

Anthropogenic activity over the past century has generated an omnipresent level of chemical pollution. Legislation, international conventions and new technologies have been developed during the past three decades in order to lower or to avoid further pollution. However, emission of legislated 'old' and emerging new chemicals continues to pollute the environment; moreover, some compounds are so persistent, that they almost do not degrade.

Dioxins and related organic pollutants are environmentally and biologically stable hydrophobic chemicals which tend to concentrate in the organic phase of soils, sediments and living organisms. In the aquatic environment, sediments act as a reservoir for persistent organic pollutants, however, a small fraction remains in solution and can be accumulated in aquatic organisms. These bioaccumulated compounds tend to be biologically persistent, may induce carcinogenicity and/or toxicity and leads to the increase of human exposure and risk.

Monitoring of dioxins in the aquatic environment is rare, due to the fact that analysis is difficult, expensive and time-consuming. Prior to this study, almost no dioxin data were available for aquatic systems in Western Europe and Belgium in particular.

The first investigation in this study deals with dioxins and other compounds with dioxin-like activity in marine sediments at the Belgian coast and river mouths (chapter 4). Sample extracts, both cleaned up and crude, were analyzed using the Chemically Activated Luciferase Expression (CALUX) bioassay. The cells of this bioassay are stably transfected with an AhR-responsive reporter plasmid, containing a firefly luciferase gene. The transcriptional activity is a measure for the dioxin-like activity of the present compounds.

Without a clean-up step, a mixture of many compounds with dioxin-like activity was measured, resulting in a complex CALUX signal. Therefore, interference effects between reference compounds 2,3,7,8-TCDD and PCB 126 were investigated further in depth (chapter 5).

The fact that higher dioxin levels were found at the Scheldt and Yser mouth suggests that riverine input represents an important contribution to dioxin pollution in marine sediments. Consequently, freshwater samples were taken along the rivers and analyzed (after clean-up) to obtain longitudinal trends in these rivers (chapter 6). The main objective of the work in this chapter was to estimate the potential risk these sediments pose to the ecosystem. Also, high resolution gas chromatography analysis with mass spectrometry was applied to all samples to determine a relationship between CALUX and chemical analysis, specific for Scheldt and Yser risk assessment.

Sediments are important environmental sinks, however, the bioavailable dioxin fraction is present in water. Therefore, current CALUX technology was evaluated to measure dioxin concentrations in samples of interstitial water (chapter 7).

As dioxins may be present in low quantities, attempts were made to obtain a lower detection and quantification limit for CALUX as the one currently available. Linear instead of non-linear regression

provides accurate and precise results as shown on a dioxin standard solution. In addition, quality control aspects were investigated for CALUX (chapter 8).

CALUX is also able to detect PAHs in raw extracts, but a problem of quantification occurs. Therefore, a relationship was determined between the CALUX signal of crude extracts and PAH concentrations and it was verified if that relationship is useful for PAH risk assessment in the aquatic environment (chapter 9). It was demonstrated that the model equations allow estimating the presence and toxicity of PAHs in an unknown sample.