

Source and formation mechanism of carbonaceous aerosols during urban haze episodes: insights from carbon isotopes (^{14}C and ^{13}C)

利用碳同位素(^{14}C 和 ^{13}C)研究城市灰霾天气下含碳气溶胶的来源与形成机制

Sponsor: The National Science Fund for Distinguished Young Scholars

Period: 2018-2020

Funding level: RMB200,000

含碳气溶胶（主要包括有机碳和元素碳）是大气细颗粒物（ $\text{PM}_{2.5}$ ）的重要组成部分，对空气质量、人体健康和全球辐射平衡都有着重要的影响。不同含碳组分的含碳气溶胶碳同位素（ ^{14}C 和 ^{13}C ）分析不仅可以获得更精细和准确的源解析结果，还可以为有机碳气溶胶形成和老化过程提供重要信息。此申请项目以碳同位素（ ^{14}C 和 ^{13}C ）示踪为核心研究手段，研究内容和目的主要包括：（1）定量解析南京地区生物源和化石源对含碳气溶胶（有机碳、元素碳和水溶性有机碳）的相对贡献及其季节变化特征；（2）揭示化石源和生物源在灰霾形成、消散过程中对一次有机碳和二次有机碳的贡献；（3）探究化石源和生物源含碳气溶胶的排放、形成。

Carbonaceous particle (mainly containing organic carbon and elemental carbon) are major fractions of the fine aerosols, and they have significant effects on air quality, human health and the Earth's radiative balance. Carbon isotope (^{14}C and ^{13}C) measurements in different carbonaceous fractions offer a more intensive and constrained source apportionment and also give additional insights into atmospheric formation and evolution process of organic carbon aerosols. By using carbon isotopes (^{14}C and ^{13}C) as source tracers, the major objectives of this projects are (1) to quantitatively determine fossil and non-fossil contributions to different carbonaceous aerosols (organic carbon, elemental carbon and water-soluble organic carbon) and its seasonality; (2) to explore fossil and non-fossil contributions to primary and secondary organic carbon during the haze bloom-decay processes; and (3) to study emissions, formation processes and transport sources of fossil and non-fossil derived carbonaceous aerosols. The obtained results could provide scientific basis for assessment and regulation of particulate matter pollution in China