Nonylphenol distribution in rivers flowing into the Seto Inland Sea

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Recently, exogenous endocrine disruptors affecting the endocrine system of human and wildlife have occupied the social interest, and the studies for the reproductive abnormality of wildlife have strengthened the recognition that the environmental pollution by endocrine disruptors is the serious problem relating to the downfall of many species in the environment.

The endocrine disrupting hazardous effects have been found widely in chemicals such as unintended products, industrial reagents, pesticides and heavy metals, many of which relate deeply to our daily life. Nonylphenol (NP) is a kind of such chemicals with estrogenic activity and used as the raw materials for surfactants, additives for plastics and bactericides. Its annual production is 40,000-50,000t/y as total of alkylphenol including octylphenol in Japan.

In the Japanese coastal investigation performed in 1997 by Environment Agency, NP was not detected in sea waters at whole stations of 29 (detection limit; 1 μ g/l), however, it was detected in sediments at the stations of 50% in the range of 0.1-1 μ g/g-dry (detection limit; 0.1 μ g/l). We also detected 0.17 μ g/g-dry of NP in the sediment of the Sea of Harima, Hyogo Pref., therefore, planned the investigation for the characteristics of NP distribution in the rivers loading NP to the sea area. The investigation was performed at about 40 stations located in smaller urban streams flowing into Osaka Bay and the Sea of Harima of the Seto Inland Sea during April and August in 1998. NP was analyzed by using solid phase extraction – GCMS method (detection limit; 0.5 μ g/l).

NP was detected in the observed rivers in the range of ND-5.0 μ g/l with the average of 1.6 μ g/l (geometric average; 0.86 μ g/l). The histogram of NP concentration showed the typical J-shaped distribution pattern in common with dissolved contaminants. The detected concentration range resembled to the reported levels in river waters of urbanized areas such as Osaka City and Nagoya City. From these results, it was presumed that the waters in smaller urban streams were contaminated by NP with the order of magnitude of 1 μ g/l in the case of higher contamination level.

The loading sources for detected NP were not clarified because of no statistically significant correlation between NP and other water quality items such as EC, MBAS and CTAS. However, some case was found in which the discharge from textile industry with over 40 μ g/l of NP increased its concentration level at one station in a major river. As to NP loads from municipal sewage treatment plants, the effluents affected little the water quality in the urban streams because of relatively low NP level of 2-3 μ g/l, otherwise, the peaks of monitor ion with m/z135 indicating NP isomer composition showed the different patterns in the effluents and in urban stream waters. This suggested

the possibility for the change of NP isomer composition under sewage treatment process.

Concerning the biodegradability of NP, the finding has been reported that NP shows good decay curve on the River die-away experiment without standard addition (initial conc.; about 5 μ g/l). However, our similar experiment (20℃, dark, no stirring) with initial NP concentration of 0.59 μ g/l revealed longer acclimatization period and comparatively low biodegradation rate at Experimental day 7 of 29%. From these results, the residual tendency of NP at low concentration level in the aquatic environment was presumed.