Using stable isotope technique to quantify vehicular ammonia emissions in urban atmospheres
应用稳定同位素技术量化机动车尾气对城市大气氨排放的贡献

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氨气是大气中含量最丰富的碱性气体，排放后形成的各种铵盐约占 PM2.5 质量浓度的 50%。农业生产活动是农村氨排放的主要来源，但在交通路网密集的城市，机动车尾气是城市大气环境氨的重要来源。区分机动车尾气与其它氨排放源对城市大气氨的贡献，有助于准确评估机动车氨排放对城市空气污染的影响。本项目拟以长三角典型城市南京和上海为研究区域，通过网络布点采集城市环境大气氨样品以分析其氮同位素值，并根据不同的氨排放源所释放的氨具有不同氮同位素值的特点，确定机动车直接排放的氨的氮同位素特征值，运用贝叶斯同位素混合模型解析机动车氨排放对沪宁城市大气环境氨的相对贡献。此外还将个体车辆的氨排放测试结果与前期获取的机动车隧道实验结果相比对，进而估算城市机动车的实际氨排放量。本项目的实施将明确回答机动车尾气对城市大气环境氨的贡献，并为我国开展更广范围的大气氨的源解析和推行涵盖机动车在内的氨减排计划提供科学依据。

Ammonia is the most abundant alkali gases in atmosphere, contributing to approximately 50% of PM2.5 mass concentrations after emitted and transformed to ammonium base salts. Most of ammonia emitted from agricultural production activities, while in urban areas with intensive traffic network, vehicle exhausts have been proved as an important emission source of ammonia. The efforts of differentiating the contribution of on-road traffic from various other ammonia sources to the ambient ammonia could greatly boost an accurate assessment of traffic-related ammonia emissions to air pollution in the urban atmospheres. To this end, here we will choose Nanjing and Shanghai, two typical megacities in the Yangtze River delta region of China, as our study area, and using stable isotope as a tool to elucidate the contribution of vehicular ammonia emissions based on the fact that different ammonia sources have different nitrogen isotope signatures. More specifically, we will first measure the concentration levels and nitrogen isotope values of ammonia emitted directly from diverse types of vehicles. Then a comprehensive isotopic source signatures of ammonia can be established after comprising our previous research results. The second step would be the networking monitoring of ambient ammonia in the city of Nanjing and Shanghai. The ammonia concentrations and nitrogen isotope values of all collected samples will be determined. Lastly, a Bayesian isotopic mixing model SIAR will be used to quantify the relative contribution of vehicular emissions to the ambient ammonia of the urban atmospheres. Moreover, a cross checking and inter-comparison of data derived from our individual vehicle emission test and previous Shanghai tunnel traffic test will be performed to constrain the vehicular ammonia emission amount in urban areas. This study can be expected to provide solid scientific supports for the source apportionment of ammonia in the urban atmospheres, and the implementation of vehicular ammonia emission reductions in the future.