# Transfer Parameters of Tritium from Seawater to Marine Organisms

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## Abstract

The operation of the commercial spent nuclear fuel reprocessing plant in Rokkasho is accompanied by the discharge of a certain amount of tritium into the Pacific Ocean. Although most of the tritium discharged is diffused and spread widely throughout the ocean, some part will be transferred into marine organisms living close to shore areas. 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. However, information on the transfer of tritium from seawater to marine organisms is quite limited. In this research, the transfer rates of tritium in seawater to OBT in several marine organisms are obtained for the realistic dose estimation of tritium discharged from the reprocessing plant. The OBT transfer through the food chain is also included in the scope of this study.

The stable isotope of hydrogen, deuterium (D), was used as a substitute for tritium in the research. Yellow striped flounder (*Pleuronectes herzensteinie*) were kept in seawater with HDO of 2000 ppm up to 150 d in the laboratory, and were analyzed for OBD concentration in their muscle. The concentration coefficient from HDO in seawater to OBD in muscle of the yellow striped flounder was determined as 0.25, and non-exchangeable OBD was found to be 73-78% of the total OBD in the muscle.

The concentration coefficient from HDO in seawater to OBD in marine seaweeds, *Ulva pertusa*, *Sargassum siliquastrum* and *Gloiopeltis fucata* were also estimated as 0.38, 0.27 and 0.28, respectively, by cultivation experiments in the laboratory.

Amphipods (*Ampithoe valida*) were fed on seaweed (*U. pertusa*) with elevated OBD concentration, and were kept up to 19 d in the laboratory. The consumed weight of the seaweed was measured in every feeding, and OBD values in the amphipods were analyzed. The two-compartment model of transfer of OBD from the seaweed to *Ampithoe valida* was constructed by using results of the experiment; the estimated values by the model agreed well with the experimental results with a correlation coefficient of 0.85.

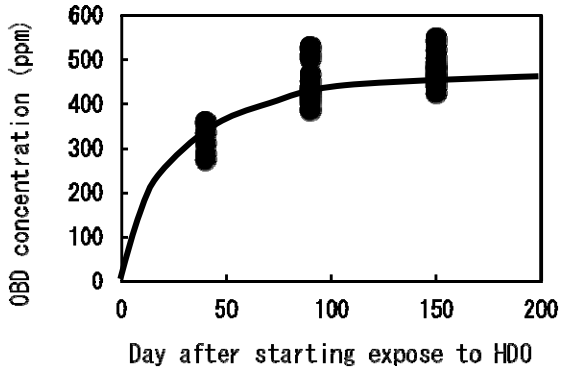


Fig. 1 Concentration of OBD in mastule of *P. herzensteinie* grown in seawater with deuterium concentration of 2000 ppm.

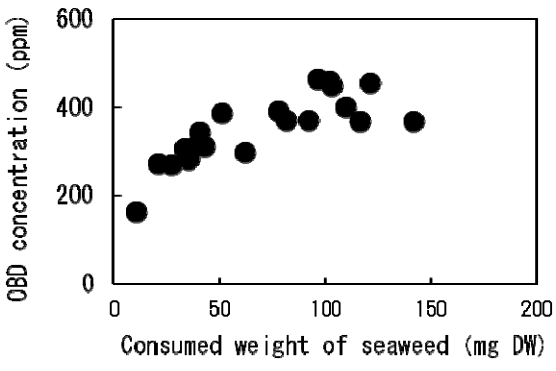


Fig. 2 Relationship between OBD concentration in *A. valida* and weight of seaweed containing OBD of 1060±85 ppm consumed by *A. valida*.

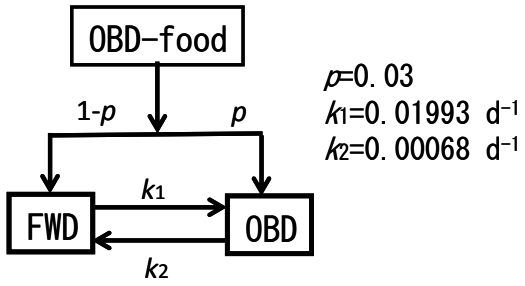


Fig. 3 Scheme of two compartment model of deuterium in *A. valida*.

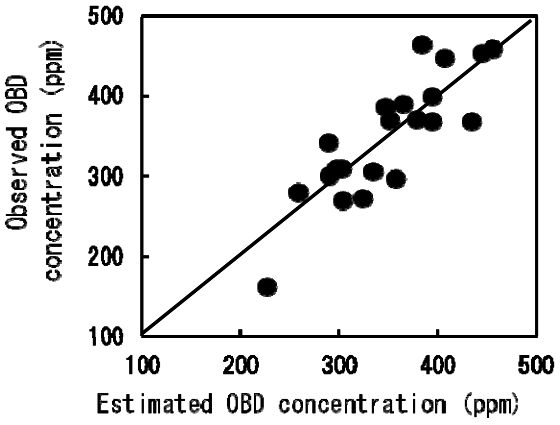


Fig. 4 Comparison of observed and estimated OBD concentrations in *A. valida*.