STUDY ON THE EFFECT OF WATER-SOLUBLE FRACTONS OF HEAVY-OIL ONTO COASTAL MARINE ECOSYSTEM USING MESOCOSM FECILITIES

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After an oil spill accident like Nakhodka in 1997, spilled heavy-oil floats as mousse lumps, attacks seashores and coastal areas accelerated by the wind and wave actions, and gives big damages to coastal ecosystems. Some parts of spilled oil forms oil slicks and brings them very quickly on the surface thin layer of seawater into big areas. Another parts of spilled-oil disperse into seawater and form water-soluble emulsions. In our project under Research for the Future Program sponsored by JSPS (Japan Society for the Promotion of Science), we constructed mesocosm facilities and are now studying the effect of water-soluble fractions of heavy-oil onto coastal marine ecosystem.

Mesocosm tanks Four FRP tanks (1.5 m in diameter and 3 m in depth) equipped with mixers at 20 rpm and two seawater reservoirs with the same size were constructed on the ground in the concrete fish-rearing pond very close to Lake Hamana (seawater lake) in the Fisheries Laboratory belong to Graduate School of Agricultural and Life Sciences, The University of Tokyo. Surface seawater of Lake Hamana was pumped up into two reservoir tanks first by aquatic pump equipped with generator, and then distributed the water equally using head spacers into experimental tanks by another pump. Sediment trays are also prepared to each tank in the case experimental runs are designed for the water and sediment systems.

Experimental runs Water-soluble fraction of heavy oil A obtained from Showa-Shell Co. were prepared mixing with 20 parts of seawater for several hours at 800 rpm. The water soluble-fraction was introduced into the mesocosm tank of 5,000 liters, and LOW tank (4.5 μ g/liter measured with chrysene as standard), HIGH tank (12.55 μ g/liter) and control were prepared. Sediment traps were placed at the bottom of the tanks for collecting sinking particles. Measurement of environmental conditions, sampling of water, settling particles were periodically conducted during experimental runs. Organisms in the early stages of coastal food chain, such as bacteria, bacterio-vorus heterotrophic nano-fragellates(HNF) and virus, chlorophyll a and phytoplankton flora in the samples were counted and observed in addition to nutrients concentrations and Carbon and Nitrogen in the settling particles. DGGE(Denaturant Gradient Gel Electrophoresis) method was also used to follow the changes of microbial communities during the experimental runs.

Acute toxicity of water-soluble fraction for the organisms in the present study was not observed in such low concentration of oil in our experiments. Bacterial growth rates were

very quickly accelerated in the HIGH tank just after loading of oil which accompanied the increase of virus and HNF, so that made the apparent increase of bacteria as smaller compared with real increase. Rather sharp increase in the HIGH tank, and gradual increase of LOW tank of chlorophyll a after several days of loading were observed. It was clearly observed under fluorescent microscope that small oil emulsions in seawater are adsorbed onto sinking detritus particles, and vertical flux of oil components rather high even at the low concentrations.