Measurements of polycyclic aromatic hydrocarbons (PAH) in precipitation by high-performance liquid chromatography (HPLC) show that precipitation is the dominant sink in the atmospheric PAH-cycle. In the precipitation the PAH-components show a characteristic distribution. The range of concentration is directly influenced by the meteorological parameters. Significant maximum concentrations in winter and low concentrations in summer prove seasonal variation. The regional distribution of the PAH in precipitation is governed by the influence of local sources.

INTRODUCTION

Polycyclic aromatic hydrocarbons (PAH) are formed in pyrolytic combustion processes of fossil fuels. The main sources are industrial processes, domestic heating and automobile traffic. Combustion material and combustion temperature determines the PAH profile and absolute amounts. In the atmosphere, they are adsorbed on air-borne particulate matter with an aerodynamical diameter ranging from 0,5 to 3,0 μm (1). Besides of nitrosamines, aflatoxines and some heavy metals PAH are potential cancerogenic substances in our environment (2). The main sinks in the atmospheric PAH-cycle are photooxidation and wet deposition by precipitation.

Up to now there exist only few studies on the PAH-concentration in precipitation and their behavior in an aqueous system. Aim of the study was it to present an overview on the PAH in precipitation and to characterize the influence of the meteorological parameters.

133

The PAH were measured by high-performance liquid chromatography (HPLC) and fluorescence detection. A special method of enrichment of the soluble PAH-fraction of the precipitation was necessary.

EXPERIMENTAL

After sampling with a pre-purified funnel (0,25 m²) the precipitation is filtrated to separate the insoluble fraction. The insoluble fraction is treated with 75 ml Tetrahydrofuran and reduced to exactly 0,5 ml in volume by means of a rotary-evaporator (3). From the soluble fraction 500 ml were enriched by a liquid-extraction with 3 x 30 ml cyclohexane. This solution is also concentrated to 0,5 ml. Both fractions are analysed by HPLC with reverse-phase-system RP 8 (7 µm particle size). A methanol-water-mixture is used as mobile phase for gradient elution. The separated PAH-components are detected with a fluorescence-detector operating at an extinction-wavelength of 322 nm and an emission-wavelength of > 350 nm.

Qualitative identification of the PAH compounds is achieved by comparison of their characteristic retention times with authentic standards. PAH-concentrations are calculated by comparing peak areas of calibration curves obtained by use of standard solution at different concentrations. A typical chromatogramm of the soluble fraction in precipitation show the separated PAH (Fig. 1).

RESULTS AND DISCUSSION

The distribution of the PAH concentration in precipitation is shown by the monthly mean value of February 1981 (Fig. 2). This diagram represents the compounds in sequence of elution as the sum of soluble and insoluble fraction. The concentrations of the single components range from only few ng/l to some hundreds ng/l. The compound fluoranthene shows the highest concentration with more than 630 ng/l. The lowest concentrations are analysed for coronene with 35 ng/l. The total amount of the measured PAH contains 1,8 µg/l. The concentrations are directly influenced by the meteorological parameters. Concentrations deviate more than 40% from the monthly mean values. Increased values are found at low temperatures and after long dry periods decreased concentrations at high temperatures and short dry intervals.

For direct comparison, the PAH-profiles are represented in a percentage distribution instead of the absolute concentration values (Fig. 3). The different distribution of the