

organophosphate including pesticides and industrial chemicals such as organophosphoric acid triesters (OPEs) have been much applied and used recently. Rather high levels of organophosphorous pesticides in river water are noticed in summer because of their application. OPEs being used as flame retardants and plasticizers, however, are always detected in aquatic environments including rivers and estuary areas.

The uptake and accumulation of PCBs and HCHs by phyto- and zooplankton collected from the estuary area near Osaka Port were clearly noticed. Moreover, the seasonal change of organochlorine levels in net-plankton was almost the same as that in estuarine water. The concentration factors of organochlorines in net-plankton differed among the organochlorines. On the other hand, organophosphates were not detected in net-plankton, although these levels were clearly detected in the estuarine water.

It is well known that marine mammals such as whales, dolphins and seals accumulate high levels of organochlorines including PCBs, DDTs, HCHs in the subcutaneous fat. Striped dolphin (*Stenella coeruleoalba*) collected from Pacific coast of Japan also showed high concentration of PCBs, DDE and β -HCHs in the tissues of high lipid content such as blubber, melon, mammary gland, kidney and pancreas. We studied on the relationship between the lipid content, lipid composition and organochlorine levels in various organs or tissues of striped dolphin, and we concluded that the organochlorine levels in organs depended not only on the lipid content but on the lipid composition. For example, in blubber and melon, triglycerides comprise more than 90% of total lipid, and organochlorines were much accumulated in these tissues. On the other hand, brain tissues such as cerebrum and cerebellum showed rather low levels of organochlorines, although these tissues showed high lipid content. This is because of the low triglyceride and high phospholipid or cholesterol content in brain tissues.

II. Fates and behavior of man-made organics in the aquatic

environments.

Fates of chemicals loaded to aquatic environments are important for the evaluation of toxicity to the aquatic organisms. Biodegradation of organics, especially degradation mostly contributes to the fates of chemicals. We studied on the degradation of some organophosphates including pesticides and OPEs by the bacteria in water and sediment. OPEs show the acute toxicity to fish in the same extent as organophosphorous pesticides, and some OPEs are known to show neurotoxicity and mutagenicity. Recently, OPEs are considered to be chemicals causing "Sick Building Syndrome". Tributyl phosphate and tricresyl phosphate degrading bacteria were isolated from river water, respectively.

Tributyltin (TBT) being used in antifouling paints shows high acute toxicity to the aquatic organisms such as fish, gastropods, crustaceans etc., furthermore, 'Imposex Phenomena' observed in marine gastropods were caused by TBT. We also isolated TBT degrading bacteria from the polluted river water in Osaka City.

The bacteria that degraded musty odor substances including geosmin and 2-methylisoborneol being produced by blue green algae and actinomycetes were also isolated from river water. These substances in drinking water cause uncomfortable problems in water supply, and the bacteria mentioned above have the possibility to utilize for the musty odor treatment processes.

III. Evaluation of toxicity of man-made organics using cultured cells.

Established cell lines including HeLa cells, MA (monkey kidney) cells and Intestine 407 (human fetal intestine) cells were used for the evaluation of the toxicities of selected organophosphates and organotins. Among organophosphates mentioned above, TCP showed the highest cell toxicity. River water extracts with XAD-2 resin were also assayed using cultured cells, and the comprehensive evaluation of river water quality concerning man-made organics was possible.

Bioaccumulation and biological impact of TBT on *Caprella* (Crustacea: Amphipoda)

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The release of EDCs (Endocrine Disruptor Compounds) in the marine environment has been found of great concern due to the deleterious effects on a wide range of aquatic organisms. Toxic anti-fouling paints containing TBT (tributyltin), one of the EDCs, are highly controversial topic in the marine environment, since TBT based paint has become the most popular technology owed to their strong effect. Although Japan as well as in other developed countries in the early 1990's placed restrictions on the usage of TBT as an anti-fouling agent for coastal boats and aquaculture beds, levels of BTs (butyltin compounds) in the marine environment remain at

high even at now.

We have conducted a comparative study on the levels of BTs including TBT and its breakdown products DBT (dibutyltin) and MBT (monobutyltin) in seawater, sediment, and organisms at various trophic levels in the food web in the marine ecosystem, with special reference to *Caprella* spp. (Crustacea: Amphipoda), along Sanriku coast, northern Japan.

Characteristics of *Caprella* spp. are,

- 1) High species diversity in North East Asian coasts.
- 2) Small crustacean in 1 to 5 cm of body length.
- 3) Well-adapted morphology for clinging to substrata such as

algae and hydroids.

- 4) A shortened generation length of ca. 1 to 3 months, with lack of planktonic larval stages.
- 5) High biomass in algal communities and in aquaculture constructions.

Concentrations of BTs in seawater samples indicate the presence of "hot spot" with higher values of BTs than closed areas in a small distance. The high concentrate accumulations of BTs were found in certain lower trophic level of the food web; BTs accumulated in plankton (mostly phytoplankton), *Caprella* spp., and some of smaller fish such as gunnels were estimated up to 70,000 times higher than seawater. However, no considerable biomagnification was observed for BTs through higher trophic level. The comparison of BTs profiles between *Caprella* spp. and gammarid amphipod that *Caprella* spp., which indicated higher concentrations of BTs, accumulated TBT at the predominant compound among BTs. These results lead a hypothesis that *Caprella* spp., have a less capacity to degrade TBT and therefore accumulate BTs at elevated levels.

The experiments on the acute toxicity of TBT to *Caprella* spp. and gammarid amphipods from Otsuchi Bay were conducted. The results indicate 48 hour LC_{50} of *Caprella* spp. in

1.2 to 6.6 μg TBT/L, are significantly lower than gammarid amphipods in 17.8 to 23.1 μg TBT/L. The analysis on the specimens which were collected together with individuals for the experiments shows that *Caprella* spp. contain more than 65% of TBT which is close to TBT content of the seawater collected from the hot spot, while gammarid amphipods do less than 30% of TBT. Thus, the results support the above hypothesis.

The characteristics, especially reduced movement ability and a shortened life-span of less than 3 months, indicate that *Caprella* spp. may be well-suited for monitoring butyltin residue changes over small spatial and temporal scales. Two groups of organisms, mussels and neogastropods, which have been predominantly used for monitoring butyltin in shallow water ecosystems, mainly inhabit the intertidal zone where the butyltin levels vary widely depending on the immersion period and exposure to the sea surface microlayer. Moreover, monitoring using neogastropods has a possibility of over estimation after the restrictions on TBT, since neogastropods show an irreversible response to residue changes owing to their long life-spans. Thus, we propose the suitability of using *Caprella* spp. to monitor temporal and spatial changes in baseline concentrations of butyltins.

Activities of the Center for International Cooperation

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Our Ocean Research Institute, the University of Tokyo has a long tradition of active participation in various international cooperation research program since its foundation in 1962. The Center for International Cooperation belonging to the Ocean Research Institute, was established in 1994 in order to enhance international cooperation in the field of Marine Science. The center is composed of two divisions: research planning division and research cooperation division. The main task of the research planning division is to plan, coordinate and manage international cooperation programs such as JGOFS (Joint Global Ocean Flux Study), ODP (Ocean Drilling Program), GLOBEC (Global Ecosystem Dynamics), GOOS (Global Ocean Observing System), WESTPAC (IOC Sub-commission for the Western Pacific) and etc. The research cooperation division tries to coordinate academic exchange programs and to establish networks among various countries. There are many on-going international projects related Living Marine Resources such as HAB (Harmful Algal Bloom), Global Coral Reef Monitoring Network, Biodiversity and Large Marine Ecosystem in the WESTPAC area. Utilization of IODE (International Oceanographic Data & Information Exchange) system is necessary in order to advance efficiency these projects.

The Japan Society for the Promotion of Science carries out a variety of international and domestic programs. The Core University System is one of major international program and includes Scientist Exchanges, Cooperative research and

Scientific Joint Seminar. Our Ocean Research Institute is Core University in the field of Marine Science, and 20 cooperating universities from all over Japan and National Science Museum support this program. The Core University System between Indonesia, Thailand, Malaysia and Japan was launched in 1989, 1989 and 1991, respectively. More than 300 Japanese scientists visited to Indonesia, Thailand and Malaysia by this program and the same number of scientists invited from these countries during the past 10 years. The Marine Pollution and Red Tide are major research topics in each country. In the case of Biodiversity, we started two cooperative researches titled "Biodiversity Studies in the Eastern Indonesian Waters" and "Studies of coral reef ecosystems biodiversity in the Malaysian waters" from this year.

The Fourth International IOC/WESTPAC Scientific Symposium was held in Okinawa, Japan, February, 1998 as the first big event of the International Year of the Ocean. About 180 scientists from 14 countries participated in the symposium. A total of 80 papers were presented in the symposium and 20 papers in the Chemistry and Biology Sessions were mainly concerned with the Pollution.

The Global Investigation of Pollution in the Marine Environment which we call GIPME, is an international cooperative program of scientific investigations focused on marine contamination and pollution. GIPME was established in 1976 in response to the recommendation of the United Nations Conference on the Human Environment in Stockholm in