

Source identification of Malaysian atmospheric polycyclic aromatic hydrocarbons nearby forest fires using molecular and isotopic compositions

ABSTRACT

We report measurements of molecular and carbon isotopic compositions of Malaysian atmospheric polycyclic aromatic hydrocarbons (PAHs) in smoke haze from the 1997 Indonesian forest fire. Comparison of the carbon isotopic compositions ($\delta^{13}\text{C}$) of individual PAHs from the smoke haze, with those from other PAHs sources (soot collected from gasoline and diesel vehicle muffler, woodburning smoke), enables us to discriminate among the diverse sources of atmospheric PAHs. Soot PAHs extracted from gasoline and diesel vehicles show heavy isotopic signatures with a large inter-species $\delta^{13}\text{C}$ variation from -12.9‰ to -26.6‰ , compared to soot PAHs extracted from woodburning smoke which are isotopically light, and have a small inter-species $\delta^{13}\text{C}$ variation from -26.8‰ to -31.6‰ . Values from -17.7‰ to -27.9‰ were obtained for the corresponding PAHs extracted from the smoke haze, indicating that they are derived mainly from automotive exhaust. Molecular and isotopic compositions of PAHs extracted from smoke haze were similar to those extracted from non-haze aerosol. Quantitative estimation shows that woodburning contribution to Malaysian atmospheric PAHs ranges from 25% to 35% with no relation to haze intensity, while automotive contribution ranges from 65% to 75%. These results suggest that the major contributor of PAHs in Malaysian air is automotive exhaust whether smoke haze is observed or not.

Keyword: Aerosols; Atmospheric PAHs; Compound-specific $\delta^{13}\text{C}$; Source identification; Tropic forest fires