ABSTRACT

The aim of this thesis, which is based on six papers [I-VI], was to assess the risks associated with photoinduced toxicity of PAHs (Polycyclic Aromatic Hydrocarbons) in the aquatic environment. Considered aspects included major chemical predictors, protective systems, species dependency and potential environmental risks. Phototoxicity was detected and quantified by using standardized acute toxicity tests with crustaceans (*Daphnia magna*, *Hyalella azteca* and *Nitocra spinipes*), followed by a 2-h exposure to solar simulated UV-irradiation, which resulted in up to >200-fold higher toxicity.

In the first paper [I], standard TIE (Toxicity Identification Evaluation) procedures were modified to enable phototoxicity identification of chemicals in environmental samples, either to confirm suspected cause-effect-relationships or to identify new groups of phototoxic contaminants.

The phototoxicity reaction of fluoranthene was found to take place inside the organism, suggesting that some species may develop special defence systems. However, none of the antioxidants and singlet oxygen quenchers tested on *Daphnia magna* produced a significant protective effect against fluoranthene phototoxicity [II].

Environmental sediment samples were tested with invertebrate species [III, IV, and V] and *N. spinipes* was generally the most sensitive species. Based on the incidence of phototoxicity, the PEL (Probable Effect Level) in the present sediment quality criterion for fluoranthene is not protective and should be lowered several times in UV rich environments.

PAH phototoxicity data for *D. magna* were compared with corresponding fish cell data [VI]. The effects were correlated to each other, suggesting that relative acute phototoxicity is not species dependent. The concentrations of eight phototoxic parent PAHs were found to be suitable chemical predictors of petroleum phototoxicity. They are either correlated well enough with other phototoxic substances or the most important phototoxicants of these complex mixtures.

Keywords: Phototoxicity, PAH, Aquatic Environment, Risk Assessment, UV irradiation, Invertebrates, Sediment Quality Criteria