（学位第３号様式）

学　位　論　文　要　旨

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ABSTRACT

Nitroarenes (NPAHs) are persistent in the environment and are reported to be carcinogenic and mutagenic. In order to investigate NPAHs pollution in waters and their biological effects, laboratory and field experiments were done.

This study consisted of four main parts with six different sub-studies to answer these objectives. Part 1 involved the investigation of NPAHs level. Study 1 was conducted to determine the level of NPAHs contamination in the surface road soil from 13 different regions. Among the regions, Thailand had the highest total NPAHs while India and Cebu (Philippines) had the highest carcinogenic 1-nitropyrene, other carcinogenic NPAHs were also detected such as 2-nitroflourene, 4-nitropyrene and 6-nitrochrysene. The main factors that affected varying NPAHs concentrations could be the type of automobile fuel used, traffic situation, urbanization and industrialization. Study 2 was conducted to investigate NPAHs contamination in road soils near the river, river sediments and water. Results showed that NPAHs concentration was higher in road soils. A positive correlation was obtained between NPAHs concentration in road and river sediments.

Part 2 involved the investigation of bioaccumulation and genotoxicity of NPAHs. Studies 3 and 4 were conducted to investigate if NPAHs were bioaccumulated through dietary or waterborne sources by marbled flounder *Pleuronectes yokohamae*. In Study 3, bioconcentration of NPAHs by *P. yokohamae* was investigated. Results showed that NPAHs are bioconcentrated with BCF between 4 to 422 and half-lives less than 6 days. In Study 4, *P. yokohamae* were exposed to dietary NPAHs. Results showed that NPAHs were accumulated but not biomagnified. In addition, micronuclei (MN) and other nuclear abnormalities (NA) were induced in exposed groups as compared to control. These studies suggest that NPAHs were accumulated from water borne sources and dietary NPAHs induced genotoxicity in *P. yokohamae*.

Part 3 involved the field experiments. Study 5 was conducted to investigate bioaccumulation of NPAHs and genotoxicity in tilapia *Oreochrombis niloticus* exposed to waters from Butuanon River upstream and downstream, Cebu, Philippines. NPAHs were accumulated and MN and NA were induced in *O. niloticus* exposed to the water from downstream. Other than NPAHs, PAHs and heavy metals were also investigated but were not possible to cause genotoxicity in *O. niloticus*. This study suggests that NPAHs can be accumulated and possibly one of the agents that can cause genotoxic effects in *O. niloticus*.

Part 4 involved the evaluation of hazards of environmental relevant concentration. Study 6 aimed to assess the overall effects of relevant NPAHs concentration in terms of oxidative stress and genotoxicity in tilapia *Oreochromis niloticus* exposed to waterborne 1-nitropyrene. Results showed that glutathione peroxidase, oxidative damage, and induction of MN and NA were significantly increased in exposed groups. These results suggested that *O. niloticus* was under oxidative stress and then induced MN and NA due to NPAHs genotoxicity. The biomarkers used in this study seem to be useful for the assessment of nitroarenes exposure or contamination in aquatic organisms.

Based on these results, it seems NPAHs pose a risk to aquatic organisms. However, monitoring of NPAHs in aquatic environment should be continued to determine further risks. In addition, further investigations should be conducted on the biological effects of NPAHs to completely understand their fate in aquatic organisms.