

ニトロアレーンの海産生物に及ぼす影響

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学 位 論 文 要 旨	
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題 目	Study of the effect of nitroarenes on marine organisms (ニトロアレーンの海産生物に及ぼす影響)
<p>Nitrated polycyclic aromatic hydrocarbons (NPAHs) are formed mainly by incomplete combustion of fossil fuels. Because NPAHs have become widely distributed in the environment, including aquatic systems, the toxicity of NPAHs to marine organisms has become a concern. Photo-induced toxicity occurs when the toxic effect of a chemical is induced or enhanced by visible or ultraviolet radiation; known photo-induced toxic chemicals include polycyclic aromatic hydrocarbons such as pyrene, which have molecular structures similar to NPAHs. The toxicity of NPAHs to marine organisms photo-induced by solar irradiation is therefore also a concern. To clarify the toxicity of NPAHs to marine organisms and to assess the current risk of exposure of marine organisms to NPAHs, the author determined the effects of NPAHs on marine organisms after taking into consideration the light environment. The effects considered in this study included toxic effects on survival, immobilization, growth, and reproduction.</p> <p>The acute toxicities of 10 NPAHs were determined for marine organisms on three trophic levels: the diatom <i>Skeletonema costatum</i>, the herbivorous crustacean <i>Tigriopus japonicus</i>, and two species of fish, <i>Pleuronectes yokohamae</i> and the mummichog <i>Fundulus heteroclitus</i>. The relative toxicities of the nitro-PAHs varied between the test species. A cholesterol pellet containing 1-nitronaphthalene or 1-nitropyrene was implanted into female mummichog, and the transfer of nitro-PAHs to the ovary was examined. The effectiveness of the pellet-implantation method was confirmed based on the transfer of nitro-PAHs to the eggs in a pregnant fish. After pregnant mummichogs were so implanted, the effects on the hatchability of the eggs were recorded, as well as the survival and growth of the resulting larvae. Hatchability was the parameter most sensitive to the effects of both chemicals; chronic toxicity values based on the actual concentrations in the eggs in the test fish were determined. Irradiation with artificial light increased the acute toxicity to <i>T. japonicus</i> of 9 of the 10 NPAHs tested. The most phototoxic compound tested was 1-nitropyrene; its toxicity after irradiation with artificial light was more than 1000 times its toxicity in darkness. The phototoxicity of 1-nitropyrene was dependent primarily on the irradiation-induced production of ROS.</p> <p>To determine the primary risk associated with exposure to NPAHs in the marine environment, the toxicity values or effect concentrations of NPAHs in the above tests were compared to reported concentrations of NPAHs in water. If the uncertainty of the chronic toxicity values and photo-induced toxicity are considered, then the conclusion is that the influence on marine organisms is rather small for four of the five NPAHs for which concentrations in water have been reported or estimated. The influence of 1-nitropyrene is a possible exception, because the predicted no-effect concentration determined in this study is similar to the reported concentration of this compound in water. This study has provided new information regarding risks to marine organisms from exposure to NPAHs.</p>	