LETTER

Tightening nonfossil emissions control: A potential opportunity for $PM_{2.5}$ mitigation in China

It has been proposed that particulate matter (PM) pollutions in urbanized and populated cities in both developing countries and most developed countries is driven by fossil emissions, mostly from industry and transportation. This conclusion is supported in a recent study by Guo et al. (1) conducted in Beijing, China, in which a suite of state-of-the-art instruments was deployed simultaneously to measure comprehensive gaseous species and aerosol properties. The authors find that secondary particles formation from photochemical oxidation of gaseous pollutants (such as volatile organic compounds and nitrogen oxides from transportation) and sulfur dioxide from regional industry (such as power plants and manufacturing) dominated over primary emissions.

However, Guo et al.'s (1) important new finding fails to consider particles emitted by nonfossil sources (e.g., biomass burning, cooking, and biogenic emissions) either from primary emissions or secondary formations, a critically important (sometimes dominant) contributor of fine particles observed in both Chinese megacities (2) and other urban areas around world, such as Delhi (3), London, and central Paris (4). A recent source-apportionment study in four Chinese megacities of Beijing, Xi'an, Shanghai, and Guangzhou during the winter of 2013 revealed the severe haze pollution event was driven by both the secondary inorganic aerosol and secondary organic aerosols (2). It should be pointed out that nonfossil sources contributed to 37–85% (averaged to 60% for all four sites) of secondary organic aerosols (2). If taken together with the contribution from primary biomass burning, nonfossil contribution to $PM_{2.5}$ is on average ∼15%, which may be a lower estimation because of unrefined sources of secondary inorganic aerosols. It is also worth noting that the nonfossil contribution could be even higher (35% of $PM_{2.5}$ mass) during the heavy haze episode during the summer in five cities of the Yangtze River Delta, one of most developed regions of China (5). During the wintertime in the megacity Delhi, India, radiocarbon measurement of aerosols demonstrated that biomass burning/biogenic sources contributed 79% to water-soluble organic carbon (averaged to 35 ± 7% of total organic carbon), despite its numerous fossil air pollution sources (3).

Nevertheless, we strongly agree with Guo et al. (1): regulatory controls of gaseous emissions, including volatile organic compounds and nitrogen oxides from local transportation and sulfur dioxide from industrial sources, are very important steps to reduce the urban PM level in China. However, besides these measures, we believe that a tighter regulation plan toward reducing nonfossil emissions can provide a new opportunity to improve air quality in China and other countries. More research studies are necessary to characterize physical properties, chemical compositions, and secondary formation processes of urban nonfossil emissions.

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