Chemiluminescence detection of 3-nitrobenzanthrone and 2-nitrotriphenylene in airborne particles with on-line reduction HPLC system

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Strong direct-acting mutagenic 3-nitrobenzanthrone (3-NBA) and 2-nitrotriphenylene (2-NTP) were successfully determined at sub-ppb level in the soluble organic fraction of airborne particles by chemiluminescence detection with an HPLC system equipped with the reducer column composed of the alumina supported platinum-rhodium catalysts. The sensitivity of the detection was considerably higher than conventional GC/MS techniques including negative ion detecting one to have the limit of detection of 20 fmol and 40 fmol for 3-NBA and 2-NTP, respectively. The average atmospheric concentrations of 3-NBA and 2-NTP in autumn at central Tokyo were 7.3 fmol/m$^3$ and 1.4 fmol/m$^3$, respectively while 2-nitrofluoranthene (2-NF), 3-nitrofluoranthene (3-NF), 1-nitropyrene (1-NP), 6-nitrochrysene (6-NC), and 1,8-dinitropyrene (1,8-DNP), which are conventionally studied nitrated polycyclic aromatic hydrocarbons, were found in the same samples at the concentration levels of 0.79 pmol/m$^3$, 2.0 fmol/m$^3$, 0.11 pmol/m$^3$, 3.2 fmol/m$^3$, and 1.8 fmol/m$^3$, respectively. Application of the method to the analysis of atmospheric occurrence revealed that dairy variation patterns of these nitrated polycyclic aromatic compounds in concentration seems to be composite of those of 1-NP, which is emitted directly from diesel-powered vehicles, and 2-NF, which is believed to be formed by atmospheric reactions of parent fluoranthene with nitrogen oxides. It suggests that both airborne 3-NBA and 2-NTP will be originated from the atmospheric reactions of parent benzanthrone and triphenylene as well as the direct emission from diesel-powered vehicles.