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# Two Component Source Apportionment Based on Absorption and Size Distribution Measurement

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**Abstract :** Beyond its climate and health related issues ambient light absorbing carbonaceous particulate matter (LAC) has also become a great scientific interest in terms of its regulations recently. It has been experimentally demonstrated in recent studies, that LAC is dominantly composed of traffic and wood burning aerosol particularly under wintertime urban conditions, when the photochemical and biological activities are negligible. Several methods have been introduced to quantitatively apportion aerosol fractions emitted by wood burning and traffic but most of them require costly and time consuming off-line chemical analysis. As opposed to chemical features, the microphysical properties of airborne particles such as optical absorption and size distribution can be easily measured on-line, with high accuracy and sensitivity, especially under highly polluted urban conditions. Recently a new method has been proposed for the apportionment of wood burning and traffic aerosols based on the spectral dependence of their absorption quantified by the Aerosol Angström Exponent (AAE). In this approach the absorption coefficient is deduced from transmission measurement on a filter accumulated aerosol sample and the conversion factor between the measured optical absorption and the corresponding mass concentration (the specific absorption cross section) are determined by on-site chemical analysis. The recently developed multi-wavelength photoacoustic instruments provide novel, in-situ approach towards the reliable and quantitative characterization of carbonaceous particulate matter. Therefore, it also opens up novel possibilities on the source apportionment through the measurement of light absorption. In this study, we demonstrate an in-situ spectral characterization method of the ambient carbon fraction based on light absorption and size distribution measurements using our state-of-the-art multi-wavelength photoacoustic instrument (4λ-PAS) and Single Mobility Particle Sizer (SMPS) The carbonaceous particulate selective source apportionment study was performed for ambient particulate matter in the city center of Szeged, Hungary where the dominance of traffic and wood burning aerosol has been experimentally demonstrated earlier. The proposed model is based on the parallel, in-situ measurement of optical absorption and size distribution. AAEff and AAEwb were deduced from the measured data using the defined correlation between the AOC(1064nm)/AOC(266nm) and N100/N20 ratios. σff(λ) and σwb(λ) were determined with the help of the independently measured temporal mass concentrations in the PM1 mode. Furthermore, the proposed optical source apportionment is based on the assumption that the light absorbing fraction of PM is exclusively related to traffic and wood burning. This assumption is indirectly confirmed here by the fact that the measured size distribution is composed of two unimodal size distributions identified to correspond to traffic and wood burning aerosols. The method offers the possibility of replacing laborious chemical analysis with simple in-situ measurement of aerosol size distribution data. The results by the proposed novel optical absorption based source apportionment method prove its applicability whenever measurements are performed at an urban site where traffic and wood burning are the dominant carbonaceous sources of emission.

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