

DETERMINATION OF ORGANIC POLLUTANTS
IN DIESEL EXHAUST EMISSION

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Dissertation submitted partial fulfilment of the requirements for the degree
of MASTER OF SCIENCE in ANALYTICAL CHEMISTRY of the
UNIVERSITY OF COLOMBO, SRI LANKA.

January / 1998

14903

Abstract

A sampler was constructed for simultaneous collection of airborne particulate matter and volatiles. The sampler consists of two components to collect the gas and particulate phases separately. This facilitates the sampling of airborne pollutants with respect to their distribution in air as gases or particulate matter. The front end of the sampler is equipped with a filter holder which can collect the particulate matter without collecting the gas phase components. Thus particle stripped air is passed through a sorbent bed to collect the gas phase components based on their affinity to the sorbent. The system was designed to use both the components simultaneously or individually as desired. Furthermore, the filter holder can accommodate several filters at a time which facilitates the segregation of the particulate matter according to their sizes. After demonstrating the phase separation, the sampler was exclusively used to collect particulate matter emitted from a diesel vehicle on to a glass wool pad.

The particulate matter collected on to glass wool pad was soxhlet extracted for 8 hours dichloromethane as a solvent and cleaned using alumina column. The cleaned extract was analysed for PAHs using a high performance liquid chromatograph equipped with a fluorescence detector. The intensity of fluorescence signals of a given PAH depends on the concentration and the fluorescence condition (excitation and emission wavelengths). For a given PAH the peak height ratio under two different excitation emission conditions is a fixed value. This concept was used to identify the PAH in the extract. Peak height ratios for the signals in extract under different excitation emission conditions were compared with those of published values. Some of the peak heights did not match with published peak height ratios indicating that the signals are due to coelution. If only the relative retention times were compared as done in normal analysis the coelution would not have been detected.



PAHs such as naphthalene, phenanthrene, anthracene, fluoranthrene, chrycene, benzo(k)fluoranthrene, benzo(a)pyrene and benzo(ghi)pyrene were identified in the diesel exhaust emission. It was not attempted to quantify the PAHs in diesel exhaust because the composition is highly dependent on the nature of the source.

It has been postulated that high molecular weight PAH in diesel exhaust arise primarily from low molecular weight PAHs which are present in unburned diesel. Analysis of PAHs in unburned diesel showed that phenanthrene, anthracene, naphthalene are present in the concentration of 4 ppm, 2 ppm and 800 ppm respectively in locally available unburned diesel and high molecular weight PAHs are not present at the detectable level. The postulate is supported from our findings where high molecular weight PAHs were present in diesel exhaust. This strategy enables one to identify the PAHs even without authentic standards.

