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Source diagnosis of PAHs using compound class specific 14C analysis and Monte Carlo source appotionment at Kolkata canal

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Atmospheric polycyclic aromatic hydrocarbons (PAHs) originate mostly from incomplete combustion of carbon-based fuels. PAHs account for most (35-82%) of the total mutagenic activity of ambient aerosols. Reduction of air pollution by PAHs is essential for an effective air quality control, which requires reliable source apportionment. It has been reported that atmospheric pollution by PAHs in Indian megacities, such as Kolkata, Mumbai and Chennai, is comparable to the highest levels across the globe and Kolkata air exhibit the highest level among them. Also, our previous survey revealed that sediments from Kolkata city canals have the highest PAHs concentrations (i.e., 15.9±11.6 μg of $\sum$14-parent PAHs/g dw, n=12) among the 174 surface sediments from 8 tropical Asian countries.[1] Examining methylated-to parental PAHs ratios of three homologous series and C30-hopane/$\sum$PAHs ratios both in sediment samples and in probable source materials, the high level sedimentary PAHs were ascribed to those emitted from combustion sources. However, relative importances of combustion sources were not solved. The present study aimed to apportion sources of combustion to PAHs in highly contaminated sediments from Kolkata, India by using combined approaches of CCSRA technique, molecular fingerprinting and Monte Carlo source apportionment.

Furthermore, three- and four ring PAHs (MW178, 192, 202) in leftover extracts were harvested on PCGC and analyzed for 14C on AMS at NIES-TERRA, NIES (Tsukuba, Japan). PAHs isolated from Kolkata canal sediments showed mostly fossil carbon isotopic signatures, i.e., ^{14}C signal of PAHs with MW178, 202 and those with MW?228 were 10.6±0.1, 5.9±0.4, 7.6±0.5 pMC (KKNC), 8.4±0.5, 8.3±0.4, 8.5±0.3 pMC (KKSC). By using source end-members of MW202 and MW276 isomer pair ratios, Monte Carlo source apportionment[2] revealed that most of fossil-PAHs were derived from coal combustion, i.e., relative contributions (median) from coal and petroleum combutions were 50% and 11% in KKNC and 13% and 56% in KKSC.

1. Saha M. *et al., Mar. Pollut. Bull.*, **2009**, 58 (2), 189-200
2. Sheesley R.J. *et al., Atmos. Environ.*, **2011**, 45(23), 3874-3881

Keywords: compound class specific radio carbon analysis, PAHs, monte carlo simulation, molecular fingerpringing, source apportionment