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Optical properties, chemical composition and sources of atmospheric brown carbon aerosol

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Brown carbon (BrC) is an important component of atmospheric aerosol particles and has significant effects on radiative forcing and climate. The optical properties, chemical composition, and sources of BrC, however, are still not well understood. In this study, we report the seasonal variations of optical properties, chromophore composition and sources of BrC in urban atmospheric $PM_{2.5}$.[1] The main chromophores of urban BrC are nitrated aromatic compounds (NACs) and polycyclic aromatic hydrocarbons (PAHs) and their derivatives. Biomass burning and coal combustion are the main sources of urban BrC in winter, and secondary formation dominates in summer. A total of 59 major chromophores (nine groups) are identified in $PM_{2.5}$ emitted from biomass burning, of which lignin pyrolysis products, stilbene, coumarins and NACs are the main chromophores.[2] Nitrate-mediated photooxidation of NACs (including 4-nitrocatechol, 3-nitrosalicylic acid and 3,4-dinitrophenol) in atmospheric aqueous phase under different pH and temperature conditions are studied.[3] The dynamic changes in light absorption of NACs during photolysis are measured, and the photolysis rates and products of NACs are further characterized. The photolysis rate of NACs generally increases with the increase of temperature, about 1.2-3.0 times higher at 30 ℃ than 0 ℃. The photooxidation of NACs begin with the addition of -OH or/and –NO (–NO_2) groups to aromatic ring, and further ring-opening of aromatic ring with formation of smaller, highly oxygenated molecules.

References:

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