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Characterizations of atmospheric fungal aerosol in Beijing, China

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Fungal aerosols constitute the most abundant fraction of biological aerosols in the atmosphere, influencing human health, the biosphere, atmospheric chemistry and climate. However, the total abundance of fungal spores in the atmosphere is still poorly understood and quantified. PM10 and PM2.5 samples were collected by high volume samplers simultaneously at a rural site (MY) and an urban site (THU) in Beijing, China. Various carbohydrates were quantified by high-performance anion exchange chromatography with pulsed amperometric detection (HPAEC-PAD), including the sugar alcohols mannitol and arabitol, proposed as molecular tracers for fungal aerosol. The annual average concentrations of arabitol in PM2.5 and PM10 at the THU site were 7.4±9.4 ng/m3 and 10.3±9.5 ng/m3, and the respective mannitol concentrations were 21.0±20.4 ng/m3 and 31.9±26.9 ng/m3. Compared to PM10, the monthly average concentrations of arabitol and mannitol in PM2.5 did not vary significantly and were present at nearly consistent levels in the different seasons. Moreover, during summer and autumn higher arabitol and mannitol levels than during spring and winter were observed in coarse particles, probably due to different dominant sources of fungal spores in different seasons. In the dry period (i.e. winter and spring) in Beijing, probably only the suspension from exposed surfaces, (e.g., soil resuspension, transported dust, etc.) can be regarded as the main sources for fungal aerosols. On the other hand, in summer and autumn, fungal spores in the atmosphere can be derived from more complex sources, including plants, vegetation decomposition and agricultural activity, such as ploughing; these fungal spore sources may contribute more to coarse PM. Mannitol and arabitol correlated well with each other, both in PM10 (R2 = 0.71) and PM2.5 (R2 = 0.81). Although fungal spore levels at rural sites were consistently higher than those at urban sites in other studies, the findings in our study were reversed, indicating a high abundance of fungal spores in the urban area of Beijing, China. Meteorological conditions were shown to have complex effects on the ambient concentrations of fungal spores: the concentrations of arabitol exhibited positive correlation with temperature below 30.0 °C, negative correlation with wind speed higher than 0.6 m/s, no relationship with solar radiation and the highest arabitol levels were mainly associated with RH in the range of 51-70%.