

Relationship of Indoor and Outdoor Levels of Black Carbon in an Urban Environment

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Abstract : Black carbon (BC) has received particular attention around the world, not only for its impact on regional and global climate change but also for its impact on air quality and public health. In order to study the relationship between indoor and outdoor BC concentrations, studies were carried out in Vilnius, Lithuania. The studies are aimed at determining the relationship of concentrations, identifying dependencies during the day and week with a further opportunity to analyze the key factors affecting the indoor concentration of BC. In this context, indoor and outdoor continuous real-time measurements of optical BC-related light absorption by aerosol particles were carried out during the cold season (from October to December 2020). The measurement venue was an office located in an urban background environment. Equivalent black carbon (eBC) mass concentration was measured by an Aethalometer (Magee Scientific, model AE-31). The optical transmission of carbonaceous aerosol particles was measured sequentially at seven wavelengths ($\lambda = 370, 470, 520, 590, 660, 880, \text{ and } 950 \text{ nm}$), where the eBC mass concentration was derived from the light absorption coefficient (σ_{ab}) at 880 nm wavelength. The diurnal indoor eBC mass concentration was found to vary in the range from 0.02 to 0.08 μgm^{-3} , while the outdoor eBC mass concentration - from 0.34 to 0.99 μgm^{-3} . Diurnal variations of eBC mass concentration outdoor vs. indoor showed an increased contribution during 10:00 and 12:00 AM (GMT+2), with the highest indoor eBC mass concentration of 0.14 μgm^{-3} . An indoor/outdoor eBC ratio (I/O) was below one throughout the entire measurement period. The weekend levels of eBC mass concentration were lower than in weekdays for indoor and outdoor for 33% and 28% respectively. Hourly mean mass concentrations of eBC for weekdays and weekends show diurnal cycles, which could be explained by the periodicity of traffic intensity and heating activities. The results show a moderate influence of outdoor eBC emissions on the indoor eBC level.

Keywords : black carbon, climate change, indoor air quality, I/O ratio

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