isotope of hydrogen, deuterium (D), was used as a substitute for tritium. Scallop (adult and young shellfish) were kept in seawater containing HDO with 2.0 mmol D mol^{-1} H up to 42 d. Non-exchangeable organically bound deuterium (NxOBD) concentration in their adductor muscle, mantle, gill, midgut gland, and gonad in adult shellfish was measured at the predetermined period after starting the exposure. For young shellfish, NxOBD concentration in their adductor muscle, mantle, and viscera (gill, midgut gland, and gonad) was measured at the predetermined period after starting the exposure. The transfer rate of each part was obtained. In scallops, the time to reach equilibrium was about one month, although it depends on the organ

In FY 2020, we constructed an experimental system for the long-term transfer of radioiodine (^{129}I) to olive flounder. As a result of measuring the iodine concentration in seawater of each aquarium system, the system using UV lamp and tank A (using coral and EHEIM MEC as a filter medium) affected the iodine concentration. These were not suitable for breeding experiment using iodine. In addition, as a result of ^{129}I seawater exposure experiment for a maximum of 28 days using the selected water tank system, no significant changes in seawater quality such as dissolved oxygen and pH were observed. Since no mortality of olive flounder was observed during the experiment period, it was clarified that an exposure experiment of about 28 days was possible under the breeding condition carried out.

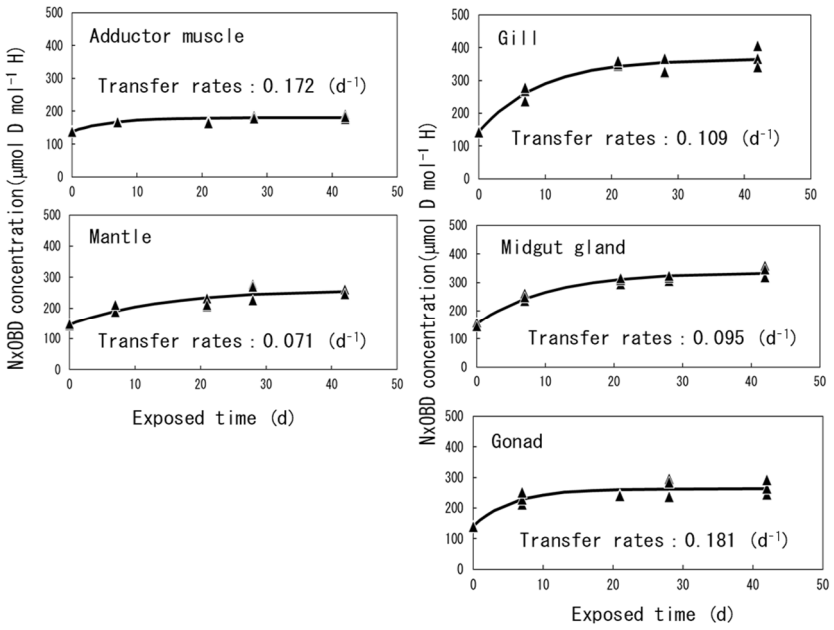

Fig. 1 Time dependent pattern of NxOBD concentration in each organ of the adult scallop during heavy water exposure in seawater.