Chlorinated PAHs in Settling Particulate Matter from the Northern Baltic Proper.

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Introduction

Chlorinated polycyclic aromatic hydrocarbons (Cl-PAHs) have recently been paid attention to because of the biological activity they display. Some chloro-added PAH derivatives have been found to be directly mutagenic while their corresponding Cl-substituted PAH derivatives showed mutagenic properties only in the presence of a metabolising system. Further, certain Cl-PAHs have shown to possess high affinity to the TCDD (2,3,7,8-tetrachlorodibenzo-*p*-dioxin) receptor. One compound has shown to be a potent AHH (aryl hydrocarbon hydroxylase) inducer as reviewed in [1].
Cl-PAHs have been detected in various industrial and environmental samples e.g. in emissions from municipal waste incinerators, automobile exhausts, snow and urban air[1].
The Cl-PAHs discussed in this study include compounds consisting of three or more fused aromatic rings with one or more chlorine atoms attached to the aromatic ring system. The chlorine may either be substituted or added to the compound.
In this study an evaluation of the distribution and occurrence of a number of Cl-PAHs and of 15 polycyclic aromatic compounds (PAHs) in settling particulate matter of the northern Baltic proper is presented.

Materials and Methods

Samples of settling particulate matter (SPM) were collected using sediment traps along a transect from the city of Stockholm to the open coastal area of the northern Baltic Sea. The sediment traps were of a self-suspended buoyant type with cylindrical collection vessels of glass[2].
All samples were Soxhlet extracted with toluene followed by a mixture of hexane and acetone. The extracts were reduced of their lipid contents using a non-destructive dialyses membrane technique[3]. The residue was further cleaned-up on an open 10% deactivated silica column followed by isolation of parent PAHs and Cl-substituted PAHs from bulk substances on a multi-column high performance liquid chromatography (HPLC) with a backflush technique. The samples were analysed on GC-MS.

Results and discussion

Earlier studies of Cl-PAHs in urban and road tunnel air have shown that some mono- and dichloro-substituted PAHs were present in the samples. The total concentrations were shown to range between 0.4-28 and 2-50 pg/m^3 in urban air and road tunnel air, respectively[1].
Generally, airborne pollutants associated to particles or present in the vapour phase, e.g. PAHs, reach the aquatic environment mainly by atmospheric deposition[4]. Therefore it is assumed that some of these Cl-PAHs are introduced to the aquatic environments of the Baltic and deposited to the bottom sediments together with settling particulate matter (SPM).
In the present study SPM collected in several locations in a transect from the vicinity of the city of Stockholm to the open coastal sea were analysed with respect to a number of Cl-PAHs as well as parent PAHs (sum of 15 compounds). The first preliminary results show that the highest concentrations were found closest to the City of Stockholm declining with increasing distance from the urban areas toward the open coastal sea as shown in earlier studies on PAHs[5]. For 1-chloropyrene, which is also shown to be one of the major components of the Cl-PAHs found in the urban and road tunnel air studies mentioned above, the highest concentration was approximately 0.5 ng/g (on a dry weight basis) and the total concentrations of the parent PAHs ranged between 30 µg/g near the urban area and 0.2 µg/g in the open coastal areas investigated.

References

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