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Assessment of organochlorines and environmental endocrine disruptors among different environmental compartments in Hong Kong mudflats

有機氯及環境荷爾蒙干擾物於香港泥灘不同環境間隔分佈調查

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by

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Abstract

In this study, persistent organic pollutants, e.g. organochlorine pesticides and polychlorinated biphenyls (PCBs), were measured in different environmental compartments, including aerial deposition, seawater, sediment and biota in different areas within the Mai Po Marshes Nature Reserve (MPMNR), an internationally acclaimed wetland reserve situated in the western part of the New territories of Hong Kong, as well as A Chau in Starling Inlet, a relatively remote island on the eastern side. Hexachlorobenzene (HCB), dichlorodiphenylthrichloroethanes (DDTs), and hexachlorocyclohexanes (HCHs) were detected in all samples collected from MPMNR. Seasonal and spatial variations of the concentrations of OCs in various environmental compartments were investigated, and were correlated with meteorological and physico-chemical conditions prevailing at the sites.

Environmental endocrine disruptors, including dioxin-like compounds and estrogenic chemicals, were measured using a cell-based chemical activated luciferase expression assay, and the results indicated that these chemicals might pose a risk to the ecological systems in the Ma Po area. Dioxin-like PCBs were detected in some of the samples, but levels were, in general, low. In this investigation, the toxic equivalency (TEQ) values of most samples were attributed to relatively high concentrations (>100ng/g dry weight in sediment) of high molecular weight polycyclic aromatic hydrocarbons (PAHs), while levels of non-ortho substituted PCBs were comparatively low. Estrogenic compounds were detected in the sediments, and these were dominated by polar compounds. Significant levels of cytotoxic compounds were detected in fish samples collected from the Mai Po area, but not in fish collected from A Chau. The precise identities of these cytotoxic compounds are still unknown.

Although the concentrations of chlordane, dieldrin, DDTs, and HCHs in the sediments were higher than the threshold effects levels (TELs) or even probable effects levels (PELs) promulgated by regulatory authorities, relative low degrees of bioaccumulation were found by comparing biota-sediment accumulation factors (BSAF) and results from bioconcentration regression models.

Sampling for bulk deposition was conducted from August, 2002 to July, 2003 in Mai Po and A Chau. HCB (0.06-0.68ng/m^2/day) was the dominant pollutants in the deposited samples among the OCs in Mai Po. The level of HCB deposited at both sites were several to several ten fold greater compared with the Great Lakes (North America). Other atmospheric deposited OCs, like DDTs, HCHs, endosulfans, chlordane and dioxin-like

PCBs were detected at lower levels in the samples from both sites. Simplified modelling for selected OCs was conducted to estimate the proportion of OCs in the sediment, water and air and the potential sources. Atmospheric depositions were shown to contribute a small proportion compared with the seawater input. Hence negative flux of those OCs might exist which transfer those OCs contaminants from the sediment to other environmental compartments.

Overall, results of the present study indicate that the management practices currently adopted in MPMNR are effective in reducing the potential risks of environmental contaminants to waterbirds and human. This study also raises questions in the use of sediment quality criteria as toxicity benchmarks for protecting local ecological systems, and highlights the importance of bioavailability considerations in risk assessment procedures.

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