On-site evaluation of pedestrian-level air quality at a U-type street canyon in an ancient city

Urban building disposition plays an important role in determining local microclimate including air quality. Ancient cities normally have some special building dispositions to reduce the penetration of cold wind in winter, which, however, may impact adversely on air pollutant dilution today. This paper investigated the pedestrian level air quality at a common building disposition in Chinese ancient cities, namely a U-type street canyon. On-site measurements were conducted comparatively at a U-type street canyon and a nearby open space in Xi'an China during January 2015. Three primary air pollutants (PM$_{10}$, PM$_{2.5}$ and NO$_x$) as well as wind speed and direction, air temperature and relative humidity were measured continuously from 8:00 a.m. to 8:00 p.m. for a six day period that covered both clean and hazy days. Pedestrian-level wind condition at the U-type street canyon is mostly independent of that above the canyon, where adverse dilution condition is clearly evident for pollutants. PM$_{2.5}$/PM$_{10}$ ratio at the street canyon reached up to 0.9, which is nearly twice that at the nearby observatory. Overall, air quality index (AQI) in the street canyon is, on average, higher by 20% than that at the open space. These findings suggest that this ancient design should be discouraged.

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