

PCDD/Fs Occurrence in a Mediterranean Coastal Lagoon (Etang de Thau, France): Concentrations and Patterns in Different Environmental Compartments

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INTRODUCTION and OBJECTIVES

Thau lagoon is one of the largest Mediterranean lagoons. Located on the French Mediterranean coast along the Gulf of Lion (Figure 1), it covers a surface of 75 km² with an average depth of 4.5 m and is isolated from the Mediterranean Sea by an offshore bar. The lagoon receives inputs from different human activities: urban activities, industries, agriculture and shell farming. The biggest town (Sète) and most of urban activities, like incineration, are located in the Eastern part of the lagoon. Few data in relevant environmental compartments from Thau lagoon on polychlorinated dibenzo-p-dioxins and dibenzofurans (PCDD/Fs) have been reported to date. Moreover, the dynamics, long term impacts and ultimate fate of the contamination induced by these chemicals in the lagoon is not well known.

The aim of this work was to investigate the PCDD/Fs concentrations and patterns in air, sediments and mussels from Thau Lagoon. The influence of the atmosphere in the accumulation of these persistent organic pollutants (POPs) in the aquatic system was also studied. Two land air sampling sites were set up in the lagoon and sediments and mussels samples were collected from selected stations (Figure 1). Sampling, extraction and clean up, and analytical methods followed are detailed elsewhere¹.

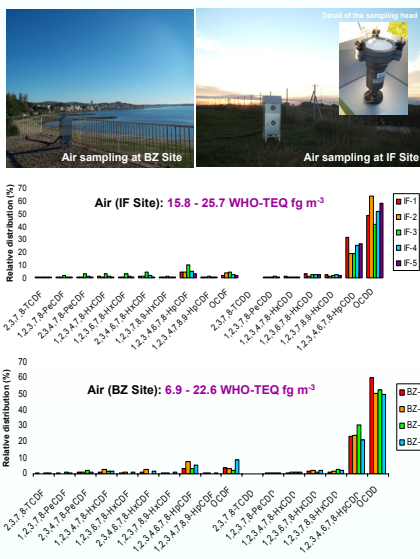


Figure II. Congener pattern of PCDD/F in air (both air sampling sites), and WHO-TEQ concentrations found in Thau Lagoon. Air samples were collected in November 2005.

Environmental concentrations

Air concentrations observed in both locations were low, typical of those from rural areas²⁻⁴. The weather conditions during the sampling week, where precipitation (14th and 15th Nov) and winds up to 9 m/s were registered might have favored the low concentrations found. Wind blew predominantly from NW during the sampling period except for a short gap (in the beginning and the end of the sampling period) where it blew from N-NE (Figure V). PCDD/Fs concentrations found in surface sediments were within the same range of those reported in the literature for surface sediments from several aquatic environments³⁻⁷. The observed WHO-TEQ concentration in mussels do not exceed the maximum level set by the European Community for marine products intended for human consumption⁸. Similar to higher PCDD/Fs concentrations in mussels have been reported for the Atlantic French coast (Vilaine river bay) and the English Channel respectively⁹.

Environmental patterns

PCDD/Fs congener patterns observed in air samples for the different days of the sampled period in both sites were very similar, indicating an homogeneous situation during the sampled week in both shores of the lagoon (Figure II). When comparing the PCDD/Fs patterns from air, sediments and mussels (Figures II, III and IV), a very similar chemical fingerprint was observed in air and sediments. This result suggests a significant contribution of the atmosphere (mainly by the particle phase) in the accumulation of PCDD/Fs in surface sediments. The PCDD/Fs fingerprint observed in mussels was different to the one exhibited by the other two studied compartments. This fact suggests a more complex situation in which different or additional sources of PCDD/Fs or a selective mechanism of accumulation of these chemicals in the mussels can be occurring. Whereas the signal observed for the high chlorinated congeners HpCDD, OCDD, HpCDF and OCDF in the mussels was very similar to the one in the sediment, the predominance of the low chlorinated PCDFs was not observed in any of the other compartments. This observation points to a combined PCDD/Fs signal in mussels arriving in part from the suspended particulate matter but also from the dissolved phase of the water column.

CONCLUSIONS

Further research is needed in order to determine whether the atmosphere has a significant role in the accumulation of PCDD/Fs in surface sediments. More data are also needed to better understand the mechanisms of mussels contamination by PCDD/Fs in Thau lagoon. Wider spatial distribution sediment sampling together with measurements of PCDD/Fs concentrations in the water column has been carried out. Analyses of other relevant POPs such as PCBs in air of Thau Lagoon is taking place in order to verify the presented hypotheses. Back trajectories of air masses arriving to the area will also be evaluated in order to better understand the occurrence of these contaminants in this coastal lagoon.

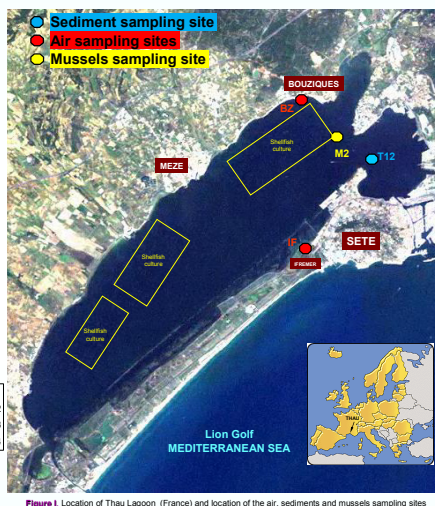


Figure I. Location of Thau Lagoon (France) and location of the air, sediments and mussels sampling sites

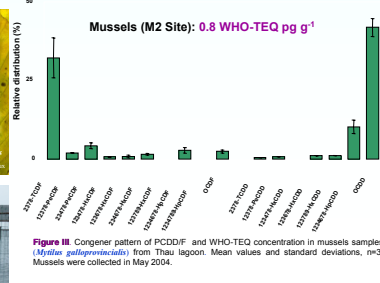
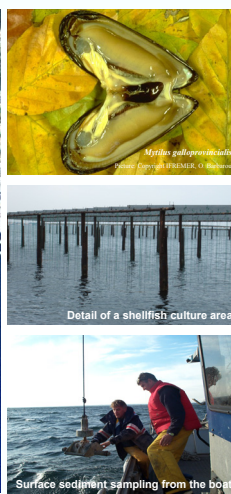


Figure III. Congener pattern of PCDD/F and WHO-TEQ concentration in mussels samples (*Mytilus galloprovincialis*) from Thau lagoon. Mean values and standard deviations, n=3. Mussels were collected in May 2004.

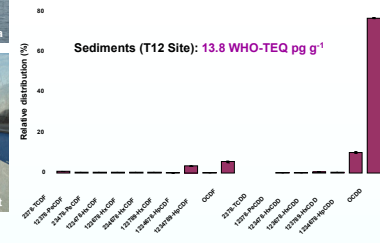


Figure IV. Congener pattern of PCDD/F and WHO-TEQ concentration in surface sediments from Thau lagoon. Mean values and standard deviations, n=2. Sediments were collected in May 2004.

RESULTS and DISCUSSION

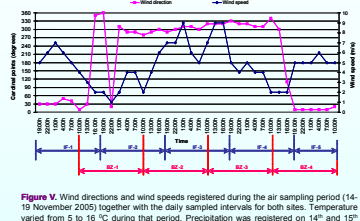


Figure V. Wind directions and wind speeds registered during the air sampling period (14-19 November 2005) together with the daily sampled intervals for both sites. Temperature varied from 5 to 16 °C during that period. Precipitation was registered on 14th and 15th Nov. Data are from Météo France, station from Sète.

References

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