Development of Nitroarene Analyzer

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Introduction

Several nitroarenes have attracted much attention due to their mutagenicity and carcinogenicity, and car exhausts have been investigated as one of their main sources. The activity of 1,3-, 1,6-, and 1,8-dinitropyrenes (1,3-, 1,6-, 1,8-DNPs) as well as 1-nitropyrene (1-NP) are significant in these nitroarenes. We developed an HPLC method with chemiluminescence detection for their determination. After chemical reduction, the DNPs and 1-NP were determined by this method with their detection limits in the sub fmol region. In order to reduce nitro groups into amino groups, an inline reducer was introduced into the above system. The new system has several advantages for the determination of both nitroarenes and their metabolites.

Methods

System I consisted of two pumps, an injector, an analytical column (ODS) and a chemiluminescence detector. A zinc column (zinc: glass beads = 3:7, 1 cm × 4 mm i.d.) as the reducer was introduced just after the analytical column (system II) or before the analytical column (system III). The mobile phase is a mixture of acetonitrile and imidazole buffer. Acetonitrile containing bis(2,4,6-trichlorophenyl)oxalate and hydrogen peroxide was used as the post-column reagent solution.

Results and Discussion

After refluxing the nitroarenes with sodium hydrosulfide, their corresponding aminoarenes were determined using system I. Ascorbic acid was added to the reduced sample solution as an effective stabilizer. Utilizing this system, 1,3-, 1,6-, and 1,8-DNPs and 1-NP were determined in airborne and car exhaust particulates after cleanup and reduction procedures. In system II, the zinc column showed quantitative reduction efficiency for 1-NP, although the lifetime was limited; 1-NP, 1-nitrosoypyrene and 1-aminoypyrene were determined in less than 10 min. This system enabled the time course study of the metabolites of 1-NP at trace levels in Salmonella typhimurium solution. When benzene/ethanol extracts from airborne particulates were injected into system III, nitrofluorene, nitroanthracene, 1,8-DNP and 1-NP were determined without using precolumn reduction procedures. By cleaning up the extracts, other nitroarenes might also be detectable.

References